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LETTER FROM THE EDITORS

Welcome to the *Academy of Accounting and Financial Studies Journal,* an official journal of the Allied Academies, Inc., a non profit association of scholars whose purpose is to encourage and support the advancement and exchange of knowledge, understanding and teaching throughout the world. The *AAFSJ* is a principal vehicle for achieving the objectives of the organization. The editorial mission of this journal is to publish empirical and theoretical manuscripts which advance the disciplines of accounting and finance.

Dr. Michael Grayson, Jackson State University, is the Accountancy Editor and Dr. Denise Woodbury, Southern Utah University, is the Finance Editor. Their joint mission is to make the *AAFSJ* better known and more widely read.

As has been the case with the previous issues of the *AAFSJ*, the articles contained in this volume have been double blind refereed. The acceptance rate for manuscripts in this issue, 25%, conforms to our editorial policies.

The Editors work to foster a supportive, mentoring effort on the part of the referees which will result in encouraging and supporting writers. They will continue to welcome different viewpoints because in differences we find learning; in differences we develop understanding; in differences we gain knowledge and in differences we develop the discipline into a more comprehensive, less esoteric, and dynamic metier.

Information about the Allied Academies, the *AAFSJ*, and the other journals published by the Academy, as well as calls for conferences, are published on our web site. In addition, we keep the web site updated with the latest activities of the organization. Please visit our site and know that we welcome hearing from you at any time.

Michael Grayson, Jackson State University

Denise Woodbury, Southern Utah University

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THE PERFORMANCE OF AMERICAN DEPOSITORY RECEIPTS LISTED ON THE NEW YORK STOCK EXCHANGE: THE CASE OF UTILITIES

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K. Michael Casey, University of Central Arkansas

ABSTRACT

In this study, we test the early and aftermarket returns of utility company American Depository Receipts (ADRs) issued from January 1987 through September 2000 and traded on the New York Stock Exchange. The results are broken down to compare IPOs versus SEOs and emerging market firms versus developed market firms. Findings indicate that utility industry ADRs significantly underperform the S&P 500 in the early trading, with the entire sample returning 5.35 percentage points less than the market index in the first month of trading. IPOs perform worse than SEOs and developed market issues perform worse than emerging market utility industry ADRs in the short-run.

Over the three-year holding period from date of issue, developed market utility ADRs tend to underperform those issued in emerging markets and utility SEOs underperform IPOs. The entire utility ADR sample underperformed the S&P 500 index by 23 percentage points in the three-year trading horizon. Essentially, our study shows foreign utility-firm ADRs initially listed on the NYSE from 1987 through mid-2000 underperformed the S&P 500 at the time of listing and for the three-year period following.

INTRODUCTION

The utilities industry consists of mostly large firms with strong, non-volatile earnings. Often regulated and in many cases with monopoly power (at least locally), utilities firms are unique in the United States, providing a safe stream of income to investors. But how do foreign utilities firms compare? The purpose of this study is to answer this question by reporting and statistically testing the early and long-term performance of foreign utility industry equities traded in the US as American Depository Receipts relative to the performance of the S&P 500 market index.

We examine daily returns for the first month, and monthly returns for three years after the issue date of non-US utility equities listed on the New York Stock Exchange (NYSE). These returns are adjusted based on the corresponding returns of the S&P 500 index to determine the excess return of foreign utility stocks relative to the market return. The excess return results are segmented to compare foreign utility IPO issues to those that are seasoned equity offerings (SEOs) and equities that were issued by firms headquartered in emerging countries to those from developed countries.

LITERATURE REVIEW

ADR Studies

American Depository Receipts (ADRs) represent ownership of foreign equities held on deposit by large custodian banks in the United States. Each receipt is backed by various share quantities of foreign stock bundled to reflect average common share prices in US equity markets. The primary purpose of ADR creation is to enable U.S. investors to participate in foreign equities without dealing directly with the foreign exchange and currency markets.

Several ADR studies examine ADR returns relative to a market benchmark using standard IPO methodology. Callaghan, Kleiman and Sahu (1999) reported positive market-adjusted returns for ADRs in the early and long-term investment horizons and found emerging market ADR returns to be higher than those for firms from developed countries. Specifically, they report one-day abnormal returns of 5.29% and one-month cumulative daily returns of 2.35% for a sample of 66 ADRs issued from 18 different countries and traded on the NYSE, the AMEX and the NASDAQ from 1986 to 1993. Annually, they found the cumulative abnormal returns for NYSE-traded ADRs were 19.6% for the first year; with the 12-month cumulative abnormal return for ADRs issued by firms in countries considered emerging markets at 34.37%.

Foerster and Karolyi (2000) found ADRs underperform comparable firms by 8% to 15% during the three-year period following the date of issuance, in contrast to the Callaghan et al. (1999) study. They examined ADR returns for a full three years from the issue date for a sample of 333 global equity offerings listed from 1982 through 1996 and including ADRs from 35 countries in Asia, Latin America and Europe. Their entire sample accumulated 1-month excess returns of -1.13% and 12-month cumulative abnormal returns of -4.07% relative to the index benchmark. The 36-month underperformance was significant with cumulative abnormal returns of -14.99% based on a local index. When compared to a US index, the cumulative abnormal returns for the ADRs were -27.53% for the three-year holding period.

Schaub and Casey (2002), Schaub (2003), and Schaub, Casey and Heslop (2004) performed industry specific ADR studies. Schaub and Casey (2002) examined short-term returns for foreign oil and gas firms listed on the New York Stock Exchange and found there was no significant difference in the performance of those firms and the S&P 500 index for the first 25 days of trading. Schaub (2003) found similar short-term results for 32 foreign bank equities listed on the New York Stock Exchange. In the long term, Schaub et al. (2004) found 34 foreign oil and gas equities performed roughly the same as the S&P 500 index for the first three years of trading from the date of listing on the New York Stock Exchange.

IPO Studies

Because ADR research uses similar methodologies as IPO studies, the results of research in the area of IPOs may be comparable to those of this study. Most research has found significant short-term abnormal positive returns for initial public offerings (IPOs), including Neuberger and La Chapelle (1983), McDonald and Fisher (1972), Neuberger and Hammond (1974), Reilly (1977), Logue (1973), Ibbotson (1975), Ibbotson and Jaffe (1975), Ritter (1984), Miller and Reilly (1987), and Ibbotson, Sindelar and Ritter (1988) examine IPO early returns. Short term results suggest first-day IPO abnormal returns in US markets range from as low as .60% (Barry and Jennings 1993) to 26.5% (Ritter 1984) and five-day cumulative abnormal returns range from 5.09% (Block and Stanley 1980) to 28.5% (McDonald and Fisher 1972).

In the long-run IPO studies, Ritter (1991) examined the long-term performance of IPOs and found that, from the first day of trading to the third anniversary, a sample of 1,526 IPOs issued from 1975-84 underperformed the benchmark by 27.4%. Essentially, Ritter's (1991) findings suggest the early positive abnormal performance of IPOs does not hold over the long term, and has found agreement from Brav and Gompers (1997).

Studies of foreign IPO behavior produced similar conclusions. Aggarwal, Leal and Hernandez (1993) found 62 Brazilian IPOs, 36 Chilean IPOs, and 44 Mexican IPOs significantly outperformed the local benchmark the first day of trading, but significantly underperformed the same benchmark after three years of trading. Other studies provide additional evidence of long-run underperformance of IPOs in foreign equity markets, including Levis (1993) and Huang (1999) who examined the UK amd Taiwan IPO performance respecitively. Studies that report differing results for the long-term IPO performance include Ben Naceur (2000), who examined the Tunisian market, and Dawson (1987), who reported long-term positive abnormal returns for IPOs traded in Malaysia.

RESEARCH METHODOLOGY

This study investigates the early and long-run abnormal returns of foreign utility industry new equity issues traded on the New York Stock Exchange. The sample consists of 24 ADRs initially listed on the New York Stock Exchange from January 1, 1987 through September 30, 2000. Of the 24 ADRs, 15 are initial public offerings (IPOs) and 9 are seasoned equity offerings (SEOs). The emerging markets sample size contains 8 firms and the developed market ADRs make up the remaining 16. Table 1 gives a further breakdown of the sample composition.

Standard IPO event study methodology was followed to compute and test the abnormal returns of the foreign equity portfolios. The daily and monthly holding period returns for each security are computed first. Then, daily abnormal returns are computed by subtracting the daily returns of each security from that of the S&P 500. The monthly abnormal returns are computed by subtracting each monthly holding period return from that of the S&P 500 index. The S&P 500 proxies the market return because the ADR sample includes only firms listed on the NYSE.

Table 1
Sample Description by Type of Issue and Level of Issue

Column 1	Column 2	Column 3	Column 4
ADR Type of Issue	Emerging Sample	Developed Sample	Total ADRs
IPO	7	8	15
SEO	1	8	9
Totals	8	16	24

Equations 1 through 3 describe the process for computing abnormal returns and cumulative abnormal returns for statistical testing. The abnormal return for each security i on day t (ar_{it}) is computed as the return of the security on day t (r_{it}) minus the return of the market on day t (r_{mt}) as shown in equation 1 below. For computing monthly abnormal returns, t represents the respective month.

$$ar_{it} = r_{it} - r_{mt} \qquad (1)$$

Equation 2 computes the average abnormal return for the sample for day/month t (AR_t) as the equally-weighted arithmetic average of the abnormal returns of each of the n securities during day/month t.

$$AR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{it} \qquad (2)$$

Cumulative abnormal returns as of day/month s are computed as the summation of the average abnormal returns starting at day/month 1 until day/month s in Equation 3.

$$CAR_{1,s} = \sum_{t=1}^{s} AR_t \qquad (3)$$

Daily/monthly average abnormal returns and the cumulative abnormal returns are tested to determine significance using a Z-score. The respective p-values for these tests are reported. A p-value of .10 or less indicates the abnormal return or cumulative abnormal return is significantly different from 0.

THE ANALYSIS

Results From Early Trading

Tables 2 through 5 summarize the early and aftermarket performance of the equities by type of issue and type of market. Contrary to the results of other ADR studies and most IPO research, the abnormal return on the first day of trading was small and non-significant for the entire sample, as reported in Table 2. This finding suggests the average NYSE-traded foreign utility equity issue returned roughly the same as the S&P 500.

Table 2. The Early Return Performance By Day For the Entire Sample, IPO and SEO Utilities Issues

	Entire ADR Sample (Obs = 24)				ADRs Issued as IPOs (Obs = 15)				ADRs Issued as SEOs (Obs = 9)			
Day	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value
D1	-0.82%	0.16	-0.82%	0.16	-1.32%	0.17	-1.32%	0.17	-0.15%	0.39	-0.15%	0.39
D2	-1.21%	**0.02**	-2.03%	**0.02**	-0.70%	0.22	-2.02%	0.11	-2.11%	**0.00**	-2.26%	**0.00**
D3	-0.27%	0.24	-2.30%	**0.02**	-0.10%	0.44	-2.12%	0.11	-0.70%	0.14	-2.96%	**0.00**
D4	-1.47%	**0.01**	-3.77%	**0.00**	-1.74%	**0.01**	-3.86%	**0.02**	-0.93%	0.21	-3.89%	**0.00**
D5	0.16%	0.48	-3.61%	**0.00**	0.20%	0.40	-3.66%	**0.04**	-0.25%	0.25	-4.15%	**0.00**
D6	-0.82%	**0.02**	-4.43%	**0.00**	-1.07%	**0.04**	-4.73%	**0.01**	-0.47%	0.12	-4.62%	**0.00**
D7	-0.17%	0.35	-4.60%	**0.00**	0.12%	0.42	-4.60%	**0.02**	-0.70%	0.18	-5.32%	**0.00**
D8	-0.55%	0.17	-5.16%	**0.00**	-0.03%	0.48	-4.63%	**0.02**	-1.45%	**0.05**	-6.77%	**0.00**
D9	0.33%	0.23	-4.83%	**0.00**	0.44%	0.25	-4.20%	**0.04**	0.19%	0.39	-6.58%	**0.00**
D10	-0.02%	0.52	-4.85%	**0.00**	-0.12%	0.40	-4.32%	**0.04**	0.27%	0.35	-6.32%	**0.00**
D11	0.62%	0.11	-4.22%	**0.01**	0.45%	0.29	-3.87%	**0.07**	1.03%	**0.03**	-5.29%	**0.01**
D12	-0.36%	**0.09**	-4.58%	**0.01**	-0.22%	0.29	-4.09%	**0.06**	-0.70%	**0.04**	-5.98%	**0.01**
D13	-0.11%	0.38	-4.69%	**0.01**	0.05%	0.46	-4.04%	**0.07**	-0.36%	0.22	-6.34%	**0.00**
D14	0.37%	0.18	-4.32%	**0.01**	-0.16%	0.39	-4.20%	**0.06**	1.53%	**0.04**	-4.82%	**0.03**
D15	-0.35%	0.14	-4.67%	**0.01**	-0.44%	0.14	-4.64%	**0.05**	-0.41%	0.31	-5.22%	**0.03**
D16	-0.23%	0.26	-4.90%	**0.01**	-0.40%	0.19	-5.05%	**0.04**	0.02%	0.49	-5.20%	**0.03**
D17	0.14%	0.45	-4.77%	**0.01**	-0.45%	0.30	-5.49%	**0.03**	0.93%	**0.01**	-4.27%	**0.07**
D18	-0.17%	0.36	-4.94%	**0.01**	-0.07%	0.46	-5.56%	**0.03**	-0.35%	0.28	-4.62%	**0.06**
D19	0.10%	0.41	-4.84%	**0.01**	0.37%	0.25	-5.19%	**0.05**	-0.35%	0.34	-4.98%	**0.05**
D20	-0.46%	0.17	-5.30%	**0.01**	-0.36%	0.23	-5.55%	**0.04**	-0.64%	0.27	-5.62%	**0.04**
D21	-0.05%	0.41	-5.35%	**0.01**	-0.48%	0.13	-6.03%	**0.03**	0.58%	0.19	-5.04%	**0.06**

The computation of average abnormal returns (AR) is described in equation 2 in the text and the computation of cumulative abnormal returns (CAR) is described in equation 3 in the text. P-values in bold italics represent returns that are significant at an alpha level of 10% or lower.

The cumulative abnormal returns for the entire sample were negative and significant for the first month of trading, reaching a significant negative cumulative abnormal return of -5.35% by day 21. Both IPOs and SEOs appear to respond about the same with significant cumulative abnormal losses of -6.03% and -5.04% respectively.

Table 3 reports the early-trading results when the sample is split into utility equities issued by firms headquartered in emerging markets versus those headquartered in developed markets. By day 21, the cumulative abnormal returns were negative in the emerging market sample, but not significant. In contrast, the developed markets experienced negative returns (-5.68%) by day 21 that were highly significant. The results suggest emerging market firms may have outperformed developed market companies, providing limited support for Callaghan et al. (1999).

Table 3. The Early Return Performance By Day For the Entire Sample, Emerging and Developed Markets Foreign Utilities Issues*

	Entire ADR Sample (Obs = 24)				ADRs Issued as IPOs (Obs = 15)				ADRs Issued as SEOs (Obs = 9)			
Day	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value
D1	-0.82%	0.16	-0.82%	0.16	-2.23%	0.17	-2.23%	0.17	-0.12%	0.37	-0.12%	0.37
D2	-1.21%	**0.02**	-2.03%	**0.02**	-0.72%	0.18	-2.96%	0.11	-1.45%	**0.03**	-1.57%	**0.04**
D3	-0.27%	0.24	-2.30%	**0.02**	-0.58%	0.16	-3.54%	**0.07**	-0.12%	0.42	-1.68%	**0.06**
D4	-1.47%	**0.01**	-3.77%	**0.00**	-1.74%	0.11	-5.28%	**0.03**	-1.33%	**0.03**	-3.01%	**0.01**
D5	0.16%	0.48	-3.61%	**0.00**	1.73%	0.16	-3.55%	**0.10**	-0.63%	**0.04**	-3.64%	**0.00**
D6	-0.82%	**0.02**	-4.43%	**0.00**	-1.01%	0.17	-4.57%	**0.07**	-0.73%	**0.01**	-4.37%	**0.00**
D7	-0.17%	0.35	-4.60%	**0.00**	-0.15%	0.41	-4.72%	**0.06**	-0.18%	0.38	-4.55%	**0.00**
D8	-0.55%	0.17	-5.16%	**0.00**	0.12%	0.47	-4.59%	**0.08**	-0.89%	**0.05**	-5.44%	**0.00**
D9	0.33%	0.23	-4.83%	**0.00**	0.79%	0.23	-3.80%	0.13	0.10%	0.41	-5.34%	**0.00**
D10	-0.02%	0.52	-4.85%	**0.00**	0.01%	0.42	-3.79%	0.14	-0.03%	0.47	-5.37%	**0.00**
D11	0.62%	0.11	-4.22%	**0.01**	0.63%	0.30	-3.16%	0.20	0.62%	**0.07**	-4.76%	**0.00**
D12	-0.36%	**0.09**	-4.58%	**0.01**	-0.68%	**0.06**	-3.84%	0.15	-0.20%	0.29	-4.96%	**0.00**
D13	-0.11%	0.38	-4.69%	**0.01**	0.13%	0.44	-3.71%	0.16	-0.22%	0.20	-5.18%	**0.00**
D14	0.37%	0.18	-4.32%	**0.01**	-0.15%	0.40	-3.86%	0.18	0.63%	0.19	-4.55%	**0.01**
D15	-0.35%	0.14	-4.67%	**0.01**	-0.19%	0.12	-4.06%	0.15	-0.43%	0.22	-4.98%	**0.01**
D16	-0.23%	0.26	-4.90%	**0.01**	-0.77%	0.15	-4.83%	0.12	0.04%	0.46	-4.94%	**0.01**
D17	0.14%	0.45	-4.77%	**0.01**	-1.07%	0.11	-5.90%	**0.08**	0.74%	0.11	-4.20%	**0.03**
D18	-0.17%	0.36	-4.94%	**0.01**	0.53%	0.34	-5.36%	**0.10**	-0.52%	0.11	-4.73%	**0.02**
D19	0.10%	0.41	-4.84%	**0.01**	0.22%	0.39	-5.14%	0.11	0.04%	0.47	-4.69%	**0.02**
D20	-0.46%	0.17	-5.30%	**0.01**	0.53%	0.26	-4.61%	0.14	-0.96%	**0.05**	-5.64%	**0.01**
D21	-0.05%	0.41	-5.35%	**0.01**	-0.09%	0.34	-4.69%	0.13	-0.04%	0.47	-5.68%	**0.01**

* See footnote for Table 2

Results From Aftermarket Trading

Tables 4 and 5 show the long-term results of the foreign utility issues by month for the first 3 years of trading on the New York Stock Exchange. The results, reported for the entire sample in Table 4, suggest the securities substantially underperformed the S&P 500 during this period. The cumulative abnormal returns by the end of the three-year period were -22.83% and statistically significant.

Table 4. Long-term Return Performance by Month for Utility ADRs Broken Down by Developed and Emerging Market Issues[*]

	Entire Utility Sample (Obs = 24)				Utility ADRs from Emerging Markets (Obs =8)				Utilitiy ADRs from Developed Markets (Obs = 16)			
Mo	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value
+1	-6.58%	**0.00**	-6.58%	**0.00**	-6.82%	**0.02**	-6.82%	**0.02**	-6.45%	**0.00**	-6.45%	**0.00**
+2	-1.00%	0.22	-7.58%	**0.00**	0.68%	0.41	-6.15%	**0.07**	-1.84%	0.21	-8.30%	**0.00**
+3	-0.68%	0.26	-8.26%	**0.00**	-4.37%	0.15	-10.52%	**0.04**	1.16%	0.23	-7.13%	**0.02**
+4	-0.64%	0.40	-8.90%	**0.01**	-0.62%	0.47	-11.14%	**0.05**	-0.65%	0.40	-7.79%	**0.04**
+5	1.21%	0.26	-7.70%	**0.03**	2.31%	0.24	-8.83%	0.12	0.65%	0.40	-7.13%	**0.09**
+6	3.17%	0.17	-4.52%	0.16	0.28%	0.49	-8.55%	0.13	4.62%	0.15	-2.51%	0.36
+7	-0.28%	0.37	-4.80%	0.15	-3.69%	**0.10**	-12.24%	**0.07**	1.43%	0.30	-1.08%	0.44
+8	-0.36%	0.49	-5.16%	0.16	-3.54%	0.33	-15.78%	**0.06**	1.23%	0.31	0.15%	0.49
+9	-1.68%	0.23	-6.84%	0.12	3.15%	**0.10**	-12.62%	0.11	-4.10%	**0.04**	-3.95%	0.32
+10	7.88%	**0.05**	1.04%	0.46	19.78%	**0.05**	7.15%	0.47	1.93%	0.24	-2.02%	0.41
+11	0.15%	0.50	1.18%	0.46	-1.05%	0.24	6.10%	0.50	0.75%	0.31	-1.27%	0.44
+12	1.39%	0.32	2.57%	0.49	2.17%	0.33	8.27%	0.47	1.00%	0.39	-0.27%	0.49
+13	-1.16%	0.29	1.42%	0.48	-3.91%	0.21	4.36%	0.47	0.22%	0.43	-0.05%	0.50
+14	-2.66%	**0.08**	-1.24%	0.38	-3.02%	0.30	1.34%	0.43	-2.48%	**0.08**	-2.53%	0.40
+15	2.63%	0.12	1.39%	0.49	0.93%	0.44	2.26%	0.45	3.48%	**0.10**	0.95%	0.46
+16	-0.47%	0.35	0.92%	0.45	-4.54%	**0.03**	-2.27%	0.34	1.56%	0.29	2.52%	0.40
+17	-0.80%	0.44	0.11%	0.44	4.01%	**0.01**	1.73%	0.44	-3.21%	**0.08**	-0.69%	0.47
+18	-1.92%	0.22	-1.81%	0.38	1.64%	0.30	3.37%	0.49	-3.70%	**0.04**	-4.40%	0.34
+19	-3.53%	**0.02**	-5.34%	0.25	-0.83%	0.30	2.54%	0.46	-4.88%	**0.01**	-9.28%	0.20
+20	-1.67%	0.20	-7.01%	0.20	-5.79%	**0.01**	-3.25%	0.35	0.39%	0.45	-8.89%	0.22
+21	0.68%	0.40	-6.33%	0.23	2.06%	0.20	-1.19%	0.38	0.00%	0.50	-8.90%	0.23
+22	-3.37%	**0.06**	-9.70%	0.15	-4.10%	**0.02**	-5.29%	0.31	-3.00%	0.16	-11.90%	0.17
+23	0.29%	0.49	-9.41%	0.15	-0.41%	0.33	-5.70%	0.30	0.64%	0.40	-11.26%	0.19
+24	-3.82%	**0.01**	-13.23%	**0.09**	-5.16%	**0.05**	-10.86%	0.22	-3.15%	**0.06**	-14.41%	0.13
+25	-1.91%	0.11	-15.14%	**0.06**	0.88%	0.47	-9.98%	0.22	-3.31%	**0.05**	-17.72%	**0.09**
+26	2.01%	0.13	-13.13%	**0.10**	8.27%	**0.00**	-1.71%	0.37	-1.11%	0.32	-18.83%	**0.08**
+27	0.09%	0.40	-13.04%	0.11	1.27%	0.20	-0.44%	0.41	-0.50%	0.43	-19.34%	**0.08**
+28	-2.15%	0.11	-15.19%	**0.08**	-4.40%	**0.07**	-4.84%	0.33	-1.02%	0.33	-20.36%	**0.07**
+29	-2.55%	**0.08**	-17.74%	**0.05**	0.55%	0.33	-4.28%	0.34	-4.11%	**0.06**	-24.47%	**0.04**

Table 4. Long-term Return Performance by Month for Utility ADRs Broken Down by Developed and Emerging Market Issues*												
	Entire Utility Sample (Obs = 24)				Utility ADRs from Emerging Markets (Obs =8)				Utilitiy ADRs from Developed Markets (Obs = 16)			
Mo	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value
+30	3.56%	**0.03**	-14.18%	**0.10**	2.11%	0.22	-2.18%	0.39	4.29%	**0.04**	-20.18%	**0.08**
+31	3.24%	0.13	-10.93%	0.16	-0.94%	0.36	-3.12%	0.37	5.33%	**0.09**	-14.84%	0.16
+32	2.09%	0.15	-8.84%	0.21	2.20%	0.17	-0.91%	0.41	2.03%	0.23	-12.81%	0.20
+33	-1.62%	0.26	-10.46%	0.17	0.19%	0.31	-0.72%	0.39	-2.52%	0.29	-15.33%	0.17
+34	-2.77%	**0.09**	-13.23%	0.12	-0.60%	0.18	-1.32%	0.34	-3.86%	0.15	-19.19%	0.12
+35	-4.29%	**0.00**	-17.52%	**0.06**	-7.61%	**0.01**	-8.93%	0.22	-2.64%	**0.04**	-21.82%	**0.09**
+36	-5.31%	**0.01**	-22.83%	**0.03**	-6.61%	**0.00**	-15.54%	0.14	-4.66%	**0.08**	-26.48%	**0.06**
* See footnote for Table 2												

Also in Table 4, note that the emerging market sample outperformed the developed market sample, though both groups reported negative CAR's during most of the test period. The cumulative abnormal losses of the emerging market sample were not significant, while the developed market sample posted significant cumulative abnormal losses of -26.48% by the end of three years. Again, these results suggest the emerging market firms outperformed the developed market firms in the three-year test period.

Breaking the long-term results into the IPO portfolio and the SEO portfolio in Table 5, we see similar negative returns. The IPO sample exhibits double-digit negative cumulative abnormal returns during the entire three-year period, but this result is insignificant. Conversely, the SEO sample posts significant losses and ends the three-year period with a -35.93% abnormal return. Among firms tested, the IPO sample outperforms the SEO utility firm sample in the three-year test period.

Table 5. Long-term Return Performance by Month for Utility ADRs Broken Down by Initial Public Offerings and Seasoned Equity Offerings*												
	Entire Utility Sample (Obs = 24)				Utility ADRs from Emerging Markets (Obs =8)				Utilitiy ADRs from Developed Markets (Obs = 16)			
Mo	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value
+1	-6.58%	**0.00**	-6.58%	**0.00**	-7.15%	**0.00**	-7.15%	**0.00**	-6.27%	**0.01**	-6.27%	**0.01**
+2	-1.00%	0.22	-7.58%	**0.00**	0.51%	0.40	-6.63%	**0.03**	-4.97%	0.11	-11.25%	**0.01**
+3	-0.68%	0.26	-8.26%	**0.00**	-2.36%	0.28	-9.00%	**0.04**	-0.66%	0.39	-11.91%	**0.01**
+4	-0.64%	0.40	-8.90%	**0.01**	1.17%	0.30	-7.82%	**0.09**	-3.40%	0.22	-15.31%	**0.01**
+5	1.21%	0.26	-7.70%	**0.03**	2.58%	0.20	-5.24%	0.21	-0.26%	0.47	-15.56%	**0.02**
+6	3.17%	0.17	-4.52%	0.16	4.42%	0.17	-0.83%	0.46	0.95%	0.40	-14.61%	**0.04**
+7	-0.28%	0.37	-4.80%	0.15	-3.00%	0.11	-3.82%	0.32	3.05%	0.25	-11.56%	0.12
+8	-0.36%	0.49	-5.16%	0.16	-3.10%	0.17	-6.93%	0.22	4.98%	**0.08**	-6.59%	0.26
+9	-1.68%	0.23	-6.84%	0.12	1.74%	0.22	-5.19%	0.29	-6.86%	**0.01**	-13.45%	0.11

Table 5. Long-term Return Performance by Month for Utility ADRs Broken Down by Initial Public Offerings and Seasoned Equity Offerings*												
	Entire Utility Sample (Obs = 24)				Utility ADRs from Emerging Markets (Obs =8)				Utilitiy ADRs from Developed Markets (Obs = 16)			
Mo	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value	AR	P-value	CAR	P-value
+10	7.88%	**0.05**	1.04%	0.46	6.03%	0.12	0.84%	0.47	9.66%	0.12	-3.79%	0.39
+11	0.15%	0.50	1.18%	0.46	-0.15%	0.46	0.69%	0.47	0.23%	0.46	-3.56%	0.40
+12	1.39%	0.32	2.57%	0.49	-1.11%	0.35	-0.41%	0.49	5.10%	0.16	1.54%	0.46
+13	-1.16%	0.29	1.42%	0.48	-1.33%	0.27	-1.74%	0.44	0.03%	0.49	1.57%	0.46
+14	-2.66%	**0.08**	-1.24%	0.38	-2.59%	0.11	-4.33%	0.35	-1.75%	0.26	-0.19%	0.50
+15	2.63%	0.12	1.39%	0.49	1.52%	0.28	-2.81%	0.41	4.15%	0.13	3.96%	0.40
+16	-0.47%	0.35	0.92%	0.45	0.01%	0.50	-2.80%	0.41	-2.31%	0.22	1.65%	0.46
+17	-0.80%	0.44	0.11%	0.44	2.53%	0.12	-0.27%	0.49	-5.04%	**0.05**	-3.39%	0.42
+18	-1.92%	0.22	-1.81%	0.38	-1.81%	0.28	-2.08%	0.44	-1.42%	0.28	-4.81%	0.39
+19	-3.53%	**0.02**	-5.34%	0.25	-1.55%	0.24	-3.63%	0.39	-7.50%	**0.00**	-12.31%	0.23
+20	-1.67%	0.20	-7.01%	0.20	-4.40%	**0.08**	-8.03%	0.27	2.34%	0.16	-9.96%	0.28
+21	0.68%	0.40	-6.33%	0.23	-1.57%	0.29	-9.60%	0.24	4.25%	0.19	-5.71%	0.37
+22	-3.37%	**0.06**	-9.70%	0.15	-4.12%	**0.01**	-13.72%	0.16	-1.97%	0.35	-7.68%	0.34
+23	0.29%	0.49	-9.41%	0.15	2.39%	0.17	-11.32%	0.21	-3.89%	**0.06**	-11.57%	0.27
+24	-3.82%	**0.01**	-13.23%	**0.09**	-4.13%	**0.02**	-15.46%	0.14	-3.27%	0.13	-14.84%	0.21
+25	**-1.91%**	**0.11**	**-15.14%**	**0.06**	**-1.01%**	**0.35**	**-16.47%**	**0.13**	**-4.47%**	**0.03**	**-19.31%**	**0.15**
+26	**2.01%**	**0.13**	**-13.13%**	**0.10**	**3.77%**	**0.09**	**-12.70%**	**0.19**	**0.18%**	**0.48**	**-19.14%**	**0.16**
+27	**0.09%**	**0.40**	**-13.04%**	**0.11**	**0.79%**	**0.38**	**-11.91%**	**0.21**	**0.15%**	**0.49**	**-18.99%**	**0.17**
+28	**-2.15%**	**0.11**	**-15.19%**	**0.08**	**-3.82%**	**0.05**	**-15.73%**	**0.15**	**-0.03%**	**0.50**	**-19.02%**	**0.17**
+29	**-2.55%**	**0.08**	**-17.74%**	**0.05**	**-1.88%**	**0.21**	**-17.61%**	**0.12**	**-3.61%**	**0.12**	**-22.63%**	**0.13**
+30	**3.56%**	**0.03**	**-14.18%**	**0.10**	**3.90%**	**0.05**	**-13.72%**	**0.19**	**3.49%**	**0.16**	**-19.14%**	**0.17**
+31	3.24%	0.13	-10.93%	0.16	5.49%	**0.10**	-8.22%	0.30	-0.58%	0.42	-19.72%	0.17
+32	2.09%	0.15	-8.84%	0.21	1.59%	0.21	-6.64%	0.34	2.92%	0.25	-16.81%	0.21
+33	-1.62%	0.26	-10.46%	0.17	-0.51%	0.40	-7.14%	0.33	-4.66%	0.28	-21.46%	0.17
+34	-2.77%	**0.09**	-13.23%	0.12	-2.99%	**0.07**	-10.14%	0.27	-4.78%	0.24	-26.24%	0.13
+35	-4.29%	**0.00**	-17.52%	**0.06**	-4.62%	**0.02**	-14.75%	0.19	-4.66%	**0.01**	-30.90%	**0.09**
+36	-5.31%	**0.01**	-22.83%	**0.03**	-6.23%	**0.01**	-20.98%	0.11	-5.03%	0.16	-35.93%	**0.07**
* See footnote for Table 2												

SUMMARY

Previous ADR and IPO studies reported significant abnormal returns in the early trading. Likewise, most aftermarket IPO studies reported long-run underperformance for IPO portfolios as compared to market benchmarks. Callaghan, Kleiman and Sahu (1999) reported one-day and one-year positive abnormal returns for a sample of 66 ADRs issued from 18 different countries and traded on the NYSE, the AMEX and the NASDAQ from 1986 to 1993. They found that the emerging market ADRs outperformed the ADRs backed by securities traded in mature markets. This study, confining its sample to utility companies, finds a similar pattern of results in both early trading and at three years after listing of the ADR.

The results of this study provide some evidence that the US markets overprice non-US utility equities across the entire time horizon of this study and provides substantial support for Foerster and Karolyi (2000). Although the sample included all utility ADRs issued on the NYSE from January 1987 through September 2000, these results should be interpreted with caution since the sample size, particularly when broken down, is small. Perhaps a larger sample might shed additional light on why utility ADRs appear to be overpriced at issue and go on to substantially underperform the market.

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THE EFFECT OF FINANCIAL INSTITUTION OBJECTIVES ON EQUITY TURNOVER

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ABSTRACT

We examine the share and dollar turnover on the New York Stock Exchange and on NASDAQ and find that investor objectives affect their contribution to stock turnover. We control for transactions costs and information (previously identified as factors affective turnover) to determine how different investment objectives of financial institutions affect turnover. We find that although all financial institutions have relatively low transactions costs and broad access to information, some institutions' holdings are associated with increased stock turnover while others' reduce turnover. We also find evidence that institutions' effect on turnover differs across different types of stocks, indicating that objectives may differ over different types of investments.

INTRODUCTION

Turnover measures the portion of a company's stock that trades during a period of time. Prior studies have shown that turnover decreases as the cost of trading increases and increases with the rate the firm or market generates new information. Information and trading costs affect how frequently investors alter their expectations regarding the firm and adjust their holdings in response to changed expectations. No other factors affecting equity turnover have been identified. This paper examines whether investors' objectives are a third factor that affects turnover. We find that even when two investors have comparable access to information and equal trading costs, they do not necessarily contribute equally to turnover. The investors we test are financial institutions, all of which have comparable access to information about equity value and trade at low cost relative to individual investors. Larger equity holdings by some financial institutions are associated with higher market turnover, while the opposite is true for other institutions. Similarly, turnover increases as some financial institutions increase their equity holdings but declines with increases in equity holdings of other institutions. We also find that the effect a financial institution has on equity turnover differs for different types of equity. The results indicate that trading costs and access to information are not the only factors affecting turnover. Investors' strategy with respect to holding and trading are an additional factor.

In the last twenty years, equity markets in the United States have experienced increased turnover. Table 1 presents turnover rates (in shares and dollars) for the New York Stock Exchange and for NASDAQ from 1985 through 2002. Turnover of shares on the New York Stock Exchange increases from 0.54 in 1985 to 1.04 in 2002. Turnover in NASDAQ increases from 0.72 to 2.80, reaching a high of 3.05 in 2000. Dollar turnover on the NYSE increases from 0.53 to 0.98 and on NASDAQ from 0.93 to 3.18 over the same period. The increased turnover indicates that the average holding period decreases from 22 months to 11½ months on the NYSE and from 13 months to 4 months on NASDAQ.

Table 1: Average Turnover

	NYSE		NASDAQ	
year	share turnover	dollar turnover	share turnover	dollar turnover
1985	0.54	0.53	0.72	0.93
1986	0.64	0.63	0.91	1.10
1987	0.72	0.73	0.98	1.26
1988	0.55	0.56	0.75	0.98
1989	0.53	0.55	0.83	1.14
1990	0.45	0.47	0.85	1.31
1991	0.48	0.46	1.10	1.62
1992	0.48	0.46	1.26	1.65
1993	0.54	0.53	1.56	1.96
1994	0.53	0.54	1.48	1.86
1995	0.60	0.58	1.80	2.36
1996	0.63	0.61	1.98	2.46
1997	0.69	0.68	2.06	2.61
1998	0.75	0.71	2.16	2.66
1999	0.77	0.76	2.52	3.17
2000	0.88	0.91	3.05	4.00
2001	0.95	0.90	2.89	3.68
2002	1.04	0.98	2.80	3.18

Trading by financial institutions contributes to turnover. All financial institutions enjoy similar access to information and relatively low trading costs. However, different institutions pursue different investment objectives. We examine how contribution to turnover differs across financial institutions. To determine whether observed differences arise in fact from differences in financial institution objectives, we control for the other two factors that have been identified as affecting turnover, trading costs and information volatility. We find that greater equity holdings by depository institutions, private pensions, closed end funds and brokers and dealers increase NYSE turnover while greater holdings by bank-managed trusts and estates, insurers other than life insurers, open-end mutual funds and state and local governments and their pensions reduces it. We also find that differences exist among financial institutions when we examine NASDAQ turnover. Those differences are not identical to the results for NYSE turnover, indicating that financial institutions may pursue different objectives with different types of stocks. The results confirm that, in addition to information and transactions costs, investment objective affects turnover.

LITERATURE DEALING WITH FACTORS THAT AFFECT TURNOVER

The academic literature examining equity turnover identifies two factors that affect turnover – information and transactions costs, Karpoff (1986). The association between turnover and information arises because the intensity of trading increases with the frequency that investors alter their expectations regarding the firm, its industry and the market. As a result, when information about a firm, an industry or the market is more volatile, when investors' access to information improves, and when there is greater divergence in investors' expectations, turnover increases. Several papers find this relationship in U.S. equity markets. Covrig and Ng (2004) find a positive correlation between information arrival and trading volume. Pollock and Rindova (2003) find that the volume of media-provided information about an initial public offering stock is positively correlated with the IPO's first day trading volume. The finding of Lee and Swaminathan (2000) that turnover depends on the type of stock, with "value" stocks having relative lower turnover than "growth" stocks reflects the greater relative volatility of information for growth stocks.

Other studies focus on turnover in international markets. Rose (2003) confirms the relationship between information and turnover in the Danish stock market, finding that share turnover is greatest immediately after information is release in investor meetings and presentations. Roewenhorst (1999) finds turnover in emerging markets is positively correlated with the standard deviation of returns and firm beta, and negatively correlated with firm size. That is, turnover increases with information volatility but decreases as firms are increasingly followed by analysts. Domowitz, Glen and Madhavan (2001) find a negative correlation between turnover and market capitalization in developed markets and a positive correlation in emerging markets. The former is due to greater homogeneity in investor expectations; the latter, to greater availability of information. Karolyi (2004) finds that emerging market firms that do not cross-list in US markets experience decreased turnover. This finding is consistent with relatively better access to information about cross-listing emerging market firms.

Transactions costs, the second factor the literature identifies as affecting turnover, have a negative effect. The greater the cost to trade a stock, the less frequently trades occur. Badrinath, Kale and Noe (1995) find that a stock's turnover is positively correlated with the level of institutional ownership, consistent with lower trading costs for financial institutions. Barron and Karpoff (2004) find that trading costs reduce the positive relationship between information precision and trading volume. Covrig and Ng (2004) find that where there is high information flow, trading by institutions (characterized by relatively low transactions costs) has a more pronounced effect on volume autocorrelation than trading by individual investors. Atkins and Dyl (1997) determine that the magnitude of the bid ask spread is negatively related to turnover. Domowitz, Glen and Madhavan (2001) find the relationship between transactions costs and turnover exists in both developed and emerging markets.

This paper explores whether an additional factor, investment objectives, affects turnover. Existing literature ignores investor objectives, assuming that all investors with equivalent access to information and the same transactions costs have the same effect on turnover. This assumption appears in a number of studies. As previously noted, Badrinath, Kale and Noe (1995) and Covrig and Ng (2004) distinguish between turnover from institutional trading and trading by individual investors. Similarly, Hotchkiss and Strickland (2003) examine how the level of institutional ownership affects price response and trading volume after earnings announcement and Tkac (1999) tests how institutional ownership affects the correlation between firm volume and market volume. These studies recognize that financial institutions and individual investors have different trading costs, but ignore the effect of differences in investment objectives between the two groups, or among the investors in either group. We test how ownership levels of and trading by different financial institutions affect equity turnover.

SAMPLE AND METHODOLOGY

To examine whether differences in financial institution objectives affect trading, we examine quarterly turnover on the New York Stock Exchange and on NASDAQ from 1985 through 2002.[1] Share turnover is the number of shares traded in a quarter divided by the total shares outstanding. We annualize this number by multiplying it by the number of trading days in the year and dividing by the number of trading days in the month. Similarly, dollar turnover is dollar volume for a quarter divided by total equity value. Shares traded, dollar volume data, and shares and dollar value outstanding come from the New York Stock Exchange and NASDAQ. Data on financial institutions equity holdings and changes in those holdings, as well as the holdings and changes for individual investors and non-U.S. residents, is from the Board of Governors of the Federal Reserve. We use commissions per share, computed from total commissions received by brokers and dealers (from the S.E.C. annual report) and total shares traded, as a measure of the costs of trading. Variables that indicate for information available to investors include market value of equity and the interest rate on federal funds (both of which come from the Federal Reserve), and the standard deviation of the daily Dow Jones Industrial Average. The first two provide information about the strength of the economy in general and the last indicates the rapidity with which new information about stock value is produced. Table 2 provides summary statistics for share and dollar turnover, the variables we use to control for transactions costs and information, and financial institution holdings.

Table 2: Descriptive Statistics

Share turnover is shares traded in the quarter divided by total shares outstanding multiplied by the ratio of annual trading days to trading days in the quarter. Dollar turnover is dollar volume for the quarter divided by total dollar value of shares outstanding annualized in the same way as share turnover. Share and volume data and Dow Jones Industrial Average comes from NYSE and NASDAQ. Commissions per share are total broker/dealer commissions from S.E.C. annual report divided by total shares traded. All other data comes from the Federal Reserve. Sample is from 1985 through 2002.

variable	mean	std.dev.	max.	min.
NYSE share turnover	0.656	0.170	1.110	0.428
NYSE dollar turnover	1.670	0.806	3.857	0.655
NASDAQ share turnover	0.649	0.158	1.037	0.408
NASDAQ dollar turnover	2.104	1.032	5.663	0.879
Commissions per share (x10-5)	3.468	1.245	5.750	1.412
Market value of domestic corporations (x106)	7.278	4.782	17.852	1.821
Standard deviation of daily Dow Jones Industrial Average	97.55	86.37	378.33	12.06
Average quarterly fed funds interest rate (%)	5.629	1.953	9.810	1.340
Household holdings	3742231	2334498	9245400	898614
Private pension fund holdings	1167930	605882	2419248	408196
Open end mutual fund holdings	1164252	1132531	3680226	87869
Non-U.S. investor holdings	640245	528258	1681652	105713
Life insurance company holdings	360700	319809	1027623	64164
State and local governments and their retirement fund holdings	334510	424466	1360950	0
Bank managed estates and trusts holdings	240503	76663	420961	153181
Holdings of insurers other than life insurers	120602	50974	207856	48796
Brokers and dealer holdings	33912	25643	89825	8971
Closed-end fund holdings	27027	14286	55956	3813
Exchange-traded fund holdings	13979	26967	98228	0
Depository institution holdings	9568	8065	29100	0
Number of observations: 72				

Table 3 presents the portion of corporate equities held by individual investors, state and local governments and their retirement funds[2], non-US investors[3], and financial institutions. The financial institutions include depository institutions, bank-managed estates and trusts, life insurers, insurance companies other than life insurers, private pensions, open-end mutual funds, closed-end funds, exchange traded funds, and brokers and dealers. The table demonstrates that beginning in 1985, individual investors, trusts and estates, insurance companies other than life insurers, and private pension funds dramatically reduce their relative holdings of corporate equities. During the same period, non-US investors, life insurance companies and mutual funds, and to a lesser extent, state and local governments and their retirement funds and exchange-traded funds increase their holdings.

Table 3: Ownership of Corporate Equities

Portion (%) of total equities owned by each investor group (identified below), calculated by dividing the dollar value of corporate equities owned by each investor group (from the Federal Reserve) by total dollar value of corporate equities.

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1985	47.5	5.4	5.6	0.2	7.9	3.3	2.6	4.9	0.2	0.0	0.6
1986	48.0	5.6	6.1	0.3	6.8	3.0	2.3	5.8	0.3	0.0	0.6
1987	48.4	6.0	6.3	0.3	6.0	3.0	2.0	6.6	0.4	0.0	0.5
1988	49.9	6.7	6.5	0.3	5.7	2.9	2.3	6.5	0.4	0.0	0.4
1989	51.3	7.3	6.6	0.4	5.6	2.5	2.2	6.3	0.4	0.0	0.4
1990	50.0	7.7	7.4	0.4	5.5	2.4	2.3	6.6	0.5	0.0	0.3
1991	50.5	8.1	6.1	0.3	5.2	2.9	2.1	6.8	0.5	0.0	0.3
1992	51.9	8.2	6.1	0.3	4.4	3.0	1.9	7.2	0.5	0.0	0.3
1993	52.0	8.0	5.8	0.3	3.3	3.0	1.7	8.8	0.4	0.0	0.3
1994	49.2	8.3	6.2	0.3	2.7	3.7	1.8	10.9	0.5	0.0	0.3
1995	48.3	8.2	6.4	0.2	2.7	3.8	1.7	12.1	0.5	0.0	0.3
1996	47.4	8.5	6.6	0.3	2.6	3.9	1.5	13.8	0.5	0.0	0.3
1997	46.5	8.7	7.0	0.2	2.7	4.2	1.4	15.1	0.4	0.0	0.4
1998	46.1	8.6	7.7	0.2	2.4	4.5	1.3	15.7	0.3	0.1	0.4
1999	45.2	8.1	8.3	0.2	2.2	4.9	1.2	16.8	0.3	0.1	0.4
2000	43.9	7.6	8.6	0.2	2.1	5.2	1.1	18.3	0.2	0.3	0.4
2001	40.1	8.8	10.0	0.3	1.9	5.6	1.1	18.4	0.2	0.5	0.5
2002	37.1	9.3	10.8	0.2	1.8	6.1	1.3	18.8	0.3	0.7	0.6

(1) Individuals
(2) State and local governments and their retirement funds
(3) Non-US investors
(4) Depository institutions
(5) Bank managed estates and trusts
(6) Life insurance companies
(7) Other insurance companies
(8) Mutual funds
(9) Closed-end funds
(10) Exchange-traded funds
(11) Brokers and dealers

To determine whether differences in financial institutions objectives affect turnover, we use linear regression to analyze how the equity holdings of financial institutions, and changes in those holdings, affect turnover. The dependent variable in the regression is share turnover and, in a separate regression, dollar turnover, on the NYSE and on NASDAQ. Independent variables control for trading costs (per share commissions and individual investor and non-U.S. investor equity holdings or change in those holdings) and for information (total market value of equity, interest rate on federal funds and standard deviation of the Dow Jones Industrial Average). In addition to controlling for these factors identified in existing literature as affecting turnover, we investigate whether different financial institutions' holdings affect turnover. We do this by including financial institution holdings (and in a separate regression, percentage changes in financial institution holdings) as additional independent variables. If a financial institution's investment objectives lead it to hold equities for a relatively longer period than average, that financial institution's equity holdings and changes in those holdings should be negatively correlated with share and dollar turnover. The opposite relationship should hold if a financial institution trades equity more intensively than other institutions.

There is a risk of multicollinearity in the regression analysis due to the fact that the aggregate holdings of individual investors, non-U.S. investors and financial institutions change from quarter to quarter only due to new issuance or repurchase of equity which is generally minimal compared to the total value outstanding. To avoid possible confounding affects, rather than using the total holdings for individual investors, non-U.S. investors and financial institutions, we use excess holdings rather than total holdings (and excess percentage change in holdings rather than percentage change in holdings) as independent variables in the regressions.

To compute excess holdings for individual investors, we regress individual investor holdings as the dependent variable on total market value of equity as the independent variable. The residuals are excess individual investor holdings. We then regress the holdings of open-end mutual funds (as the dependent variable) on total market value of equity and individual investor holdings (as dependent variables). The residuals are excess open-end mutual fund holdings. Private pension fund holdings are then regressed on total market value, holdings of individual investors and holdings of open-end mutual funds to obtain excess holdings for private pension funds. We continue the process for non-U.S. investors, and for all the other financial institutions and residuals from each regression represent excess holdings, controlling for correlation with all prior investor groups' holdings. The order depends on the group's average holdings over the 18 year period; individual investors on average hold the largest value of equity, open-end mutual funds the next largest, then private pension funds, and etc.

The residual excess holdings for each investor group are orthogonal to all other excess holding residuals, eliminating the possibility of multicollinearity among these variables in our regression. We similarly adjust the percentage change in holdings variables to avoid multicollinearity in those regressions as well, although the risk is lower since the percentage changes do not necessarily aggregate to zero.

We report only the results of the regressions using excess holdings. Results using unadjusted data are similar to those reported and are available from the authors.

RESULTS

Table 4 presents the regression results for share turnover on NYSE (Panel A) and on NASDAQ (Panel B). NYSE turnover increases significantly with the excess equity holdings of depository institutions, private pension funds and closed-end funds. Excess equity holdings of bank managed estates and trusts, insurers other than life insurance companies and open-end mutual funds have a significantly negative effect on turnover. Holdings of life insurance companies and brokers and dealers are positively correlated; those of exchange traded funds and state and local governments and their retirement funds, negatively correlated with turnover, but the relationships are not statistically significant.

These results indicate that not all financial institutions have the same effect on NYSE turnover. Some increase turnover while others reduce it. While we are not able to identify specifically the average investment objectives that induce financial institutions to contribute differently to turnover, it is clear that differences exist. Since those differences are not due to differences in trading costs or access to information, they are necessarily associated with a financial institution's relative tendency to trade. This must be related to the institutions investment objectives. Depository institutions, private pension funds and closed-end funds contribute to turnover differently from bank managed estates and trusts, non-life insurers and open-end mutual funds.

Individual investors' excess holdings are negatively correlated with turnover. This may reflect individuals investors' relatively higher trading costs, their relatively more limited access to information, or their relatively longer investment horizons. Results for bank managed trusts and estates and those for open end mutual funds may be due to individual use of these institutions as a substitute for direct investing, causing the institutions to mirror longer individual holding periods even though the institutions have lower trading costs and better access to information.

With regard to the variables that control for other factors affecting turnover, the correlation between NYSE share turnover and average commissions per share, market value of equity and the standard deviation of the Dow Jones Industrial Average is positive. The result for equity value and volatility is consistent with theory and with prior findings that turnover increases with information. However, the correlation between average commissions per share and turnover is contrary to existing theory and findings in prior studies. This may arise because the inclusion of individual investor and financial institution holdings in the regression equation impounds the effects of differences in trading costs. The fed funds rate is positively correlated with turnover, but not significant.

Table 4: Regression of Share Turnover on Investor Holdings

OLS regression in which dependent variable, share turnover, is shares traded in the quarter divided by total shares outstanding, annualized by multiplying by the ratio of the number of trading days in the year to the number of trading days in the quarter. Independent variables are: percentage commissions per share based on annual broker/dealer commissions and total annual shares traded; total market value of corporate equity; standard deviation of daily Dow Jones Industrial Average for the quarter, average federal funds interest rate for the quarter; and excess holdings of corporate equity by households, non-US investors; depository institutions; bank-managed trusts and estates; life insurers; non-life insurance companies; private pension funds, state and local governments and their retirement funds; open end mutual funds; closed end funds; exchange traded funds; and brokers and dealers. Excess holdings by the household sector are the residuals obtained from regressing household holdings on total market value of equity. Excess holdings for each additional investor group are the residuals obtained from regressing that group's holdings on total market value of equity, household holdings and each additional investor groups' holdings..

	Panel A. NYSE turnover		Panel B. NASDAQ turnover	
Parameter	coeff.	t statistic	coeff.	t statistic
Intercept	0.138	0.974	1.153	2.592**
Commissions per share	5185.3	2.216**	-12939.0	-1.759*
Market value of corporate equity (x10-8)	2.750	4.226***	9.423	4.605***
Standard deviation of Dow Jones Industrial Average (x10-4)	8.226	4.123***	0.0024	3.829***
Federal funds rate	0.0104	1.302	0.008	0.322
Household sector (x10-7)	-2.598	-7.912***	-0.777	-0.753
Non-US investors (x10-7)	1.309	0.525	17.910	2.283**
Depository institutions (x10-7)	218.723	2.197**	-437.831	-1.398
Bank managed estates and trusts (x10-7)	-42.557	-4.588***	-95.120	-3.260***
Life insurance companies (x10-7)	9.107	1.425	23.811	1.185
Insurance companies other than life insurers (x10-7)	-48.756	-2.013**	-220.914	-2.900***
Private pension funds (x10-7)	6.406	3.862***	26.797	5.138***
State and local governments and their retirement funds (x10-7)	-5.162	-1.108	-8.805	-0.601
Open end mutual funds (x10-7)	-3.574	-1.679*	-7.677	-1.147
Closed end funds (x10-7)	105.951	1.781**	121.567	0.650
Exchange-traded funds (x10-7)	-27.926	-0.964	170.837	1.875*
Brokers and dealers (x10-7)	23.740	0.703	112.635	1.061
	F= 39.938 Adj R2 = 0.898		F= 95.124 Adj R2 = 0.94	

Number of observations: 72
*** (**, *) significant at the 1% (5%, 10%) level

In the NASDAQ turnover regression, the correlation of share turnover with private pension holdings (significantly positive) and with bank managed estates and trusts and insurers other than life insurers (both significantly negative) is the same as for NYSE turnover. That is also true for life insurers and brokers and dealers (positive, but not significant) and for state and local governments and their retirement funds (negative, but not significant).

Financial institutions can contribute to turnover in one market but have little effect on it in another. This may arise because most of the financial institution's holdings are in one market so its trading has little effect on total turnover in the other, or because the financial institution employs different strategies with different types of stocks. If the latter is true, it is consistent with the findings of Lee and Swaminathan (2000) that turnover differs with the characteristics of stocks. We observe this with respect to open and closed end mutual funds and for non-U.S. investors, the sign is the same as in the NYSE regression but the level of significance changes, and for depository institutions and exchange traded funds, the sign and the significance of the correlation with share turnover both change. Open and closed end funds excess holdings significantly affect NYSE turnover (the former negatively, the latter, positively), but do not have a significant effect on NASDAQ turnover. Depository institutions excess holdings significantly increase NYSE turnover, but reduce NASDAQ turnover, although not significantly. This indicates that these financial institutions trade differently in the two markets. The changes in significance suggest that these institutions' trading is concentrated in larger companies' stocks. In contrast, exchange traded funds reduce NYSE turnover (but not significantly), but significantly increase share turnover on NASDAQ. This financial institution appears also to pursue different objectives with different types of stocks.

Individual investor holdings are positively correlated with NASDAQ turnover. While our focus is on financial institutions with relatively low, homogeneous transactions costs, this result reinforces the idea that investor objectives are an important factor affecting turnover. Despite individual investors' relatively greater transactions costs, their excess equity holdings increase NASDAQ turnover.

Results for other market value of equity and for volatility are similar to those for NYSE turnover. Per share commissions are negatively correlated with NASDAQ share turnover and significant. This is consistent with expectations that higher transactions costs reduce turnover.

We also perform the regression analysis using dollar turnover as the dependent variable. See Table 5. For the most part, results for dollar turnover on NYSE (Panel A) and NASDAQ (Panel B) reflect the same relationship between the independent variables as for share turnover, with differences principally in levels of significance. Those differences provide additional weak support for the idea that financial institutions pursue different objectives with different types of stocks. Specifically, state and local government and their retirement funds appear to concentrate NYSE trading in high priced stocks (NYSE dollar turnover correlation is significant while NYSE share turnover correlation is not) and depository institutions and brokers and dealers concentrate

NASDAQ trading in high priced stocks (NASDAQ dollar turnover correlation is significant while share turnover is not). In contrast, open-end mutual fund and non-life insurers effects on NYSE turnover and exchange traded funds effect on NASDAQ turnover are more pronounced in low price stocks (share turnover correlation is significant while dollar turnover correlation is not).

Table 5: Regression of Dollar Turnover on Investor Holdings

OLS regression in which dependent variable, dollar turnover, is dollar volume for the quarter divided by total value of shares outstanding, annualized by multiplying by the ratio of the number of trading days in the year to the number of trading days in the quarter. Independent variables are: percentage commissions per share based on annual broker/dealer commissions and total annual shares traded; total market value of corporate equity; standard deviation of daily Dow Jones Industrial Average for the quarter, average federal funds interest rate for the quarter; and excess holdings of corporate equity by households, non-US investors; depository institutions; bank-managed trusts and estates; life insurers; non-life insurance companies; private pension funds, state and local governments and their retirement funds; open end mutual funds; closed end funds; exchange traded funds; and brokers and dealers. Excess holdings by the household sector are the residuals obtained from regressing household holdings on total market value of equity. Excess holdings for each additional investor group are the residuals obtained from regressing that group's holdings on total market value of equity, household holdings and each additional investor groups' holdings.

	Panel A. NYSE turnover		Panel B.NASDAQ turnover	
Parameter	coeff.	t statistic	coeff.	t statistic
Intercept	0.202	1.457	2.746	2.840***
Market value of corporate equity (x10-8)	4055.6	1.768*	-53410.1	-3.342***
Std dev. of Dow Jones Industrial Average (x10-4)	2.295	3.599***	3.981	0.896
Federal funds rate	0.001	4.165***	0.003	2.189**
Household sector (x10-7)	0.0106	1.359	0.1119	2.058**
Non-US investors (x10-7)	-2.097	-6.515***	-2.205	-0.983
Depository institutions (x10-7)	1.694	0.693	33.516	1.967*
Bank managed estates and trusts (x10-7)	226.761	2.323**	-1249.621	-1.837*
Life insurance companies (x10-7)	-39.487	-4.342***	118.179	1.865*
Insurance companies other than life insurers (x10-7)	4.777	0.762	44.274	1.014
Private pension funds (x10-7)	-32.875	-1.384	-496.662	-3.002***
State, local governments and retirement funds (x10-7)	7.199	4.428***	34.319	3.029***
Open end mutual funds (x10-7)	-7.902	-1.729*	-10.490	-0.329
Closed end funds (x10-7)	-0.755	-0.362	-12.612	-0.867
Exchange-traded funds (x10-7)	110.494	1.895*	-73.264	-0.180
Brokers and dealers (x10-7)	-35.771	-1.259	169.355	0.856
Market value of corporate equity (x10-8)	16.472	0.498	561.425	2.434**
	F= 35.33 Adj R2 = 0.886		F=30.77 Adj R2 = 0.870	

Number of observations: 72

*** (**, *) significant at the 1% (5%, 10%) level

For one financial institution, bank managed estates and trusts, the effect on NASDAQ share and dollar turnover is significantly different. Correlation of excess holdings with dollar turnover is significantly positive, but correlation with share turnover is significantly negative. Bank managed trusts and estates holdings increase NASDAQ dollar turnover but reduce its share turnover. This institutions' trading of NASDAQ equities must be highly concentrated in high value stocks.

Table 6: Regression of Share Turnover on Percentage Change in Investment

OLS regression in which dependent variable, share turnover, is shares traded in the quarter divided by total shares outstanding, annualized by multiplying by the ratio of the number of trading days in the year to the number of trading days in the quarter. Independent variables are: percentage commissions per share based on annual broker/dealer commissions and total annual shares traded; total market value of corporate equity; standard deviation of daily Dow Jones Industrial Average for the quarter, average federal funds interest rate for the quarter; and excess percentage change in household holdings of corporate equity, non-US investors; depository institutions; bank-managed trusts and estates; life insurers; non-life insurance companies; private pension funds, state and local governments and their retirement funds; open end mutual funds; closed end funds; exchange traded funds; and brokers and dealers. The data for excess percentage change in household holdings are the residuals obtained from regressing percentage change in household holdings on percentage change in total market value of equity. Excess percentage change in holdings for each additional investor group are the residuals obtained from regressing the percentage change in that group's holdings on percentage change in total market value of equity, percentage change in household holdings and percentage change in each additional investor groups' holdings.

	Panel A. NYSE turnover		Panel B. NASDAQ turnover	
Parameter	coeff.	t statistic	coeff.	t statistic
Intercept	0.704	6.198***	2.084	7.879***
Commissions per share	-3253.3	-1.095	-23605.4	-0.412***
Market value of corporate equity	-0.568	-0.930	6.926	4.870***
Standard deviation of Dow Jones Industrial Average	0.001	5.498***	0.002	3.565***
Federal funds rate	-0.003	-0.295	-0.050	-2.372**
Household sector	-11.535	-4.058***	-17.186	-2.596**
Non-US investors	2.097	2.705***	3.265	1.808*
Depository institutions	0.000	-0.020	0.015	1.044
Bank managed estates and trusts	-0.765	-1.354	1.349	1.025
Life insurance companies	-0.041	-0.110	-0.312	-0.358
Insurance companies other than life insurers	-0.470	-0.594	0.447	0.243
Private pension funds	-3.169	-1.972*	-4.150	-1.109
State and local governments and their retirement funds	0.036	0.466	0.138	0.775
Open end mutual funds	0.010	0.012	5.629	2.709***
Closed end funds	0.259	1.944*	0.450	1.450
Exchange-traded funds	0.099	1.856*	0.204	1.641
Brokers and dealers	0.014	0.143	0.319	1.414
	F= 18.04 Adj R2 = 0.793		F= 85.52 Adj R2 = 0.950	

Number of observations: 72
*** (**, *) significant at the 1% (5%, 10%) level

The results of regressions that use excess percentage change in investment as the dependent variable confirm that financial institutions contribution to turnover rates differs across institutions. Portfolio adjustments that alter institutions' net corporate equity investment position affect turnover differently for different financial institutions. Table 6, presents the results for share turnover on NYSE (Panel A) and NASDAQ (Panel B); Table 7, the results for dollar turnover.

Table 7: Regression of Dollar Turnover on Percentage Change in Investment

OLS regression in which dependent variable, dollar turnover, is dollar volume for the quarter divided by total dollar value of shares outstanding, annualized by multiplying by the ratio of the number of trading days in the year to the number of trading days in the quarter. Independent variables are: percentage commissions per share based on annual broker/dealer commissions and total annual shares traded; total market value of corporate equity; standard deviation of daily Dow Jones Industrial Average for the quarter, average federal funds interest rate for the quarter; and excess percentage change in household holdings of corporate equity, non-US investors; depository institutions; bank-managed trusts and estates; life insurers; non-life insurance companies; private pension funds, state and local governments and their retirement funds; open end mutual funds; closed end funds; exchange traded funds; and brokers and dealers. The data for excess percentage change in household holdings are the residuals obtained from regressing percentage change in household holdings on percentage change in total market value of equity. Excess percentage change in holdings for each additional investor group are the residuals obtained from regressing the percentage change in that group's holdings on percentage change in total market value of equity, percentage change in household holdings and percentage change in each additional investor groups' holdings.

	Panel A. NYSE turnover		Panel B. NASDAQ turnover	
Parameter	coeff.	t statistic	coeff.	t statistic
Intercept	0.633	5.969***	3.067	5.078***
Commissions per share	-2461.0	-0.887	-49544.0	-3.137***
Market value of corporate equity	-0.398	-0.698	4.613	1.421
Standard deviation of Dow Jones Industrial Average	0.001	5.485***	0.003	2.474**
Federal funds rate	0.0030	0.349	0.0228	0.471
Household sector	-12.243	-4.612***	-22.240	-1.472
Non-US investors	2.279	3.147***	-0.418	-0.101
Depository institutions	-0.003	-0.528	0.006	0.184
Bank managed estates and trusts	-0.432	-0.819	1.272	0.423
Life insurance companies	0.026	0.074	-0.809	-0.407
Insurance companies other than life insurers	-0.814	-1.102	10.524	2.504*
Private pension funds	-2.826	-1.884*	-2.268	-0.265
State and local governments and their retirement funds	0.045	0.634	0.365	0.894
Open end mutual funds	0.001	0.002	8.550	1.802*
Closed end funds	0.248	1.992*	1.035	1.461
Exchange-traded funds	0.087	1.748*	0.460	1.625
Brokers and dealers	0.035	0.382	0.037	0.071
	F= 17.72 Adj R2 = 0.790		F= 0.000 Adj R2 = 0.890	

Number of observations: 72
*** (**, *) significant at the 1% (5%, 10%) level

The effect of a financial institution changing its net equity investment differs across institutions. Changes by closed-end funds and exchange traded funds are positively correlated with NYSE share and dollar turnover; changes by private pensions funds, negatively correlated. That is, turnover is greater in those months in which closed end funds or exchange traded funds increase their equity holdings and lower in those months in which pension funds increase theirs. NASDAQ share and dollar turnover is positively correlated with changes in open end mutual fund holdings and dollar turnover is also positively correlated with changes in equity holdings by insurance companies other than life insurers.

CONCLUSION

We examine how financial institutions' equity holdings and change in their net equity investments affect the components of share and dollar turnover in the New York Stock Exchange and on NASDAQ from 1985 through 2002. The effect of factors previously identified in the turnover literature, transactions costs and the volatility of information affect turnover, is as expected based on that literature. We find that differences exist in how financial institutions' equity holdings and changes in those holdings affect turnover. Since there is likely little difference in financial institutions' access to information or trading costs, the differences must be related to differences in financial institutions' investment objectives. We also find that some financial institutions affect turnover in NYSE and NASDAQ differently and that some investor groups generate turnover in only a subset of stocks in NASDAQ.

Our results suggest that studies that examine equity turnover should not only control for transactions costs and information but for differences arising the composition of the investors holding a particular companies stock. Turnover will be greater if a larger portion of a company's equity is held e.g. by depository institutions or closed end funds, and lower if it is held instead by insurers other than life insurance companies. Ignoring the effect of investor objectives on turnover may lead to erroneous inferences.

We identify several additional research opportunities. We do not specifically identify the differences in financial institutions' objectives that cause the observed differences in effect on turnover. We note that it is possible that the financial institutions' effect on turnover arises from the stocks that it holds. That is, it may be possible that some stocks are associated with greater turnover regardless of what investor group holds them. If turnover is driven by stocks held rather than investment objectives, differences we observe among financial institutions may be due to the composition of the institutional portfolio rather than differences in institutional objectives. Finally, we do not examine whether individual financial institutions within an investor group pursue different objectives and thus whether effects on turnover differ within a single type of financial institution. Each of those studies requires additional information about the holdings of individual financial institutions or the investor composition for individual stocks. While such data is available, those questions are beyond the scope of this study.

ENDNOTES

1 S.E.C. data on total commissions received by securities brokers is available only through 2002.

2 The holdings of state and local government and their retirement funds are dominated by the retirement fund portion so we interpret the results for this variable as a result for a financial institution rather than a non-institutional investor group.

3 Non-U.S. investors may be primarily financial institutions. However, their access to information and trading costs are likely to differ from those of domestic financial institutions. Differences observed for this investor group may be due to trading costs or access to information rather than investment objectives.

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THE RELATIONSHIP BETWEEN INTEREST RATES ON THE NUMBER OF LARGE AND SMALL BUSINESS FAILURES

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ABSTRACT

This paper presents evidence suggesting interest rates have dissimilar effects on the large firm and small business failures. We examine monthly time-series data for the period 1984-1998 and find the interest rate is positively associated with the number of large business failures and negatively associated with the number of small business failures. We also find interest rates exhibit a long memory. For small businesses the negative impact of the interest rate on the number of failures is immediate and the lagged interest rate continues to be significant and strong and for over four years; for large firms the positive impact of the interest rate on the number of failures is delayed several months before gaining strength. Using maximum likelihood estimation to relate the number of large and small business failures to the interest rate, we find the interest rate is a statistically significant determinant of small business failure and the sign of the coefficient is negative. We do not find the interest rate a statistically significant determinant of large business failure. These results suggest the interest rate is more influential in the small business failure process.

INTRODUCTION

In this paper we analyze the business failure process for large and small firms in the context of changing interest rates. Anecdotal evidence suggests interest rates and business failures are positively associated; however, empirical evidence of a positive association is weak. Most of the prior empirical work tests large firm samples and, due to research design limitations, correlated predictor variables and nonstationarity over time make interpretation of individual predictors speculative. The present study focuses exclusively on the association between interest rates and the number of large firm and small firm failures over the period 1984-1998.

Although macroeconomic factors are commonly viewed as important causes of business failure, they have received sparse attention in the literature (Everett and Watson, 1998). This is unusual given the potential benefit of understanding the external causes of business failure. For example, the forecasting accuracy of bankruptcy prediction models could be enhanced by the incorporation of macroeconomic variables. This would assist lenders in assessing the risk of default, auditors in assessing the failure risk of their clients, and management in assessing the merits of restructuring. Also, understanding the external causes of business failure would allow public policymakers to better serve the business sector. Once the effects of the key macroeconomic determinants are understood, government policy could influence the failure rate by changing the economic environment in which businesses operate.

This is the first study to report differential effects for interest rates in the large firm versus small firm failure processes. Specifically, using correlation analysis, we find the relationship between interest rates and the number of large firm failures is positive (as interest rates increase, large firm failures increase), while the relationship between interest rates and the number of small firm failures is negative (as interest rates increase, small business failures decrease). Interest rates also exhibit long-term statistical dependence; however, we find the magnitude and nature of the dependence differs between large and small firms. We find the negative association between interest rates and small business failure strong and immediate and it continues to persist for over four years. In contrast, we find the positive association between interest rates and large business failure weak initially, but after a four month lag it becomes significant and continues strong for over four years. In addition to correlation analysis, we perform regression analysis to assess concurrent interest rates as a predictor of the number of firm failures. We find a statistically significant association for small firms and the coefficient is negative; we do not find a statistically significant association for large firms. These results suggest the impact of interest rates on the small firm failure process is different both in direction and magnitude from the impact on the large firm failure process.

A brief review of previous studies is presented in the following section. A description of the research design, the results, and conclusions are presented in the succeeding sections.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Empirical evidence suggests business failure is often caused by a complex combination of endogenous factors (Altman, 1968; Olson, 1980; Hambrick and Crozier, 1985; Duchesneau and Gartner, 1990; Lussier, 1996; Perry, 2001; Carland et al., 2001) and exogenous factors (Altman, 1971; Carroll and Delacroix, 1982; Rose et al., 1982; Everett and Watson, 1998; Yrle et al., 2001). Empirical evidence also suggests heterogeneous failure processes for large and small firms. Large firm failure is generally a long downward spiral (Hambrick and D'Aveni, 1988), while small firm failure is generally catastrophic and abrupt (Venkataraman et al., 1990).

The primary causes of small business failure appear to be the lack of appropriate management skills, inadequate capital, and fraud (Carland, 2001). However, a number of small business studies also document the relevance of exogenous factors, such as interest rates. Peterson et al. (1983) found, although endogenous factors were the main cause of failure, exogenous factors had a significant effect in approximately one-third of small business failures. Birley and Niktari

(1995) report the economy ranked third as the primary cause of failure for 486 independent owner-managed businesses as described by their accountant or bank manager. Everett and Watson (1998) suggest economic factors are associated with between 30% and 50% of small business failures, depending on the definition of failure used.

Large firm studies generally find a positive relationship between interest rates and the number of business failures (e.g. Rose et al., 1982; Wadhwani, 1986; Hudson 1989). Rose et al. (1982) performed a stepwise regression on thirteen macroeconomic factors using various lead-lag relationships. They found the most promising model had six factors two of which were interest rates, the prime rate and the ninety-day treasury bill rate, both lagged four quarters. In their regression results, the lagged ninety-day treasury rate had a positive sign and was significant at the .0001 level, while the lagged prime rate had a negative sign and was significant at the .01 level. These results illustrate the correlation among variables problem existing in most multivariate models containing several macroeconomic factors.

Studies examining the macroeconomic determinants of small business failure also tend to find a positive relationship between interest rates and firm failure. Hall and Young (1991) found directors, in stating reasons for the failure of their businesses, rated high interest rates as ranking eighth in importance. Using regression analysis, Yrle et al. (2001) found small business failure rates are positively associated with interest rates. Everett and Watson (1998) found a significant positive association between business failures and interest rates when "failure" was defined as bankruptcy, but when "failure" was defined as discontinuance of ownership, the unemployment rate replaced the interest rate as a significant predictor.

Conventional theory holds in a period of high interest rates or credit unavailability, failure may be induced by raising borrowing costs in excess of profit margins (Mensah, 1984). Many small businesses carry relatively heavy loads of short-term debt and are particularly sensitive to debt carrying costs (Hall, 1992). Additionally, in times of high interest rates, consumer discretionary income is reduced which impacts the revenues of many small businesses. Conventional theory thus argues for a positive association between interest rates and business failure.

Recent literature suggests a more complex theoretical relationship between interest rates and business failures. Campbell and Choudhury (2002) view business failure as a process in which individual firm failures are interconnected through layers of contractual relationships. The length of the collaboration period can affect the failure rate by mitigating the disruptive impact of contractual disengagement on other marginally viable firms. A longer collaboration period causes less contractual disruption, thereby mitigating contagion effects and slowing business failure momentum (Campbell and Choudhury, 2002). But, the effect of interest rates on the collaboration period is uncertain. Levy (2001, p1) presents a model highlighting the, "nexus of interactions among financial, industrial and macroeconomic factors determining the Pareto optimal date on which the firm's claimants stop collaborating and force the firm into liquidation". On the one hand a high interest rate will discourage the equity holder since it increases the firm's liability accumulation rate.

On the other hand, it enhances the attraction of the firm's debt to the creditor relative to alternative financial transactions and thereby reduces the compensation payment required for the creditor's collaboration (Levy, 2001, p.8). High interest rates certainly increase borrowing costs which could induce some firms to fail; however, by extending the collaboration period, higher interest rates could slow business failure momentum and thereby save other marginally viable firms. The net effect of high interest rates on business failure is therefore uncertain under the Levy model.

In summary, the empirical evidence suggests a positive association between interest rates and firm failures for both large and small firms, however, the anecdotal evidence is weak and the multivariate studies have collinearity problems. Using the research design discussed in the following section, the present study attempts to isolate the association between interest rates and the number of large firm and small firm failures.

RESEARCH DESIGN

Our sample is a time series of monthly business failure and interest rate data beginning January 1984 and ending November 1998. Limiting the sample period to these months, avoids certain shortcomings in the business failure data. In January 1984 Dun and Bradstreet, Inc. (D&B) made significant changes in its data collection procedures, D&B is the primary source of data on the number of business failures and the business failure rate. It increased its coverage of the service sector, included three new sectors (agriculture, forestry, and fishing; finance, insurance, and real estate; and transportation and public utilities), and moved some industries from the manufacturing and services sector to other sectors (Lane and Scary, 1991). A footnote to the D&B business failure data warns users of the potential non-comparability in the pre- and post-1984 data (Dunn and Bradstreet's measures of failures, 1955-1998) and Lane and Scary (1991) find the 1984 data change, "seriously affects the comparability of the pre- and post-1984 data on business failures" [p.96]. To avoid this non-comparability problem, we begin the time series in January 1984 and end the time series in November 1998, at this time D&B reorganized its internal operations and ceased reporting business failure statistics.

D&B defines a business failure as, "a concern that is involved in a court proceeding or voluntary action that is likely to end in a loss to creditors" (Dun and Bradstreet, 1998). All industrial and commercial enterprises petitioned into the Federal Bankruptcy Courts are included in this definition. Also included are: 1) concerns forced out of business through actions in the state courts such as foreclosures, executions, and attachments with insufficient assets to cover all claims; 2) concerns involved in court actions such as receiverships, reorganizations, or arrangements; 3) voluntary discontinuations with a known loss to creditors; and 4) voluntary out of court compromises with creditors. D&B defines a small business as a concern having less than $100,000 in current liabilities and a large business as a concern having more than $100,000 in current liabilities. Current liabilities include all accounts and notes payable, whether secured or unsecured, known to be held by banks, officers, affiliated companies, suppliers, or government. Not included are long-term publicly held obligations (Dun and Bradstreet, 1998).

Table 1: Summary Statistics for Large and Small Firm Failures for the Periods
January 1984 - November 1998 (Monthly Data)[a]

Variables[b]	Monthly Means	Standard Deviations	Minimums	Maximums
SMFAIL	3763.00	1202.00	1230.00	6365.00
LGFAIL	2027.00	511.84	1223.00	4145.00
INTEREST RATE	8.70	1.63	6.00	13.00

[a] Small firms have less than $100,000 in current liabilities; large firms have more than $100,000 in current liabilities. A failure is defined as, "a concern that is involved in a court proceeding or voluntary action that is likely to end in a loss to creditors." Source: Dun & Bradstreet, Inc.
[b] Variable Definitions:
SMFAIL = number of small firm failures;
LGFAIL = number of large firm failures;
INTEREST RATE = average prime rate charged by banks, stated as a percentage.

Table 1 shows the distributions of small and large business failures for the sample period. Small firm failures exceeded large firm failures by a little less than a 2:1 margin. Also, the number of small firm failures per month shows more variance than the number of large firm failures. Table 1 also presents the summary statistics for the prime bank interest rate over the sample period. The interest rate data were obtained from the Conference Board. The prime interest rate was relatively stable over the sample period, ranging from six to thirteen percent.

To test the relationship between interest rates and the number of business failures we perform two separate analyses. First, we use correlation analysis to examine the direction of the association and whether interest rates exhibit a long memory, a term used to refer to long-term statistical dependence in time series data. Second, we regress the number of small firm and large firm business failures on the prime interest rate (INTEREST RATE) and a control for business failure momentum (MOMENTUM). INTEREST RATE is the bank prime rate stated as a percentage; MOMENTUM is a constant growth series beginning at 1 and growing by the constant amount B=1 each month. The control variable, MOMENTUM, is a proxy for market expansion and systemic growth.

In the regression analysis, the Durbin-Watson statistic on ordinary least squares (OLS) estimates indicated the presence of positive autocorrelation even after controlling for systemic growth. One major consequence of autocorrelated errors (or residuals) when applying ordinary least squares is the formula variance [$\sigma^2 (X'X)^{-1}$] of the OLS estimator is seriously underestimated where X represents the matrix of independent variables and σ^2 is the error variance (Choudhury, 1994). We evaluated the autocorrelation function and partial autocorrelation function of the OLS regression residuals using SAS procedure PROC ARIMA (see SAS/ETS User's Guide, 1993). This was necessary because the Durbin-Watson statistic is not valid for error processes other than first order (see Harvey 1981, pp. 209-210). This allowed observance of the degree of autocorrelation and identification of the order of the model sufficiently describing the autocorrelation. After evaluating the autocorrelation function and partial autocorrelation function, the residuals model was identified as second order autoregressive model $\left(1 - \phi_1 B - \phi_2 B^2\right) \nu_t = \varepsilon_t$ (see Box, Jenkins, & Reinsel, 1994). The final specification of the regression model is of the following form for large and small firm failures:

$$LGFAIL_t = \beta_0 + \beta_1 MOMENTUM_t + \beta_2 INTEREST\_RATE_t + \nu_t \qquad (1),$$
and $\nu_t = \phi_1 \nu_{t-1} + \phi_2 \nu_{t-2} + \varepsilon_t$

$$SMFAIL_t = \beta_0 + \beta_1 MOMENTUM_t + \beta_2 INTEREST\_RATE_t + \nu_t \qquad (2),$$
and $\nu_t = \phi_1 \nu_{t-1} + \phi_2 \nu_{t-2} + \varepsilon_t$.

Where:

MOMENTUM = a series starting at 1 and growing at a constant amount B=1 each month;
INTEREST RATE = the average prime rate charged by banks.

We use the maximum likelihood technique to estimate the regression parameters. Maximum likelihood estimation is preferred over two step generalized least squares because it can estimate both regression parameters and autoregressive parameters simultaneously. In addition, maximum likelihood estimation accounts for the determinant of the variance-covariance matrix in its objective function (likelihood function). In general, the likelihood function of a regression model with autocorrelated errors has the following form:

$$L(\beta, \theta, \sigma^2) = -\frac{n}{2} \ln (\sigma^2) - \frac{1}{2} \ln |\Omega| - \frac{(Y - X\beta)'\Omega^{-1}(Y - X\beta)}{2\sigma^2},$$

where

Y- vector of response variable (number of failures),
X – matrix of independent variables (MOMENTUM, NEWBUS, and Intercept),
β – vector of regression parameters,
θ – vector of autoregressive parameters,
σ^2 – error variance,
Ω – variance-covariance matrix of autocorrelated regression errors.

For further discussion on different estimation methods and the likelihood function, see Choudhury et al. (1999); also see SAS/ETS User's Guide, 1993 for expressions of the likelihood function.

RESULTS

In this section we report the results of tests investigating the association between interest rates and the number of large and small business failures. Table 2 presents correlation statistics for business failures and interest rates, and lagged interest rates for the period January 1984 – November 1998. Strong correlations are observed in opposite directions for large and small firms.

Table 2: Correlations between Number of Failures, Interest Rate, and Lagged Interest Rate for the Periods January 1984 – November 1998.

Monthly Lags[a]	Large Firm Failures[b]	Small Firm Failures[b]	Monthly Lags[a] (contd.)	Large Firm Failures[b]	Small Firm Failures[b]
INTEREST RATE LAG0	0.06456 (0.3905)	-0.77135 (<.0001)			
RATE LAG1	0.07790 (0.3000)	-0.76215 (<.0001)	RATE LAG25	0.53808 (<.0001)	-0.40337 (<.0001)
RATE LAG2	0.09258 (0.2177)	-0.75384 (<.0001)	RATE LAG26	0.52880 (<.0001)	-0.41202 (<.0001)
RATE LAG3	0.12374 (0.0989)	-0.73810 (<.0001)	RATE LAG27	0.52879 (<.0001)	-0.41761 (<.0001)
RATE LAG4	0.15973 (0.0327)	-0.72331 (<.0001)	RATE LAG28	0.53150 (<.0001)	-0.42731 (<.0001)
RATE LAG5	0.19998 (0.0073)	-0.70803 (<.0001)	RATE LAG29	0.53792 (<.0001)	-0.43827 (<.0001)
RATE LAG6	0.24166 (0.0011)	-0.68991 (<.0001)	RATE LAG30	0.55111 (<.0001)	-0.45553 (<.0001)
RATE LAG7	0.27786 (0.0002)	-0.67374 (<.0001)	RATE LAG31	0.56267 (<.0001)	-0.47297 (<.0001)
RATE LAG8	0.31010 (<.0001)	-0.65273 (<.0001)	RATE LAG32	0.57631 (<.0001)	-0.49083 (<.0001)
RATE LAG9	0.33816 (<.0001)	-0.62985 (<.0001)	RATE LAG33	0.58200 (<.0001)	-0.50864 (<.0001)
RATE LAG10	0.36590 (<.0001)	-0.60411 (<.0001)	RATE LAG34	0.58878 (<.0001)	-0.52820 (<.0001)
RATE LAG11	0.38220 (<.0001)	-0.58176 (<.0001)	RATE LAG35	0.57716 (<.0001)	-0.54882 (<.0001)
RATE LAG12	0.39348 (<.0001)	-0.55911 (<.0001)	RATE LAG36	0.56716 (<.0001)	-0.56809 (<.0001)

Table 2: Correlations between Number of Failures, Interest Rate, and Lagged Interest Rate for the Periods January 1984 – November 1998.					
Monthly Lags[a]	Large Firm Failures[b]	Small Firm Failures[b]	Monthly Lags[a] (contd.)	Large Firm Failures[b]	Small Firm Failures[b]
RATE LAG13	0.40935 (<.0001)	-0.53279 (<.0001)	RATE LAG37	0.56207 (<.0001)	-0.58248 (<.0001)
RATE LAG14	0.41630 (<.0001)	-0.50647 (<.0001)	RATE LAG38	0.53461 (<.0001)	-0.59443 (<.0001)
RATE LAG15	0.43179 (<.0001)	-0.47767 (<.0001)	RATE LAG39	0.51875 (<.0001)	-0.59917 (<.0001)
RATE LAG16	0.44502 (<.0001)	-0.45676 (<.0001)	RATE LAG40	0.48838 (<.0001)	-0.60252 (<.0001)
RATE LAG17	0.45763 (<.0001)	-0.43850 (<.0001)	RATE LAG41	0.46729 (<.0001)	-0.60173 (<.0001)
RATE LAG18	0.47734 (<.0001)	-0.42417 (<.0001)	RATE LAG42	0.45652 (<.0001)	-0.60174 (<.0001)
RATE LAG19	0.49121 (<.0001)	-0.41501 (<.0001)	RATE LAG43	0.43372 (<.0001)	-0.60598 (<.0001)
RATE LAG20	0.51164 (<.0001)	-0.40557 (<.0001)	RATE LAG44	0.43324 (<.0001)	-0.60957 (<.0001)
RATE LAG21	0.52333 (<.0001)	-0.39840 (<.0001)	RATE LAG45	0.42167 (<.0001)	-0.61636 (<.0001)
RATE LAG22	0.52956 (<.0001)	-0.39509 (<.0001)	RATE LAG46	0.41563 (<.0001)	-0.62099 (<.0001)
RATE LAG23	0.53878 (<.0001)	-0.39678 (<.0001)	RATE LAG47	0.40197 (<.0001)	-0.63103 (<.0001)
RATE LAG24	0.53811 (<.0001)	-0.39989 (<.0001)	RATE LAG48	0.38682 (<.0001)	-0.64370 (<.0001)

( ) p-values
[a] Variable Definitions: RATE LAG(J) = bank prime interest rate lagged J months back in time.
[a] Small firms have less than $100,000 in current liabilities; large firms have more than $100,000 in current liabilities. A failure is defined as, "a concern that is involved in a court proceeding or voluntary action that is likely to end in a loss to creditors." Source: Dun & Bradstreet, Inc.

In Table 2 the large firm time series exhibits a weak positive correlation between interest rates and the number of large firm failures initially; however, interest rates exhibit a long memory. The impact of interest rates becomes significant at four months and remains strong for over four years. This finding is consistent with prior empirical evidence suggesting large firm failure is a protracted downward spiral (Hambrick and D'Aveni, 1988). The concept of long memory is used to indicate a statistical dependence in which in a time series the autocorrelation function decays at a much slower rate than in the case of short-term statistical dependence. Long-term dependence has only begun to be addressed in macroeconomic and financial time series data (Abderrezak, 1998).

The third and sixth columns in Table 2 report the correlation statistics for small firm failures. Contrary to the large firm results, the correlation between interest rates and the number of small firm failures is negative and immediate. The immediate impact is consistent with prior empirical evidence suggesting small firm failure, particularly new small firm failure, is often abrupt and catastrophic (Venkataraman et al., 1990), but the negative correlation was unexpected. The lagged interest rate correlations are also negative and exhibit a long memory.

The regression results reported in Table 3 provide confirming evidence of the contrasting effects of interest rates on large firm and small firm failures.

Table 3: Regression Results for Number of Large and Small Firm Failures for the Period January 1984 - November 1998 (Monthly Data)[a] : Maximum Likelihood Estimates.

Independent Variables[b]	Large Firm Failures (corrected for autocorrelation[d])	Small Firm Failures (corrected for autocorrelation[e])
Intercept	3621.00[C] (2.66)***	1848.00 (0.97)
MOMENTUM	-3.44 (1.30)	10.75 (2.93)***
INTEREST RATE	-25.49 (-0.40)	-269.89 (-2.96)***
R-Squared	0.62	0.86
Durbin-Watson	2.06	2.08

[a] Small firms have less than $100,000 in current liabilities; large firms have more than $100,000 in current liabilities. A failure is defined as, "a concern that is involved in a court proceeding or voluntary action that is likely to end in a loss to creditors." Source: Dun & Bradstreet, Inc.

[b] Variable Definitions:

MOMENTUM = a series starting at 1 and growing at a constant amount B=1 each time period;

INTEREST RATE = average prime rate charged by banks;

[c] The t-statistics reported in parenthesis are significant at ten (*), five (**), and one (***) percent levels.

[d] The regression residuals model was identified as, $\left(1-\phi_1 B-\phi_2 B^2\right)\nu_t=\varepsilon_t$ and the estimated first and second order autoregressive (AR) parameters from SAS were, $\left(1+\underset{(6.26)^{***}}{0.44\,B}+\underset{(5.26)^{***}}{0.40\,B^2}\right)\nu_t=\varepsilon_t$

Where t-statistics for autoregressive parameters are reported in parentheses and they are both significant at the one (***) percent level.

[e] The regression residuals model was identified as $\left(1-\phi_1 B-\phi_2 B^2\right)\nu_t=\varepsilon_t$, and the estimated first and second order autoregressive (AR) parameters from SAS were $\left(1+\underset{(6.37)^{***}}{0.46\,B}+\underset{(5.00)^{***}}{0.37\,B^2}\right)\nu_t=\varepsilon_t$

Where t-statistics for autoregressive parameters are reported in parentheses and they are both significant at the one (***) percent level.

The interest rate variable is not a statistically significant predictor of large firm failures; however, for small firms failures the interest rate variable is significant and the coefficient is negative. These results suggest, if the prime interest rate increases by one percent, small business failures decrease by approximately 270 firms per month. The estimated coefficient for business failure momentum (MOMENTUM) is also statistically significant for small business failures. These results suggest, if time advances by one month, the number of small business failures increase by approximately 11 firms over the prior month. After being adjusted for autocorrelation, the Durbin-Watson test-statistic indicates the errors are not correlated. Also, the R-squared statistic for the small firm model is high at .86, versus .62 for large firm failures. This result further suggests interest rates are more determinative of small business failure.

CONCLUSION

This paper makes a number of significant contributions to the literature. It provides additional evidence of differences in the small business and large business failure processes. Interest rates were found to be a key determinant of small business failure, but not large business failure. It also provides evidence suggesting interest rates exhibit a long memory. These results while important were not unexpected given the prior work done in this area. The unexpected finding was the negative association between interest rates and the number of small business failures. This result contradicts other small firm studies examining the macroeconomic determinants of business failure; however, unlike the present study, these prior studies did not control for systemic growth, nor did they address the autocorrelation and collinearity issues.

Considering interest rates separately from other macroeconomic factors illustrates how state policy makers can benefit from using the results of this study. It is well known high interest rates impede small business formation. These results add another dimension to the debate concerning the effects of changing interest rates. Regarding small business failures, changing interest rates involves a policy choice of either helping marginally viable existing small businesses survive (a high interest rate environment) or helping new small businesses form (a low interest rate environment). Additional theory development is needed, particularly with regard the importance of the collaboration period in the small business failure process.

The sample period is a limitation of this study. To determine whether the negative association between interest rates and small business failure is stationary, future research could examine interest rates and business failures over different time periods and in different economies. Also, future research concerning the macroeconomic determinants of business failure should consider whether more useful results could be obtained by explicitly addressing multicollinearity and autocorrelation in the research design. Isolating the effect of specific macroeconomic determinants may be more informative than multivariate models with greater explanatory power.

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A MODEL FOR DETERMINATION OF THE QUALITY OF EARNINGS

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ABSTRACT

This article is grounded on the premise that corporate earnings drive corporate value which subsequently drives stock prices. For example, if a corporation generates better than expected earnings, then corporate value increases and is followed by related stock price increases. Historically, literature suggests that good equity investments are those of companies that show better than average earnings. This close correlation of earnings and stock price movement often exerts an unrealistic demand on top company officials to maintain better than expected earnings figures. Such expectations led to the 'earnings management' phenomenon the United States began experiencing in 2001 that later reached epidemic portions during 2002. This state of affairs prompted a call for the accounting and finance community to do something to detect earnings management practices early so that investors did not continue to lose their life savings when investing in capital markets.

The authors propose a model identified as the Q Test that provides a mathematical approach to quality earnings determination. The model is designed along the same lines as Altman's Z Score, which is a widely acclaimed model used to assess companies in various stages of financial distress. The model is tested using financial statements of publicly held companies in which the Q Test is compared to stock price movements of selected companies. Results of the study indicate that the Q Test is a reliable measure of quality of earnings reported by publicly held companies.

INTRODUCTION

The marketing profession uses a measurement known as the Q Score in a way to measure the familiarity and appeal of a brand, company, or television show. There is evidence that the Q Score is more valuable to marketers than other popularity measurements such as the Nielsen Ratings because Q Scores indicate not only how many people are aware of or watch a product, but also how those people feel about the product. The music industry uses the Q factor to measure the "quality" of a resonant system. Resonant systems respond to frequencies close to the natural frequency much more strongly than they respond to other frequencies. The authors assert that there is a need for a measure in accounting that can be used to accurately assess the quality of earnings reported by public companies on financial statements. A mathematical model we identify as the Q Test is proposed in this article.

EARNINGS MANAGEMENT

Earnings management usually consists of one or a combination of the following: 1) over-statement of revenue, (2) understatement of expenses, and (3) misrepresentation of accruals. Such earnings management practices typically cause long-term disastrous results. Often affected companies' stock prices deteriorate to practically nothing in short periods of time (for example, Enron, WorldCom, and Lucent). The earnings management fiasco led to a call for the accounting and finance community to do something to detect the earnings management process early, thereby protecting investors from losing life savings when investing in capital markets. Many accounting and finance journals have included articles that identified ways of distinguishing quality earnings from managed earnings (Brown, 1999, Branner; 2001, Morgenson; 1999; and Krantz, 2002).

THE DETERMINANTS OF QUALITY EARNINGS

"High quality" EPS (Wayman, 2003) means that the number is a relatively true representation of what the company actually earned (i.e. cash generated). Amernic and Robb (2003) observed that quality earnings converge with reported profits of publicly held companies. It has been suggested (Kamp, 2002) that three elements encompass aspects of quality earnings; clear indication of ongoing costs and revenues, clear indication of performance of the company's core business, and a direct correlation of cash flow with earnings.

McClure (2004) purports the three characteristics of 'quality earnings' as those earnings that are repeatable, are controllable, and are efficient cash generators. There are two quality ways to boost earnings: increase sales and cut costs because these are repeatable. Next, earnings growth that is the result of economic or societal factors is not really quality growth. For example, earnings growth in the oil industry could be more the result of uncontrollable factors such as soaring commodity oil and natural gas prices than true economic growth. Finally, quality earnings should generate cash efficiently.

The bankruptcy of W.T. Grant Company in 1975 is an example of a company that showed good earnings until just before it went under (Largay and Stickney, 1980). Revenue increased by 35% from 1972 to 1974 and earnings grew by 7% from 1972 to 1973 before declining by 78% from 1973 to 1974 (Stickney, et al, 2004). Also, Grant financial statements revealed good working capital, current, and acid test ratios up to the year of bankruptcy. The W.T. Grant case is one of the early experiences that involved non-quality reported earnings. Grant's stock prices remained high along with its reported earnings until just before bankruptcy occurred.

Stickney, et al (2004) notes that quality accounting information should be a fair and complete representation of a firm's economic performance, position, and risk. Further, quality accounting information should provide relevant information to forecast the firm's expected future earnings and cash flows.

A search of the literature reveals several ideas that writers suggest as methods for determination of quality or earnings. Most literature surveyed included cash flow from operating activities as an important determinant of quality of earnings. Additionally, recurring themes of continuity of operations and good performance in the company's core business (operating income) surfaced as strong indicators of the quality of reported accounting information. Also, some test should be used to check for persistency and predictability of reported earnings. Performance in the company's core business and continuing operations seem to meet these criteria.

Finally, risk plays an important part in reporting quality accounting information. This is especially true for balance sheet presentations where true economic representation of assets and liabilities are important. Inflated earnings create inflated reported values of assets and, likewise, understated expenses are likely to lead to understated liabilities or inaccurate capitalization of expenses. Thus earnings quality has a direct bearing on items reported on the balance sheet.

PURPOSE OF THIS STUDY

In 1968, Edward Altman developed a statistical model that had a 95% success rate in predicting bankruptcies (Eidleman, 1995). Altman used eight weighted variables from the balance sheet and the income statement to arrive at a figure he identified as the Z score. Firms with scores less than 1.81 were considered bankrupt; 1.81-2.99 were in the cautious zone, and greater than 3.00 were considered financially solid. Altman's model was introduced at a time when the determination of whether an entity was a going concern or not was vitally important for auditors. His model merged active measurements from the income statement with passive measurements from the balance sheet. The authors believe there is a need in investment circles for a similar test for the quality of earnings reported on income statements and that the test should incorporate cash flow statement data.

The purpose of this research is to propose a model that will be a reliable determinant of the quality of earnings reported by public companies. It is important to remember that quality of earnings is only one factor that affects stock price movements. In some cases quality earnings might not drive increases in stock prices of the company. Regardless, the authors believe that if a company generates quality earnings, its stock prices will tend to move upward and will not reflect volatility to the extreme that non-quality earnings do.

MODEL DEVELOPMENT

The model proposed consists of variables from the three major financial statements required by generally accepted accounting principles (cash flow statement included). It is stated as follows with variable definitions given in Exhibit A.

$$Q\ Test = 10(CFO/S) + (IS/IAR) + (CFO/EBIT) + (COI/NI) + 10(CFO/TL)$$

Exhibit A: Definition of Variables Used		
Symbol	Description	Financial Statement
CFO	Cash flow from operating activities	Cash Flow Statement
S	Sales	Income Statement
IS	Increase in sales from previous year	Income Statement
IAR	Increase in accounts receivable	Balance Sheet
EBIT	Earnings before interest and taxes	Income Statement
COI	Income from continuing operations	Income Statement
NI	Net Income	Income Statement
TL	Total liabilities	Balance Sheet

Some explanations are in order for the use of variables identified in Exhibit A. Each variable is calculated in a manner to place equal weight (1/5) on it in the total mix. Cash flow from operating activities (CFO) divided by sales is a commonly used ratio that measures efficiency of cash collections from sales (Mills and Yamamura, 1998). Ten percent is considered a good return of cash on sales in a given year. To equalize the weight of these observations we multiply the annually computed ratio by ten. The same is true for CFO divided by total liabilities. If a company can pay all of its liabilities in 10 years from the current stream of CFO, it is considered financially healthy. Accordingly, to give equal weight to the measurement one should multiply the calculated ratio by ten. The other three variables are equally weighted by making the respective calculations, since one (1) is the target for quality earnings determination for each of these three ratios.

The ratio of annual percentage increase in sales divided by percentage increase in accounts receivable is used to evaluate the quality of reported revenue. For example, a larger increase in accounts receivable than sales indicates poor quality earnings. In the case of a decline in sales, one must invert this ratio. Thus, if sales decrease and accounts receivable decrease by a lesser amount (an unfavorable trend), the ratio will be less than one because of the inversion process. Cash flow from operating activities divided by earnings before interest and taxes compares convergence of cash provided by operations to reported operating earnings before interest and taxes. Net income from continuing operations is used in the equation for comparison to the bottom line net income figure, which often includes discontinued operations and other charges that detract from predictability and persistency of reported earnings. Exhibit B shows the summary and integration of the model.

Exhibit B: Summary of the Model and Integration of Variables

$$\text{Q Test} = \underbrace{10(CFO/S)}_{\text{Cash Efficiency}} + \underbrace{(IS/IAR)}_{\text{Revenue Quality}} + \underbrace{(CFO/EBIT)}_{\text{Consistency}} + \underbrace{(COI/NI)}_{\text{Core Operations}} + \underbrace{10(CFO/TL)}_{\text{Risk}}$$

A TEST OF THE MODEL

Figures were obtained from W.T. Grant, Inc.'s financial statements for the three years that preceded its bankruptcy in 1975. The Q Tests calculated were .618, -1.329, and -.832 for 1972, 1973, and 1974 respectively. Clearly, this indicates inferior quality of earnings for Grant during the three years prior to its bankruptcy. Traditional financial analysis at that time did not provide any alarm signals until just before the company collapsed. The model proposed in this paper could have helped investors outrun the impending financial disaster associated with Grant's failure.

FINDINGS AND DISCUSSION

Financial statements of 20 publicly held companies for the three most recent years of operations were extracted from Microsoft's moneycentral.msn.com Web Page. Figures from the financial statements were then inserted in the model and Q Tests were calculated for each year and for the three-year average. Stock price movement of each of the companies included in the study was observed three months after the close of each company's fiscal year. This procedure provides for adequate time between close of the year and related earnings announcements. Results are presented in Table 1.

Average Q Tests of the companies observed ranged from a high of 19.64 (Microsoft) to a low of .03 (Lexar Media, Inc.). Correction Corporation of America's average was skewed by the cumulative adjustment for change in accounting principles of over $80 million in 2002. Otherwise, the average would have been 5.63.

As can be seen from Table 1, nine of the 20 companies showed gains in stock prices each year over the three-year period observed. Target, Nokia, Home Depot, and Ericcson had losses over the three-year period but impressive gains from year two to year three. Halliburton and Lexar Media reflected deteriorating Q Tests over the three-year period, indicative of poor quality earnings for these two companies. Even so, both companies posted stock price gains during this time.

Halliburton's large stock price gain in the third quarter 2004 more than likely is attributable to the war in Iraq and no bid contracts rather than the quality of its earnings. TyCo experienced a corporate scandal in 2002 that apparently has not affected stock prices to a great extent. Strong companies such as TyCo tend to recapture stock price losses caused from unfavorable media releases much easier than weaker companies regardless of quality of earnings. Accredo was the only company in the sample that showed losses in stock prices in both the three-year period and from year two to year three.

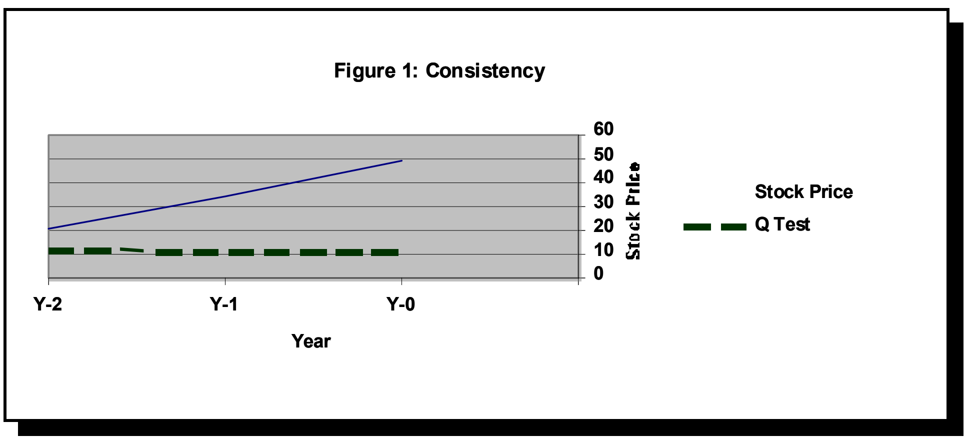
Table 1: Q Test and stock price movement

Company		QT	QT	QT	QT	Price	Price	Price
	FYE	Y-2	Y-1	Y-0	Avg	Y-2	Y-1	Y-0
Oracle Systems	5	13.37	13.70	13.03	13.37	9.59	12.83	9.97
EBAY	9	17.70	15.65	16.85	16.73	16.96	32.31	8.17
Black & Decker	12	4.87	5.37	5.26	5.17	34.86	56.94	78.99
Adobe	11	11.96	15.63	26.59	18.06	27.50	37.25	61.75
Wal-Mart	1	5.68	7.13	13.86	8.89	55.86	56.32	57.01
Pepsico	12	6.61	7.32	8.56	7.50	40.00	53.85	53.84
Ericcson	12	-.62	1.43	7.82	2.88	41.80	6.36	27.76
Cisco	7	16.60	10.62	13.60	13.10	11.18	20.93	19.21
Corrections Corp	12	4.37	-9.83	6.90	.48	13.00	17.46	35.60
Target	1	3.58	2.90	6.39	4.29	43.65	33.44	35.64
Home Depot	1	12.18	7.88	13.25	11.10	48.61	24.36	37.36
McAfee, Inc.	12	6.79	6.05	18.06	10.30	13.81	18.00	22.56
Lucent	9	2.68	1.20	2.00	1.96	1.26	2.84	3.76
TyCo, International	9	2.63	.29	1.43	4.37	17.08	21.50	35.74
Microsoft	6	17.02	25.90	16.00	19.64	21.87	27.80	27.65
Acxiom	3	11.03	18.32	10.75	13.37	17.49	15.25	24.83
Accredo	6	3.06	20.47	4.81	9.45	31.79	27.99	23.57
Nokia	12	17.25	14.13	10.89	14.09	20.74	14.01	20.28
Lexar Media, Inc.	12	2.22	.16	-2.28	.03	3.28	16.56	4.98
Halliburton	12	4.34	2.12	.30	2.25	17.07	20.73	30.39

FYE=Month of end of fiscal year; QT=Q Test; Y-2=First year of series; Y-1=Second year of series; Y-0=Current year; Price=Stock price three months after the close of each year

Oracle, Black & Decker, Home Depot, Wal-Mart, Pepsico, Target, and Microsoft had Q Test scores that moved in the same direction as their stock prices each year. Each of these companies showed above average or improved trends in quality of earnings. Accredo's Q Test increased from 3.06 to 20.47 and then dropped to 4.81. Its stock price declined over 50% during those two years. Lucent, with its very poor quality of earnings experienced nominal gains in its stock price over the three years. It should be noted that Lucent's Q Test results indicate a favorable trend even though the test results continued to be somewhat lower than other companies in the sample. Ericcson shows an impressive gain in Q Test scores and stock price from year two to year three. This indicates improved quality of earnings and a related improvement in stock prices.

Analysis of Table 1 indicates trends that warrant six comments regarding the Q Test scores and stock price trends of the companies investigated in this study. First, evidently one of the most important characteristics the Q Test can possess appears to be consistency and, thus, lack of extreme variation. EBAY, Oracle, and Black and Decker show the most consistent Q Test scores over the three years analyzed. Their stock prices also showed greatest gains in each of the three years as can be seen in Figure 1.



Second, a constantly improving trend in Q Test Scores correlates positively with increasing stock price trends (Adobe, Wal-Mart, PepsiCo, and Ericcson). Ericcson had a very impressive Q Test improvement over the three years (-.62 to 7.82). Its stock price responded by moving from \$6.36 in year two to \$27.76 in year three. Refer to Figure 2 for a graphic comparison of average stock prices and Q Tests of these companies.

Third, the most common trend of Q Tests from the companies (seven) studied was a decline in year two followed by a subsequent increase in the year three (See Figure 3). The second year for most of the companies falls into the 2002-2003 era, the time when widespread corporate earnings management scandals were uncovered. This indicates that over one third of the companies in the sample had earnings quality deterioration at the same time the scandals were noted by the media.

From this observation one can reason that more companies were actually managing earnings than were caught doing so during this time. Interestingly, each of these seven companies showed stock price gains either over the three-year period or from year two to year three. This indicates improvements in Q Tests were followed by gains in stock prices.

Figure 2: Improving Q Tests

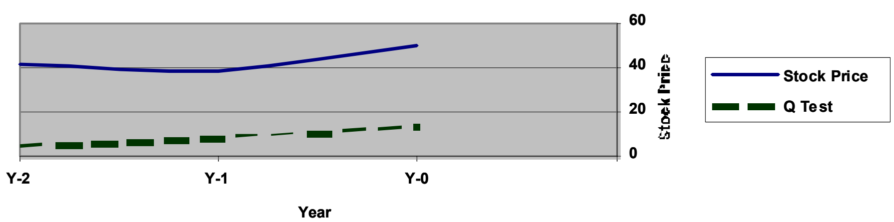
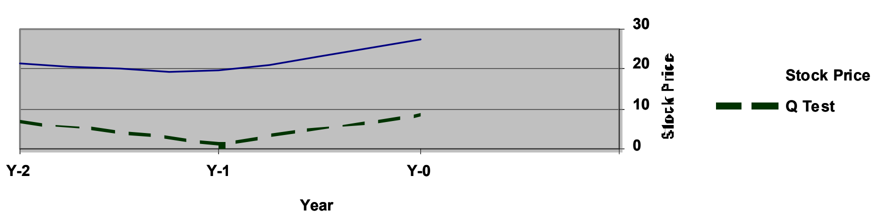


Figure 3: Middle Year T Test Decline



Fourth, three companies (Microsoft, Acxiom, and Accredo) in the study showed significant increases in Q Tests in year two followed by declines in the year three. Microsoft's stock price increased in year two and then leveled off in year three. Acxiom's stock price declined in the year two, and then increased in year three. Accredo showed declines in its stock price in both year two and year three. Microsoft and Acxiom demonstrated healthy Q Tests for all years with little variation. However, Accredo showed low Q Test scores in year one and year three sandwiched around a very high score in year two. Here again, inconsistency plays a part in subsequently lower stock prices of the company.

The fifth observation concerns three companies (Nokia, Lexar, and Halliburton) with declining Q Tests in each of the three years included in the study. Nokia's stock price declined 67%

in year two, and then rebounded for a 45% gain in year three. Nokia's Q Test scores, even though they declined in each year, remained double digit healthy. This probably accounts for Nokia's ability to rebound to previous stock price levels in year three. Lexar's Q Tests gyrated from 3.28 in year one to 16.56 in year two and back to 4.98 in year three. The tremendous decline in its stock price from year two to year three is indicative of problems with its quality of earnings. Halliburton is another case for more intensive study. Stock prices increased by substantial amounts even though the Q Tests declined each year in the series. This appears to be a case where media releases and other extraneous market factors trump quality of earnings as stock price drivers. Halliburton's well publicized involvement in the Afghanistan and Iraqi Wars appears to have met with favor among investors.

Finally, something should be said about TyCo, International. TyCo's Q Test scores were low therefore indicative of low quality earnings for the three year period. The score declined from 2.63 to .297 from year one to year two, and then increased to 1.43 in year three. However, its stock price increased rather nicely from $17.08 to $20.73 to $35.74 during the same time frame. Throughout the time the company received media attention for financial improprieties and other corporate misappropriations, its stock price remained solid. The possible explanation for this phenomenon could be TyCo's corporate strategy of diversification. TyCo's revelation of its corporate scandal to the public, unlike that of Enron and WorldCom, did not impair its financial soundness. This allowed them to weather a period of inferior quality earnings until they could get their house in order once again.

Results of research in this study endorse the following observations about Q Test measurements. First, anything below 5.0 indicates suspect quality of earnings. When one obtains a measurement at this level, it should lead to further investigation of the company involved to determine the quality of other reported financial information such as asset values and liabilities. Next, if the Q Test falls between 5.0 and 9.99, the financial analyst should accept the reported earnings as better than average quality. Finally, any Q Test over 10.00 (double digit) indicates superior quality earnings and, therefore, reported earnings can be relied upon as indication of true earnings and consequently true corporate growth.

CONCLUSION

The Q Test that we propose in this article should help analysts discriminate between quality earnings and traditional bottom line earnings. Since earnings are primary stock price drivers and, accordingly, have been the object of various management schemes in recent years, it is important to develop a test such as the one we propose to detect such schemes early. The Q Test should be used to determine quality of reported earnings and not as a predictor of overall stock price movement. It is merely a tool that one can use to help evaluate investment potential of company stock. Other intangible factors such as general market movement, economic trends, and media releases should continue to play important roles in investment strategies along with the Q Test analysis proposed in this article.

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INVESTOR RISK AVERSION AND THE WEEKEND EFFECT: THE BASICS

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ABSTRACT

This paper provides an explanation of the continued persistence of the weekend effect. Using the 23 non-holiday Wednesday closings of 1968 as a benchmark, it is postulated that negative Monday returns can be explained by risk averse investors reacting to the arrival of new information.

INTRODUCTION

It is well documented that stock returns, on average, are statistically lower on Monday. Yet there is little consensus on the explanations for this phenomenon. This paper pursues two objectives. First, to provide additional theoretical insight into the empirical persistence of the weekend effect, and secondly, using the non-holiday Wednesday closings of 1968, examine the underlying liquidity and information dissemination processes and thereby isolate factors driving the weekend effect. Of particular interest is the employment of pre-1986 daily liquidity and information data from the Center of Research in Security Prices (CRSP).

During the second half of 1968, the NYSE and the AMEX were closed on twenty-three Wednesdays due to a backlog of paperwork. These closings offer a unique opportunity to analyze the anomalous behavior of the market surrounding non-trading hours. By using cross-sectional data this study observes several determinants of information flow and market liquidity related to individual security prices.

An opportunity to test the effect of information flow on anomalous returns is provided by the systematic discontinuities in trading surrounding the 1968 Wednesday closings. The twenty-three closed Wednesdays were non-trading, regular business days with full information flow in the market, whereas weekends represent non-trading, non-business days with reduced information flow.

LITERATURE

Differences in information processing are usually explained using three different hypotheses, (French & Roll, 1986). First, public information is more likely to arrive during normal business hours. Second, private information affects prices throughout the trading day. Third, noise caused by trading may induce pricing errors. In light of these three hypotheses, the 1968 Wednesday closings represent normal business days when no information, public or private, can be absorbed into the market. While weekends are non-trading days with information absorption into the market not being possible, they are also non-business days with less information flow available for absorption. Weekends are non-trading, non-business days, whereas the twenty-three closed Wednesdays are non-trading, regular business days. Also, interestingly, for the 1968 closed Wednesdays, there is no trading noise to induce pricing errors.

The major component of liquidity reflected in market data, and addressed in this study is daily volume. (Karpov, 1987) provides a comprehensive review of the work related to the price/volume relationship through 1986. Most studies find a positive correlation between price change and volume. Other studies look at the NYSE intraday bid-ask spread as a measure of volatility. (Keim & Stambaugh, 1984) hypothesize, test, and reject the hypothesis that market makers transacting at the bid (ask) price with disproportionate frequency at the market close on certain days of the week could induce low (high) returns on those days. They indicate that bid-ask effects can be discounted as an important contributor to high pre-holiday returns. However, holidays, while representing non-trading days, often represent non-business days. Holidays, being non-business days, do not have the same information flows as do the non-trading, regular business closed Wednesdays of 1968. (Stoll & Whaley, 1990) propose that wider spreads reflect the specialists' ability to profit from their privileged knowledge. (Brock & Kleidon, 1992) test specialists' monopoly power to control inelastic demand during times of wider spread. (Madhavan, 1992) explains wider spreads with variation in the cost of adverse selection. (Lee, Mucklow & Ready, 1993) document the relationship between the intraday width of bid-ask spreads for NYSE stocks and reported earnings, which reflects information flow occurring only on business days. Further evidence of a day-of-the-week effect for bid-ask spreads is provided by (Chordia, Roll & Subrahmanyam, 2001). These authors find that, for a sample of NYSE stocks, liquidity declines on Friday and spreads increase "dramatically" during down markets but decline only slightly during up markets.

A conclusive body of literature demonstrates that seasonal return patterns for equity securities vary by firm size. (Rogalski, 1984) finds significant differences in post-holiday return by weekday and firm size. (French, 1980) uses a time-diffusion process as an explanation for higher than expected returns for post-holiday trading days for every weekday except Tuesday. (Roll, 1983) finds high returns accruing to small firms on the trading day prior to New Year's Day. (Lakonishok & Smidt, 1984) note that “prices also rise in all (size) deciles (of market capitalization) on the last trading day before Christmas.” (Merrill, 1965) finds a disproportionate frequency of Dow Jones Industrial Average advances on days preceding holidays during the 1897 to 1965 period. (Keim & Stambaugh, 1984) indicate that the weekend effects generate significant premiums that accrue to small firms on Fridays.

Some research incorporates the 1968 Wednesday closings and/or the weekend effect in volume and volatility studies. (French & Roll, 1986) and others show that returns are more volatile during exchange trading hours than during non-trading hours. In addition, French and Roll argue that private information dissemination is the principle factor behind high trading-time variances. (Jain & Joh, 1988) report that average volume across the days of the week (and for each hour) are significantly different. Average daily trading volume is lowest on Monday, increases from Monday to Wednesday, and then declines on Thursday and Friday. (Ross, 1989) argues that "in an arbitrage-free economy, the volatility of prices is directly related to the rate of flow of information to the market." (Pettengill, 1989) tests whether the weekend effect is a closed market effect by examining the difference between the mean returns on the trading days prior to exchange holidays and on ordinary days. He finds no significant difference between Wednesday closings and regular trading days. However, Pentengill's study excludes the trading days immediately adjacent to the twenty-three 1968 closed Wednesdays. (Houston & Ryngaert, 1992) look at volume and volatility patterns for weeks with Wednesday closings. They report that Wednesday closings did not affect weekly volume or weekly volatility. However, they argue that volume and variance are shifted between periods within the weeks with reduced trading hours. This is consistent with reduced trading, temporarily and simultaneously, reducing the transmission of private information into traded market prices. They further indicate that trading volume is redistributed rather evenly among Monday, Tuesday, and Friday with the largest increase in trading volume on Thursday following Wednesday closings. Trading volatility is also redistributed to the remaining four days with the largest increase on Fridays and smallest on Mondays. (Steeley, 2001) finds that a day-of-the-week effect exists for market returns in the UK and is related to the arrival time and nature of new information. Finally, (Berument & Halil, 2001) report that the variance of the S&P 500 index is a function of the week day. They find that variance is highest on Friday and lowest on Wednesday and propose that Friday's high variance is the result of increased levels of macroeconomic news releases on Thursday and Friday. Although some of these works include an examination of the 1968 Wednesday closings, none provide a tested explanatory link between non-trading, regular business day influences and liquidity and information flow. This can be attributed in part to the, heretofore, unavailable necessary data.

PREMISE

Stock returns on Monday are lower than other days. Why? There is no clear consensus. With a cursory review, there appears to be no consistent and logical reason for Monday to be any different than other days except for the fact that the market is closed over the weekend. However, market closure in and of itself should make no difference. The premise here is that if the market is closed, and there is no new information arriving, then the price should not change. If there is new information while the market is closed, then the market should react in the following ways:

1) Good News: The spread should increase slightly as analysts try to determine the new "correct" price. If nothing else, the Ask price should increase. The volume should also go up as traders try to react to the information. Return should increase as investors react to the news.

2) Bad News: The market reaction should be the same as above but in the opposite direction for the spread. Volume should go up as investors try to dump the stock. Finally, returns should decrease for obvious reasons.

3) Ambiguous Information: The spread should increase substantially while analysts try to assess the impact on firm price. Volume should increase substantially as some traders believe the information to be good and others believe it to be bad and try to make a profit by trading accordingly. If investors are risk neutral, the price will remain unchanged provided the information is truly ambiguous as the number of traders who believe the price will increase and those that believe that it will decrease should be the same. However, if participants in the market are risk averse, they will be more inclined to attempt to protect themselves from loss rather than attempt to profit on the information thus causing a decrease, or at a minimum no change, in price.

The preceding premise is dependent on the stock being actively traded. If the stock is held in a portfolio primarily as a "buy-and-hold" security, the market reactions will be somewhat mitigated. This is often the case for large firms. In addition, the larger the firm, the larger the number of analysts who follow the stock, thereby increasing the likelihood of the market reaching a consensus on the "correct" new price prior to the market opening, thus reducing the premise effects. This will not necessarily hold true for securities of smaller firms, indicating that small and large firms should be viewed differently in light of return, liquidity, and information flows.

Even with a conservative assumption that there are equal amounts of good, bad, and ambiguous information coming to the market after closure on Friday and over the weekend, one should see a low return, increased volatility, and increased liquidity (volume) on Monday. As indicated earlier, a preponderance of past research supports this conclusion.

Therefore, if the arrival of information is the driving factor for Monday returns, then there should be the same effects on Thursday after a Wednesday close. In fact, the "closed-Wednesday-Thursday effect" should be more pronounced since there is information dissemination of a full, active business day.

DATA AND METHODOLOGY

The hypothesis is that differences in daily returns can be explained by liquidity and information flow. Inferences are made using daily firm-specific data drawn from the Center of Research in Security Prices (CRSP) files. This approach is particularly appealing in that daily liquidity and information data from periods prior to 1986, not available from CRSP before July 1995, and therefore not available to most previous researchers, are used to provide empirical insight into the persistence of the weekend effect.

To this end, this research investigates firm-specific daily returns, firm-specific trading liquidity, and firm-specific trading information flow for firms whose stock was continuously traded on the NYSE and/or the AMEX from the beginning of 1968 to the middle of 1969. The ability to attribute differences in volume and volatility to firm-specific rather than institutional factors is enhanced by the inclusion, not only of the NYSE firms, but of AMEX firms as well.

The applied methodology addresses the return-liquidity-information issue with a two approach process. In Approach I, ordinary least squares (OLS) analysis is performed for the test-period, consisting of the twenty-three weeks with closed Wednesdays in 1968, and addresses return, dispersion, and volume differences between days of the week with particular attention given to Thursdays that follow closed Wednesdays. More complicated, alternative approaches for daily returns is offered by (Scholes & Williams, 1977) and (Dimson, 1979) that reduce the bias in the estimated b's, however, according to (Peterson, 1989), they do not provide a clear-cut benefit over OLS procedures. (Ingram & Ingram, 1993) indicate that joint generalized least squares (JGLS) methods have advantages over OLS procedure if there is significant cross-correlation. In this study cross-correlation is not found to be significant. Approach II addresses differences between days of the week for return, dispersion, and volume measures tested over two time periods:

1) Before-Closings: the pre-test period (January 1968 through June 1968)
2) During-Closings: the test-period (the twenty-three weeks with closed Wednesdays in 1968); and across two firm groups:
- 1) Small Firms: Decile 1, the lowest capitalized firms, and
- 2) Large Firms: Decile 10, the highest capitalized firms.

A traditional restrictive model approach is used that differentiates firm-specific daily returns, liquidity influences, and information flow influences by the day of the week for the test-period. This approach differentiates firm-specific daily returns by the day of the week and isolates the impact of liquidity and information influences. The following traditional restricted models for the four-day trading week are applied to the firm-specific daily data for the twenty-three weeks with Wednesday closings:

$$Rt = b0 + b1D1t + b2D2t + b3D4t + \epsilon t, \quad (1)$$
$$It = b0 + b1D1t + b2D2t + b3D4t + \epsilon t, \quad (2)$$
$$Lt = b0 + b1D1t + b2D2t + b3D4t + \epsilon t, \quad (3)$$

where, Rt = the daily return,
It = information flow (volatility measure) for the security, quantified by firm-specific relative range:
= daily high less the daily low / [(daily high plus the daily low)/2]
Lt = liquidity (volume measure) for the security, quantified by firm-specific relative volume:
= the daily number of shares traded / the total number of shares outstanding
D1t = {1 if Monday, 0 otherwise}
D2t = {1 if Tuesday, 0 otherwise}
D4t = {1 if Thursday, 0 otherwise}
ϵi = disturbance term.

Previous research and a priori expectations indicate that in equation 1, b1 and b3 should be negative and the latter should have greater magnitude. If the hypothesis presented is correct, these lower returns on Monday and Thursday (after a Wednesday close) are a function of the arrival of new information. Therefore, in equations 2 and 3, b1 and b3 should be positive. Also, if a regular business day produces more information than appears on the weekend, the latter should have greater magnitude.

For the purpose of detecting the impact of liquidity and information flow on security returns, the usual, straight-forward method for testing the equality of means from two samples is employed. Typical t-test methodology is used to compare:

1) Daily information flow differences between the Before-Closings Period and the During-Closings Period for:
   a) Small and Large Firms together,
   b) Small Firms, and
   c) Large Firms;
2) Daily liquidity differences between the Before-Closings Period and the During-Closings Period for:
   a) Small and Large Firms together,
   b) Small Firms only, and
   c) Large Firms.

The usual t statistic for testing the equality of means is employed for the two sample comparisons:

$$t = \frac{(\overline{x_1} - \overline{x_2})}{\sqrt{s^2(1/n_1 + 1/n_2)}},$$

where, s2 is the pooled variance

$$s^2 = \frac{[(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2]}{n_1 + n_2 - 2},$$

and, where s12 and s22 are the sample variances of the two groups. The usual assumption of equal population variances for this *t* statistic in comparisons is satisfied.

Of particular interest is the intriguing polar contrast of decile sampling techniques. By examining the highest and lowest capitalized firms, decile sampling provides a polar analysis of the existence of influential effects on liquidity and information predicated on firm size. Rather than using a firm size continuum, a more rigorous examination is made by comparing the extreme poles of firm size, namely the Small Firms and Large Firms groups.

In general, the information arrival should be the same in both the before-closings and during-closings periods for all days except Thursday. Also liquidity should be higher on all days with Thursday getting the lion's share of the increases. This corresponds to the work done by (Houston & Ryngaert, 1992).

RESULTS

The first step in the analysis is to ascertain the pattern of returns, information arrival, and liquidity within the week. Parameter estimates from equation 1 appear in Table 1. As predicted, Thursday's returns are significantly less than Friday's for all three groupings. Also, the returns for the large firm portfolio on Monday and Tuesday are less than Friday's return, but the decrease is only one fourth that observed on Thursday. Of more interest, however, are the liquidity (equation 2) and information flow (equation 3) results in Tables 2 and 3 respectively. Liquidity is significantly greater on Thursday than any other day. In conjunction with this, information flow is greatest for all three portfolios on Thursday and for the combined and small firm portfolios on Monday. The magnitude, as predicted, is greatest on Thursday.

Table 1: OLS Results For Testing Differences in Daily Returns

Independent Variable	Combined	Small-Firm	Large-Firm
Intercept (Friday)	0.001967**	0.003212**	0.000839**
	(0.0001)	(0.0001)	(0.0003)
b1 (Monday)	-0.000142	0.000416	-0.000648*
	(0.7330)	(0.5999)	(0.0493)
b2 (Tuesday)	-0.000801	-0.000964	-0.000654*
	(0.0537)	(0.2240)	(0.0473)
b3 (Thursday)	-0.002073**	-0.001558*	-0.002541**
(0.0001)	(0.0496)	(0.0001)	

* significant at the 5% level
** significant at the 1% level
Parameter estimates for model: $R_t = b_0 + b_1D_{1t} + b_2D_{2t} + b_3D_{4t} + \ _t$, applied to the firm-specific daily data for the twenty-three weeks in 1968 with Wednesday closings. Where, R_t is the average daily return. The Combined portfolio consists of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969. The Small-Firm and Large-Firm portfolios consist of the smallest and largest capitalization decile respectively.

Having identified the fact that returns are lower on Monday and Thursday, that information flow is larger on these days, and that liquidity is greater on Thursday, the next step is to determine if there is a change in these variables as a result of the Wednesday closings. The t-test results for a change in information flow for the three portfolios appear in Tables 4, 5, and 6. Information flow is numerically larger on all days except Thursday for all three portfolios during the before-closings period. This difference is statistically significant only for the combined portfolio and the large firm portfolio, however. In contrast, the information flow is significantly greater during the after-closings period on Thursday for all three portfolios. This result at first was rather surprising. However, assuming that there is no increase in information on any day during a Wednesday-closings week except Thursday and observing that liquidity across all days has either remained constant or increased, this result makes perfect sense. Holding all else constant, an increase in liquidity should cause the relative range (information flow) to decline. This simply puts the Thursday increases in stark contrast and shows that the open business day generates a large amount of information that must be analyzed and absorbed into the market.

Table 2: OLS Results For Testing Differences in Daily Liquidity

Independent Variable	Combined	Small-Firms	Large-Firms
Intercept (Friday)	0.003083**	0.005557**	0.000844**
	(0.0001)	(0.0001)	(0.0001)
b1 (Monday)	-0.000066	-0.000087	-0.000050
	(0.5920)	(0.7259)	(0.1101)
b2 (Tuesday)	-0.000023	-0.000029	-0.000018
	(0.8525)	(0.9071)	(0.5588)
b3 (Thursday)	0.000472**	0.000715**	0.000251**
(0.0001)	(0.0040)	(0.001)	

*   significant at the 5% level
** significant at the 1% level
Parameter estimates for model: $L_t = b_0 + b_1 D_{1t} + b_2 D_{2t} + b_3 D_{4t} +$ t, applied to the firm-specific daily data for the twenty-three weeks in 1968 with Wednesday closings. Where, L_t is firm-specific daily relative volume. The Combined portfolio consists of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969. The Small-Firm and Large-Firm portfolios consist of the smallest and largest capitalization decile respectively.

A comparison of liquidity between periods shows an increase across all days for the combined portfolio (Table 7) and the small firm portfolio (Table 8) with the largest increases occurring on Thursday. Relative daily trading volume for the combined portfolio increases by 16.2% on Monday, 16.7% on Tuesday, and 23.1% on Friday. Thursday's increase is a staggering 36.0%. As can be seen below, the small firms in the portfolio are driving these increases. The net result is an overall weekly volume that is relatively unchanged. These numbers are consistent with those of (Houston & Ryngaert, 1992). Thursday's increase is probably due to the markets' reaction to Wednesday's information as well as a general redistribution in trading patterns as investors make up for lost time.

The small firm portfolio reflects a similar pattern of increases. Volume on Monday and Tuesday increases by 19.9% and 20.4% respectively. Friday sees an increase of 27.6% and Thursday nearly doubles that of Monday and Tuesday at 38.7%. It appears that for small firms, which are followed by fewer analysts, it takes two days to sort out the meaning of any information which arrived on Wednesday.

Table 3: OLS Results For Testing Differences in Daily Information Flow

Independent Variable	Combined	Small- Firms	Large-Firms
Intercept (Friday)	0.026336**	0.035244**	0.018270**
(0.0001)	(0.0001)	(0.0001)	
b1 (Monday)	0.001225**	0.002082**	0.000440
	(0.0002)	(0.0005)	(0.0552)
b2 (Tuesday)	0.000318	0.000657	0.000008
	(0.3409)	(0.2691)	(0.9698)
b3 (Thursday)	0.003333**	0.003898**	0.002817**
	(0.0001)	(0.0001)	(0.0001)

* significant at the 5% level
** significant at the 1% level
Parameter estimates for model: It = b0 + b1D1t + b2D2t + b3D4t + t, applied to the firm-specific daily data for the twenty-three weeks in 1968 with Wednesday closings. Where, It is firm-specific daily relative trading range. The Combined portfolio consists of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969. The Small-Firm and Large-Firm portfolios consist of the smallest and largest capitalization decile respectively.

Table 4: T-Test Comparing Daily Information Flow Before and During Wednesday Closings: Combined Portfolio

Day of the Week	Monday	Tuesday	Thursday	Friday
Mean Before Closings	0.02859637	0.02746306	0.02839674	0.02728663
Mean After Closings	0.02756052	0.02665362	0.02955900	0.02215075
Prob > |T|	0.0025	0.0137	0.0003	0.0037

Information flow is measured as the firm-specific daily relative trading range. The Combined portfolio consists of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969.

Table 5: T-Test Comparing Daily Information Flow Before and During Wednesday Closings: Small-Firm

Day of the Week	Monday	Tuesday	Thursday	Friday
Mean Before Closings	0.03736189	0.03616932	0.03703348	0.03586639
Mean After Closings	0.03732636	0.03590122	0.03914173	0.03524393
Prob > |T|	0.9544	0.6526	0.0009	0.2942

Information flow is measured as the firm-specific daily relative trading range. The small-firm portfolio consists of the smallest capitalization decile of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969.

Table 6: T-Test Comparing Daily Information Flow Before and During Wednesday Closings: Large-Firm				
Day of the Week	Monday	Tuesday	Thursday	Friday
Mean Before Closings	0.02061107	0.01953222	0.02052350	0.01947363
Mean After Closings	0.01871067	0.01827890	0.02108688	0.01827019
Prob > |T|	0.0000	0.0000	0.0248	0.0000
Information flow is measured as the firm-specific daily relative trading range. The large-firm portfolio consists of the largest capitalization decile of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969.				

Table 7: T-Test Comparing Daily Liquidity Before and During Wednesday Closings: Combined Portfolio				
Day of the Week	Monday	Tuesday	Thursday	Friday
Mean Before Closings	0.00259552	0.00262157	0.00261368	0.00250412
Mean After Closings	0.00301673	0.00306026	0.00355552	0.00308338
Prob > |T|	0.0000	0.0000	0.0001	0.0001
Liquidity is measured as the firm-specific relative daily volume. The Combined portfolio consists of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969.				

Table 8: T-Test Comparing Daily Liquidity Before and During Wednesday Closings: Small-Firm				
Day of the Week	Monday	Tuesday	Thursday	Friday
Mean Before Closings	0.00456254	0.00459088	0.00452039	0.00435591
Mean After Closings	0.00547016	0.00552826	0.00627191	0.00555727
Prob > |T|	0.0000	0.0000	0.0001	0.0001
Liquidity is measured as the firm-specific relative daily volume. The small-firm portfolio consists of the smallest capitalization decile of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969.				

Table 9: T-Test Comparing Daily Liquidity Before and During Wednesday Closings: Large-Firm				
Day of the Week	Monday	Tuesday	Thursday	Friday
Mean Before Closings	0.00080359	0.00082766	0.00087552	0.00081783
Mean After Closings	0.00079342	0.00082521	0.00109452	0.00084355
Prob > |T|	0.7020	0.9288	0.0001	0.3514
Liquidity is measured as the firm-specific relative daily volume. The large-firm portfolio consists of the largest capitalization decile of all firms whose stock was continuously traded on the NYSE and/or AMEX from the beginning of 1968 through the middle of 1969.				

The large firm portfolio (Table 9) has no change in liquidity on any day except Thursday which has a 25.0% increase. In fact, the relative volume decreased on Monday, Tuesday, and Friday, but these changes are not statistically significant. For those who believe in an efficient market this is good news. The more closely watched larger firms react very quickly to any new information.

SIGNIFICANT IMPLICATIONS

While previous studies fail to provide a consensus explanation for negative Monday returns, this study synthesizes a coherent explanation of "anomalous" Monday negative returns. The intent is to show that negative Monday returns are not anomalous, and can be explained logically based upon the degree of liquidity and information flow.

The most important result is that on Thursday following a Wednesday market closing, returns are significantly lower while information flow and liquidity are significantly larger. This indicates that when there is an increase in information coming to the market, traders, being risk averse, lower the price of securities until they can process the information and/or observe the markets' reaction. It is reasonable to assume, therefore, that this reaction is not limited only to days following a normal business day with the market closed, but also on Mondays which follow information arrival over the weekend.

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THE EFFECT OF THE FIRM'S MONOPOLY POWER ON THE EARNINGS RESPONSE COEFFICIENT

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ABSTRACT

The purpose of this study is to provide further evidence on the determinants of the earnings response coefficient (ERC). More specifically, we have attempted to examine the 'monopoly power' of a firm as an additional factor affecting the ERC.
Using a firm valuation model that explicitly incorporates the degree of monopoly power in its product markets (Thomadakis, 1976; Subrahmanyan and Thomadakis, 1980), we demonstrate that the ERC is positively related to the firm's monopoly power.

This theoretical prediction is empirically examined using a sample of 144 Korean firms listed in the Korean Stock Exchange during the period extending from 1986 to 1992. The sample firm's monopoly power is measured by whether or not the firm is designated as a market-dominant enterprise by the Korean Fair Trade Commission according to the Monopoly Regulation and Fair Trade Act. Such designation implies that the firm has a monopoly power.

The empirical results are generally consistent with the theoretical prediction. Specifically, the ERC is higher for the designated firms than for the non-designated firms. This result is robust across different methods.

INTRODUCTION

The determinant of cross-sectional and/or inter-temporal variations of the earnings response coefficient (hereafter, ERC in short) has been investigated in quite a few previous studies (e.g., Kormendi and Lipe, 1987; Collins and Kothari, 1989; Easton and Zmijewski, 1989; Dhaliwal, Lee and Fargher, 1991; Dhaliwal and Reynolds, 1994; Ahmed, 1994; Kallapur, 1994; Choi and Jeter, 1992; Biddle and Seow, 1991; Teets, 1992; Collins and Salatka, 1993; Bandyopadbyay, 1994). The determinants of the ERC identified in previous studies are characteristics of the firm's earnings generating process, systematic risk of common stock, firm size, the default risk, growth opportunity, cost structure, dividend payout ratio, audit opinion, industry, and interest rates. However, the effect of a firm's monopoly power on the ERC has not been extensively investigated, so far. Thus, the purpose of this study is to examine the effect of a firm's monopoly power on the ERC using Korean capital market data.

Using a firm valuation model that explicitly incorporates the degree of monopoly power in its product markets (Thomadakis, 1976; Subrahmanyan and Thomadakis, 1980), we demonstrate that the ERC is positively related to the firm's monopoly power. This theoretical prediction is empirically tested by comparing ERC's between the firms designated as market-dominant enterprises by the Monopoly Regulation and Fair Trade Act and the other firms. To the extent that designation as a market-dominant enterprise is an appropriate proxy for the degree of monopoly power, we expect the ERC's of the designated firms to be higher than those of the non-designated firms.

The remainder of this paper is organized as follows. In the next section, we derive the theoretical relationship between the firm's monopoly power and the ERC within the framework of a firm valuation model developed by Thomadakis (1976), Subrahmanyan and Thomadakis (1980), and Ahmed (1994). Section three contains our research hypothesis and research methodology. Section four describes sample selection procedure and descriptive statistics for the variables used. The empirical results are presented in section five. A summary of the results and some suggestions for future research appear in final section.

MONOPOLY POWER AND EARNINGS RESPONSE COEFFICIENT

A firm valuation model based on cash flow has been used in many previous ERC literature such as Kormendi and Lipe (1987), Collins and Kothari (1989), Dhaliwal, Lee and Fargher (1991), and Dhaliwal and Reynolds (1994). On the other hand, Thomadakis (1976) and Subrahmanyan and Thomadakis (1980) developed a model that incorporates the degree of monopoly power in the valuation of a firm. By combining these two valuation approaches, we develop a valuation model that describes a functional relationship between the monopoly power and the ERC.
To simplify the analysis, we make the following assumptions:

Assumption 1: The demand function faced by the firm is

$$p_t = a_t q_t^{-n}$$

Where p = *the price of a unit of product in period t;*
q = *the quantity of output chosen by a firm in period t;*
a = *a random variable representing the uncertainty concerning the demand function. Its mean, variance and covariance are constant through time;*
n = *the measure of a firm's monopoly power,* $0 \leq n \leq 1$.

From Assumption 1, the marginal revenue (MR) is $(1-n)\, aq^{-n}$ and the average revenue (AR) is aq^{-n}. Therefore, the firm is in a perfect competition when n=0 and hence MR=AR= p, while the firm is in a monopolistic position when n>0. Also, since n is the inverse of the elasticity of demand, the demand becomes more inelastic as n increases. Therefore, n is reliable measure of a firm's monopoly power. This is also evident from the fact that Lerner's index, a popular measure of the monopoly power, is usually defined as 1/(1-n).

Assumption 2: The cost function for the firm is

$$TC_t = c_t q_t$$

Where TC= *the total cost;*
c= *the operating cost per unit of output in period t. c is invariant to the level of output, and its mean, variance and covariance are also constant through time.*

Assumption 3: As a discount rate for the capitalization of a firm's future cash flow, a single period CAPM is applicable to each period. Also, it is assumed that the market parameters in the CAPM (risk-free rate, market returns, and systematic risk) are exogeneous and constant through time. Thus, the risk-adjusted expected return for a firm in period t (Kt) is:

$$K_t = R_f + \beta \left[E(R_m) - R_f \right]$$

Where β = *the systematic risk of the firm;*
R_f = *the risk-free interest rate;*
R_m = *the rate of return on market portfolio*

Using the above assumptions, a firm valuation model is developed in a two period world (Thomadakis, 1976). The firm's problem is to choose its output level that maximizes the present value of its future cash flows. In a two period world, the sequence of events is as follows:

At the beginning of the first period (t=0), the firm chooses the optimal level of output (Q) for the first period based on expectation about future cash flows (i.e., prices and costs). At the end of the first period (t=1), prices and operating costs for the first period are realized. The firm revises its expectations about period 2 cash flows and chooses the optimal quantity for period 2 based on the revised expectations. The firm is liquidated at the end of the second period. Under this setting, the firm's value at time 0 (V_0) can be described as follow.

$$V_0 = k_1 Q_1 + \frac{nE_0(p_1 Q_1 - c_1 Q_1)}{1+K_1} + \frac{nE_0(p_2 Q_2 - c_2 Q_2)}{(1+K_1)(1+K_2)} \text{........(1)}$$

Where $p_t =$ *the price of a unit of product in period t;*
$Q_t =$ *the quantity of output chosen by a firm in period t;*
$K_t =$ *the risk-adjusted expected return for a firm in period t;*
$k_1 =$ *the actual risk-adjusted return for a firm in period 1;*
$n =$ *the measure of a firm's monopoly power,* $0 \leq n \leq 1$.

Abnormal returns or excess returns for the first period (AR1) are computed by the difference between realized returns (R1) and expected returns (ER1) as follows:

$$AR_1 = R_1 - ER_1 = \frac{V_1 - V_0 + D_1}{V_0} - \frac{E_0(V_1) - V_0}{V_0}$$

Where $D_1 =$ *the dividend paid to stockholders after deducting investments for the second period from the realized cash flows in period one.*

Two additional assumptions regarding the firm's earnings generating process are made to develop a model for abnormal returns. First, cash flows to the firm and accounting earnings (X_t) are identical (i.e., $X_t = p_t q_t - c_t q_t$). Second, the firm's earnings have time-series characteristics described by the following model:

$$E_1(X_2) - E_0(X_2) = \lambda [X_1 - E_0(X_1)]$$

Where $\lambda =$ *the extent to which the current period's earnings shock affects the revisions in expectations of future earnings, usually referred to as persistent coefficient. The sign and value of will depend on the time-series properties of the firm's earnings.*

It can be shown that λ is a function of time-series model parameters even when earnings generating process is specified by a general ARIMA(pdq) model (Collins and Kothari, 1989).

Then Abnormal returns or excess returns for the first period (AR_1) can be described as follow:

$$AR_1 = \left[1 + \frac{n\lambda}{1 + R_f + \beta[E(R_m) - R_f]}\right] \frac{X_1 - E_0(X_1)}{V_0} ....(2)$$

It is obvious from equation (2) that the impact of β, λ, $E(Rm)-R_f$, and n on the ERC (the bracket term) are, ceteris paribus:

$$\frac{\partial ERC}{\partial \beta} < 0, \frac{\partial ERC}{\partial \lambda} > 0, \frac{\partial ERC}{\partial [E(R_m) - R_f]} < 0, \frac{\partial ERC}{\partial n} > 0$$

The first three results reveal that, if other factors be constant, the ERC is negatively related to both the systematic risk of the firm (β) and the market risk premium (*E(Rm)-R_f*), but positively related to the persistence coefficient (λ). Previous studies such as Kormendi and Lipe (1987), Easton and Zmizewski (1989), and Collins and Kothari (1989) provide empirical evidence consistent with these predictions. The fourth comparative static result indicates that the ERC is a positive function of the firm's monopoly power (n) in its product markets.

HYPOTHESIS AND RESEARCH DESIGN

Hypothesis

The research question addressed in this study is whether there is an association between firm's monopoly power and the ERC. The analytical results in the preceding section suggest, among other things, that the a firm's monopoly power is positively related to the ERC.

As a surrogate for the firm's monopoly power, the firm's designation as a market-dominant enterprise by the *Monopoly Regulation and Fair Trade Act* is used. According to the *Monopoly Regulation and Fair Trade Act*, the *Korea Fair Trade Commission* designates and notifies market-dominant enterprises at the beginning of each year. A firm with its annual domestic sales exceeding 100 billion won is designated as a marker-dominant enterprise if its market share is over 50% or 75% (combined with up to 3 other designated firms) in a same or similar industry. If a firm is designated as such, the firm (hereafter, designated firm) has a higher degree of monopoly power relative to other firms that are not designated (hereafter, non-designated firms).

A testable hypothesis for the positive relationship between the ERC and the firm's monopoly power derived herefrom would be,

Hypothesis: Earnings response coefficients of designated firms are higher than those of non-designated firms.

Measurement of Variables

Under an assumption that earnings are described by the random walk with a drift model. Expected earnings, E(X), can be written as follows:

$$E_{t-1}(X_t) = X_{t-1} + \delta_t$$

Where X_t = *the earnings at time t;*
δ = *a drift term obtained by averaging earnings changes for the 5 previous years.*

Unexpected earnings (UE), excess of actual earnings over expected earnings, can be described as follow:

$$UE_{it} = \frac{X_{it} - (X_{it-1} + \delta_{it})}{P_{it-1}}$$

Where P_{it-1} = *the market value of the equity of firm i at the beginning of period t (stock price times number of shares outstanding).*

Expected earnings as well as stock price are often used as a deflator. Stock price is chosen because it was shown to be a theoretically superior deflator (Christie (1987)) and has been used in a number of previous studies (e.g., Easton and Zmizewski (1989), Collins and Kothari (1989)). To avoid the problem of extreme values, observations with |UE|>200% are truncated to 200%.

The systematic risk (BETA) of firm i in time t, is obtained by estimating the following market model:

$$R_{itj} = \alpha_{it} + \beta_{it} R_{mtj} + \varepsilon_{itj} \text{...........(3)}$$

Where R_{itj} = *the rate of return on firm i during month j in year t;*
R_{mtj} = *the rate of return on market portfolio during month j in year t;*
α_{it}, β_{it} = *the intercept and the slope coefficient, respectively, from the market model.*

The above model is estimated using four years (48 months) of monthly return data up to 3 months after the beginning of a fiscal year. If less than 24 monthly returns were available, the firm-month observation is excluded from the analysis.

The estimated parameters, it and it, from the market model (3) are used to calculate monthly abnormal returns (AR) as follows:

$$AR_{itj} = R_{itj} - (\alpha_{it} + \beta_{it} R_{mtj})$$

Where i = *the firm index;*
t = *the year index;*
j = *the month index.*

The monthly abnormal returns are then cumulated over twelve months up to the three months after the end of the fiscal year to get cumulative abnormal returns (CAR):

$$CAR_{it} = \sum_{j=4}^{15} AR_{itj}$$

Where CAR_{it} = *the cumulative abnormal returns for firm i in year t;*
AR_{itj} = *the abnormal returns of firm i for the jth month of year t.*

To test the hypothesis that ERC's of designated firms be higher than those of non-designated firms, we estimated the following regression model:

$$CAR_{it} = a + bUE_{it} + \phi D_{it}UE_{it} + e_{it} \text{..........(4)}$$

Where UE_{it} = *the unexpected earnings for firm i in year t,*
D_{it} = *the dummy variable which takes a value of one if firm i is designated as a market-dominant enterprise ('designated firm') in year t, and zero if otherwise.*

Test for any significant difference in ERC's between the designated firms and the non-designated firms is equivalent to testing the significance of the estimated coefficient in the regression model (4). Thus, our hypothesis can be formally stated as:

Ho: $\phi = 0$, *Ha:* $\phi > 0$

SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

The sample firms examined in this study are Korean firms listed on the Korean Stock Exchange as of December 31, 1992. To be included in the sample, the firm must satisfy the following criteria: (1) Sufficient accounting data including net income and equity are available over the study period (1981-1992); (2) Monthly security returns data are available from January 1981 to December 1992; (3) Firms in banking and finance industry are excluded. Criteria (1) and (2) are imposed to ensure the data availability of accounting earnings and returns data enough to carry out empirical analyses. The firms in banking and finance industry are excluded because they tend to have different characteristics from the other firms. The above selection criteria yielded a sample of 144 firms. The number of firms designated as market-dominant enterprises by the KFTC varies over time. For example, 181 firms were designated in 1981 while 209 firms were designated in 1992.

The breakdown of sample firms by industry is shown in Table 1. The sample consists of 14 industries and there are some clustering in particular industries. For example, designated firms in foods & beverage do have 29% market share, while those in textile industries have 14.5% market share. On the other hand, the medical products industry appears to be very competitive in the sense that only 1 out of the total 17 sample firms is designated. In general, designated sample firms consist of large firms with a relatively long history and hence there may be a potential problem of survivorship bias.

Table 1: Industry Classification of Sample Firms [1]						
Industry	Designated Firms		Non-designated Firms		Total Firms	
	N	%	N	%	N	%
Foods and Beverage	18	29.0	6	7.3	24	16.7
Textiles	9	14.5	11	13.4	20	13.8
Pulp, Paper and Paper Products	1	1.6	5	6.1	6	4.2
Chemicals & Chemical Products	6	9.7	11	13.4	17	11.8
Medical Products	1	1.6	16	19.5	17	11.8
Rubber Plastic Products	4	6.5	1	1.2	5	3.5
Non-metalic Mineral Products	5	8.1	9	11.0	14	9.7
Basic Metals	2	3.2	9	11.0	11	7.6
Fabricated Metal Products	1	1.6	4	4.9	5	3.5
Machinery and Equipment	5	8.1	1	1.2	6	4.2
Radio, TV and Communication Equipment	3	4.8	7	8.5	10	6.9
Electrical Machinery and Apparatus	3	4.8	0	0.0	3	2.1
Motor Vehicles and Trailers	3	4.8	2	2.5	5	3.5
Medical, Precision and Optical Instruments, Watches	1	11.6	0	0.0	1	0.7
Total	62	100.0	82	100.0	144	100.0

Table 2 provides descriptive statistics for selected variables of the sample firms. Also reported are Wilcoxon rank test statistics for the differences in these variables between designated firms and non-designated firms. Selected variables include unexpected earnings (UE), cumulative abnormal returns (CAR), systematic risk (BETA), growth as measured by the ratio of market value to book value of equity (GROWTH), leverage as measured by the ration of total liabilities to total asset (LEVG), Tobin's Q ratio (QRATIO), return on asset (ROA), return on equity (ROE) and firm size as measured by the market value of equity (SIZE).

As expected, the average firm size of the designated firms is much greater than that of the non-designated firms: i.e., 2,366 billion Won for the designated firms ($1.57 billion at the exchange rate of 1500 Won per dollar as of August, 2004), while 528 billion Won ($0.35 billion) for the non-designated firms. This difference is statistically significant at less than 0.01 confidence level. There is no significant difference in UE and CAR between the two groups. However, mean (median) systematic risk (BETA) of the designated firms is 0.816 (0.801), which is much smaller than that of the non-designated firms. These differences are consistent with the theoretical prediction that monopoly power is negatively correlated with firm's systematic risk (Subrahmanyan and Thomadakis, 1980).

Table 2: Descriptive Statistics of Selected Variables

Variable	Designated Firms			Non-designated Firms			Wilcoxon Z-value [11]	Significance (p-value)
	Mean	S.D.	Median	Mean	S.D.	Median		
UE [2]	-0.001	0.131	0.001	-0.002	0.196	0.002	0.542	0.5871
CAR [3]	0.061	0.362	0.058	0.057	0.424	0.045	0.535	0.5922
BETA[4]	0.816	0.239	0.801	0.936	0.282	0.935	-7.483	0.0001
GROWTH[5]	2.381	3.601	1.241	1.925	3.051	1.001	5.036	0.0001
LEVG [6]	0.706	0.120	0.723	0.646	0.135	0.660	7.759	0.0001
QRATIO [7]	1.356	0.945	1.051	1.268	0.884	1.000	4.557	0.0001
ROA [8]	0.023	0.022	0.017	0.030	0.029	0.024	-4.334	0.0001
ROE [9]	0.076	0.056	0.068	0.083	0.186	0.073	-1.072	0.2833
SIZE [10]	236.59	558.53	75.24	52.78	84.90	26.59	12.519	0.0001

1) Total 1,064 observations were used for 144 sample firms during 7 years (1986-1992)
2) Cumulative abnormal returns are cumulated over 12 months form April to March of the year t + 1
3) Unexpected earnings as measured by subtracting expected earnings described by the random walk with drift model from actual earnings, and then deflated by total market value of equity at the beginning of the fiscal period.
4) Systematic risk of common stock, estimated from market model.
5) Growth as measured by the ratio of market value to book value of equity.
6) Leverage as measured by the ratio of total liabilities to total assets.
7) Tobin Q ratio = (Total Liabilities + Market value of equity) / Total assets
8) Return on total assets = Net Income / Total Assets
9) Return on equity = Net Income / Equity
10) Firm size is measured by the market value of equity (10 billion won).
11) Wilcoxon signed ranks tests statistics

The median ROA and ROE are statistically significantly greater for the non-designated firms, which appears to be contrary to our expectation from a monopoly gain perspective. On the other hand, QRATIO of the designated firms are significantly greater than that of the non-designated firms. Higher QRATIO for the designated firms implies that the designation as a market dominant enterprise is recognized as having monopoly power in that product markets.

EMPIRICAL RESULTS

Table 3 presents the results from estimations of equation (4). We estimate equation (4) for the designated firms and the non-designated firms, as well as total sample. The results are reported for two types of samples, one for the total sample (Sample A) and the other for the reduced-sample (Sample B) excluding those firms that changed their designation status. Overall results are consistent with the theoretical prediction.

Table 3: Effects of Monopoly Power on the ERC $CAR_{it} = a + bUE_{it} + \phi D_{it}UE_{it} + e_{it}$				
Panel A: Sample A (including firms that changed their designation status)				
Independent Variables	Expected Sign	Designated Firms	Non-designated Firms	Total Sample Firms
Intercept	?	-0.177 ** (5.340)	-0.142 ** (5.109)	-0.156 ** (7.303)
UE	+	1.159 ** (3.708)	0.408 * (2.397)	0.418 ** (2.510)
D*UE	+			0.744 * (2.023)
R2 (%)		5.35	1.50	2.91
Panel B: Sample B (excluding firms that changed their designation status)				
Independent Variables	Expected Sign	Designated Firms	Non-designated Firms	Total Sample Firms
Intercept	?	-0.206 ** (5.599)	-0.124 ** (4.144)	-0.155 ** (7.303)
UE	+	1.406 ** (2.473)	0.437 ** (2.400)	0.461 ** (2.510)
D*UE	+			0.764 + (1.273)
R2 (%)		3.06	1.82	2.14

1) Dit is a dummy variable which takes a value of one if firm i for the year t belongs to designated firms, and zero if firm i belongs to non-designated firms
2) t-values are in parenthesis.
+ : Significant at a = 0.10; * : Significant at a = 0.05; ** : Significant at a = 0.01.

Panel A of Table 3 shows the results for the total sample (Sample A). The ERC for the designated firms is 1.159, while that of non-designated firms is 0.408. The regression coefficient (ϕ) of $D_{it}UE_{it}$ in equation (4) are positive as predicted and statistically different from zero at the significance level of 0.05, supporting the Hypothesis.

Sample A may have some estimation bias because the number of the 'designated firms' is not symmetrical with that of the 'non-designated firms' each year. Thus, we delete those firms that changed their designation status during the test period and hold only those firms that consistently keep designated or non-designated status over the whole test period. The results are shown in Panel B, which are quite consistent with the results in Panel A.

Overall, these results lend empirical support to our maintained hypothesis that the ERC is a positive function of a firm's monopoly power measured by the designation as a market dominant enterprise.

In general, the above results support our hypothesis. However, the empirical estimation procedure might include the following potential problems. First, the firm size of the two sample groups is significantly different from each other, which may contaminate the estimation results. Secondly, different industry distributions of the two groups may also contaminate the estimation results. To resolve these potential problems, matched-paired sample based on firm size and industry is used. Industry is classified based on the classification by the Korean Listed Companies Association, while firm size is measured as the market value of equity. Through this procedure, 48 matched paired sample firms (total 96 firms) are selected.

Table 4 provides the estimation results of equation (4) for the matched paired sample. For the sample A including those firms who changed their designation status, the regression coefficient (ϕ) is statistically significantly positive at the significant level 0.05 as predicted. The results for sample B excluding those firms who changed their designation status are similar to those for sample A (panel B). Overall, the results for the matched paired sample also support the hypothesis that the ERC is a positive function of a firm's monopoly power.

Table 4: Effect of Monopoly Power on the ERC: Matched Paired Sample based on Firm Size and Industry

$$CAR_{it} = a + bUE_{it} + \phi D_{it} UE_{it} + e_{it}$$

Panel A: Sample A (including firms that changed their designation status)				
Independent Variables	Expected Sign	Designated Firms	Non-designated Firms	Total Sample Firms
Intercept	?	-0.191 ** (5.063)	-0.226 ** (5.339)	-0.208 ** (7.362)
UE	+	1.182 ** (3.551)	0.279 (0.886)	0.261 (0.879)
D*UE	+			0.947 * (2.073)
R2 (%)		6.25	0.41	3.20
Panel B: Sample B (excluding firms that changed their designation status)				
Independent Variables	Expected Sign	Designated Firms	Non-designated Firms	Total Sample Firms
Intercept	?	-0.188 ** (4.406)	-0.144 ** (3.109)	-0.165 ** (5.256)
UE	+	1.565 ** (2.593)	0.099 (0.289)	0.122 (0.375)
D*UE	+			1.362 ** (1.942)
R2 (%)		4.78	0.06	2.08

1) Dit is a dummy variable which takes a value of one if firm i for the year t belongs to designated firms, and zero if firm i belongs to non-designated firms.
2) t-values are in parenthesis.
+ : Significant at a = 0.10; * : Significant at a = 0.05; ** : Significant at a = 0.01.

The variables, RISK and GROWTH, have been shown to affect ERC's in the previous literature (e.g., Easton and Zmijewski, 1989 and Collins and Kothari, 1989). Thus, our findings in the previous section may be due to systematic differences between these two groups in the variables that affect the ERC's. In an attempt to investigate this possibility, we estimated the following regression model:

$$CAR_{it} = b_0 + [b_1 + b_2 RISK_{it} + b_3 GROW_{it} + \phi D_{it}] * UE_{it} + e_{it} ....(5)$$

where $RISK_{it}$ = *1 if the systematic risk of common stock (BETA) for firm i in year t is above the sample median, and 0 if otherwise,*

$GROW_{it}$= *1 if growth rate (GROWTH) for firm i in year t is above the sample median, and 0 if otherwise.*

In equation (5), the coefficient b1 of UE is predicted to be positive as a measure of usefulness of accounting earnings information. The b2 and b3 are predicted to be negative and positive, respectively.

Table 5: Effect of Monopoly Power on the ERC: After controlling for Systematic Risk and Growth

$$CAR_{it} = b_0 + [b_1 + b_2 RISK_{it} + b_3 GROW_{it} + \phi D_{it}] * UE_{it} + e_{it}$$

Total Sample			
Independent Variables	Expected Sign	Sample A	Sample B
Intercept	?	-0.160 (7.469) **	-0.158 (6.796) **
UE	+	0.723 (3.044) **	0.866 (3.439) **
RISK*UE	-	-0.699 (2.107) *	-0.853 (2.340) **
GROW*UE	+	0.236 (0.617)	0.055 (0.138)
D*UE	+	0.508 (1.308) +	0.589 (0.977)
R2 (%)		3.60	3.29
Matched Paired Sample			
Independent Variables	Expected Sign	Sample A	Sample B
Intercept	?	-0.211 (7.514) **	-0.164 (5.217) **
UE	+	0.834 (2.111) **	0.581 (1.339) +
RISK*UE	-	-1.265 (2.453) **	-0.989 (1.667) *
GROW*UE	+	2.468 (2.261) *	0.320 (0.231)
D*UE	+	0.372 (0.747)	1.105 (1.538) +
R2 (%)		5.75	3.12

1) RISKit = 1 if the systematic risk of common stock for firm i in year t is above sample median, and 0 otherwise
GROWit= 1 if growth (ratio of market value to book value of equity) for firm i in year t is above sample median, and 0 otherwise.
2) t-value is in parenthesis
+ Significant at a = 0.10; * Significant at a = 0.05; ** Significant at a = 0.0; all two tailed tests

Table 5 provides the empirical results for both total sample and matched paired sample. Each sample includes two different groups: one group includes those firms that changed their designation status while the other group does not include those firms that changed their designation status. Overall, the coefficients on RISK and GROW have their predicted signs. Furthermore, the coefficient b2 of RISK is statistically significant at the significance level of 0.05.

As expected, the estimate of the coefficient ϕ on D_{it}*UE_{it} are positive, which is similar to earlier results. The coefficients are statistically significant at the 0.10 significance level for sample A of total sample and sample B of matched-paired sample.

CONCLUSIONS

The purpose of this paper is to provide further evidence on the factors that affect the coefficient relating unexpected earnings and abnormal stock returns, viz., the ERC. In particular, this study examines whether a firm's monopoly power has a systematic impact on the ERC. From analytical results, we derive a theoretical prediction that the ERC is a positive function of the firm's monopoly power in its product markets.

Using a sample of 144 Korean firms listed in the Korean Stock Exchange during the period from1986 to 1992, we empirically test this theoretical prediction. A firm's monopoly power is measured by whether or not the firm is designated as a market-dominant enterprise by the Monopoly Regulation and Fair Trade Act.

The empirical results are generally consistent with the theoretical prediction. Specifically, the ERC is higher for the designated firms than for the non-designated firms. This result is robust across different methods and samples. The results from this study may provide additional insights into the effect of the monopoly power on the ERC and the economic effect of the monopoly regulation policy in Korea.

One related issues left for future research is a time-series approach that examines the direction of changes in ERC's associated with shifts in the firm's monopoly power would provide meaningful results. For example, we can compare the ERC's over time using a sample of firms that are newly designated as a market-dominant enterprise or de-listed from the designation.

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BRAND VALUE AND THE REPRESENTATIONAL FAITHFULNESS OF BALANCE SHEETS

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ABSTRACT

This study examines the impact of brand value on the representational faithfulness of balance sheets. The results of this research reveal that brand value is significant in explaining variations in the price to book value ratios over and above the explanatory power of variables that are typically thought to be related to price to book value differentials. These results suggest that assets of firms with significant brand value may be underreported on the firms' balance sheets. Accordingly, if the representational faithfulness of balance sheets is to be enhanced, accounting standards should consider including reliable measures of intangible assets (especially for high brand value firms) in balance sheets.

BACKGROUND

Little and Coffee (2000) found that the balance sheets of knowledge and service based companies are less representationally faithful than the balance sheets of more traditional firms because they systematically under-report assets. They suggest that one reason for this may be that the assets of knowledge and service based companies include more soft, intangible assets as opposed to the comparatively hard, tangible assets of more traditional business enterprises like heavy manufacturing and traditional wholesaling/ retailing.

Knowledge and service based companies are not, however, the only kinds of companies that may have significant intangible assets. It is well established that brands like Nike, Coca-Cola, Disney and McDonald's are assets that have a separately identifiable economic value (Kallapur and Kwan, 2004; Kerin and Sethuraman, 1998). Fernandez (2002) reports the Marketing Science Institute definition of brand value as the "strong, sustainable, and differentiated advantage with respect to competitors that leads to a higher volume or a higher margin for the company compared with the situation it would have without the brand." Interbrand (2001) estimates that brand value accounts for a significant percentage of the market value of the top 100 global brand companies.

The Financial Accounting Standards Board recognizes the potential economic value of brands with respect to intangibles acquired as part of a business combination. FASB Statement No.

141: Business Combinations (FAS 141), requires the use of the purchase method of accounting for business combinations. Under this method, the acquiring company will be treated as though it purchased the target company's net assets at their fair market value on the date of acquisition. Net present value is deemed to be the best method for determining fair market value. The use of the purchase method requires that goodwill be recognized as an asset. Furthermore, other intangibles should be recognized as assets separate and apart from goodwill if these other intangibles either arise from contractual or legal rights or are capable of being transferred from the acquired entity. FAS 141 in paragraph 16A identifies brand as a general marketing term typically used to refer to a group of complementary assets such as the trademarks or service marks and their related trade names, formulas, recipes, and technological expertise which may or may not be patented. The statement does not preclude an entity from recognizing, as a single asset apart from goodwill, a group of complementary intangible assets commonly referred to as a brand if the assets that make up that group have similar useful lives.

Accordingly, brand value is not exclusive to knowledge and service based companies. For the last several years, Interbrand Corporation has estimated the value of the 100 top global brands and published the results in Business Week. The 2002 list includes knowledge based companies like Microsoft, IBM and Intel, as well as more traditional retail companies like Coca-Cola, Nike, and Gap and manufacturing companies like Ford, Honda, Toyota and GE. Interbrand estimates that each of the top 100 brands has a value in excess of $1 billion. The brand with the highest value in 2002, Coca-Cola, had an estimated value of nearly $70 billion. The representational faithfulness problem linked to knowledge and service based companies may extend to more traditional companies if brand value comprises a significant unrecorded asset.

BOOK VALUE VERSUS MARKET VALUE

Little and Coffee (2000) used the ratio of book value to market value per share of common stock as a measure of the representational faithfulness of the balance sheet. Book value per share of common stock measures the amount each share of common stock would receive if all assets on the balance sheet were sold at an amount equal to the balance sheet carrying (book) value, all liabilities were retired at their carrying (book) value, preferred stockholders were paid according to the liquidation provisions of the preferred stock (usually call value), and the common shareholders received the remaining cash in a pro-rata distribution. The book value per share of common stock can therefore be viewed as a measure of the net assets attributable to each share of common stock, as these net assets are recognized and measured in accordance with generally accepted accounting principles.

Market value per share of common stock is essentially the capital market's collective measure of the perceived present value of the future cash flows of a share of common stock, with both the amounts and timing of the future cash flows and the discount rate being in the eyes of the capital market. When the market value is above book value this indicates the capital market's recognition of valuation not represented on the balance sheet. This could be the result of assets reported on the balance sheet (usually at historical cost) at less than their market value, or it could indicate the existence of separately identifiable (usually intangible) assets which are not recognized on the balance sheet. For companies with very high brand values, nearly all of the difference between market and book value could be captured in unrecognized brand value. In fact, advocates of brand value accounting suggest that for many companies brand value may be the single most important asset. Chris Pearce, CFO of Rentokil, maintains that brand assets should be recorded on the balance sheet because they have real value and are sold between companies on a regular basis (Fernandez, 2002).

Aaker (1991) and Morris (1996) assert that successful, established brand names are corporate assets that have an economic value. Kerin and Sethuraman (1998) were among the first to test for the possibility that the capital markets attribute an economic value to brands. Their basic model was a simple, bivariate model that examined the functional relationship between brand value and the market to book ratio for a sample of top-100 brand companies. They used Financial World's estimates of brand value rather than Interbrand's estimates. The bivariate relationship examined by Kerin and Sethuraman (1998) was a Log-Log model (log market to book ratio and log brand value). A positive and significant relationship was found between brand value and the book to market ratio. The Log-Log model had an explanatory value of (Adj. R2= .40).

Kerin and Sethuraman (1998) suggested that a simple, bivariate model may be insufficient to explain the observed association between brand value and the market to book ratio. To test this possibility, they added sales as a variable in their model. Sales did not alter the results, but Kerin and Sethuraman suggested that future research should introduce other variables to determine whether additional variables might "attenuate or amplify the observed association and functional form...."

Also, there are other variables that might affect market/book ratios and the association between them and brand value. Little and Coffee (2000) found significant relationships between market/book ratios and risk, size (sales or assets), growth (projected 5-year earnings per share growth) and asset intensity (ratio of plant assets to total assets). They based their model in part on prior studies that reported that growth companies have higher market to book ratios after controlling for risk (Stickney and Brown, 1999) and that larger companies have higher market/book ratios (Fama and French, 1992).

OBJECTIVES OF THIS STUDY

Are high brand values an indicator of balance sheets with poor representational faithfulness? One would presume so, as brand values are not captured as assets under GAAP, unless a company has been acquired in a transaction using the purchase method of accounting following FAS 141 guidelines. How do high brand value companies compare to low brand value companies in the representational faithfulness of their balance sheets? If there is a strong connection with high brand value and representational faithfulness, then this is evidence that balance sheet problems are not limited to knowledge and service based companies but extend to many companies in traditional manufacturing, retailing, and other areas. If true, this suggests that accounting standards should examine the concept of capturing some measurement of brand value to improve the representational faithfulness of balance sheets.

RESEARCH METHODOLOGY

Brand value data were obtained from Business Week's 2003 Top 100 Global Brand Scoreboard. Of the one hundred companies, sixty one companies were selected whose brand name defines the company itself. For example, the brand name Coke defines the Coca-Cola company but Marlboro does not define the Philip Morris company.

Brand values for the year 2003 were derived by Business Week using Interbrand's method which project's net future earnings for the brand over and above the cost of owning tangible assets. The resulting "Economic Value Added" of the brand is discounted using a discount rate that is adjusted for the risk of the projected earnings based on the assessed strength of the brand. While it is true that Interbrand's estimate of future earnings from the brand and the risk factor based on brand strength is somewhat subjective, the credibility of Interbrand's brand value estimates is enhanced by the use of respected financial analysts, market research, and interviews with industry executives.

Other financial data were obtained from the 2003 Value Line database for fifty four of the sixty one "brand value" companies for which data were available. In addition, a sample of fifty four companies from ‘zero brand value" companies was selected. It was assumed that companies from the Utility industry would best represent those which have little or no brand value. Because of the dichotomous grouping of companies, the total sample of "brand value" and "zero brand value" companies allow for tests of the representational faithfulness of balance sheets, as represented by variations in price to book value ratios.

Fernandez (2002) postulates that a firm's price to book value relationship can be expressed as,

PRBV = (ROE-g)/(Ke-g)
Where, PRBV = Market Value to book Value
ROE = Return on Shareholders' Equity
g = Projected Growth Rate of Earnings
Ke = Cost of Equity Capital

This relationship is supported by Little and Coffee (2000) who found that risk (Beta) and projected earnings per share growth were significant in explaining variations in PRBV.

Also, Fama and French (1992) reported that size, as measured by the natural log of sales, was a significant variable in explaining variations in PRBV. Given the findings of Kerin and Sethuraman (1998), a variable representing brand value should add to the explanatory power of a model that includes the aforementioned variables.

Thus, the variables selected for the statistical tests in the study are, as follows:

Dependent Variable: *PRBV (Natural Log of PRBV)*
Independent Variables: *RISK (Beta)*
PEPSG (Projected 5 Year EPS Growth)
SIZE (Natural Log of Sales)
BRAND (Brand Value Categorical)
1 = Brand Value Firms
0 = Zero Brand Value Firms

In the following presentation of the results of this research, sample statistics are presented along with the results of the regression analysis using the aforementioned model. Appendix A reports the "Brand Value" and "Zero Brand Value" companies
used in this research.

RESULTS OF THE RESEARCH

Table one reports statistics for the variables used in the regression model for companies in the "Brand Value" and "Zero Brand Value" samples.

Table One: Sample Statistics					
Brand Value					
	n	Mean	Std. Dev.	Max.	Min.
PRB	54	1.39	0.75	3.48	-0.20
PISK	54	1.11	0.35	1.90	0.55
PEPSG	54	1.67	1.15	8.67	1.08
SIZE	54	10.17	1.39	14.34	7.39
Zero Brand Value					
PRBV	54	0.47	0.21	0.95	0.09
RISK	54	0.80	0.17	1.55	0.50
PEPSG	54	1.13	1.12	3.18	-6.67
SIZE	54	7.93	1.22	10.02	5.36

As expected, due to the fact that brand values are not recorded as assets on the balance sheet, the PRBV mean for the "Brand Value" firms are close to three times of the PRBV mean for the "Zero Brand Value" firms. Also, the "Brand Value" firms have a higher cost of equity capital (as reflected by the higher Beta mean), a higher projected growth of earnings, and are larger in size.

Table two reports the statistics of the regression model using the variables shown in table one:

Table Two: Regression Model
Dependent Variable: PRBV

Independent Variable	Parameter Estimate	Standard Error	Prob >T
RISK	-0.664	0.182	0.0004
PEPSG	0.025	0.044	0.5662
SIZE	-0.113	0.038	0.0036
BRAND	1.364	0.136	0.0001
Note: R2 = 0.535; Adjusted R2 = 0.517			

As expected, RISK, SIZE, and BRAND have a high degree of statistical significance in explaining the variations in PRBV. However, PEPSG was not statistically significant as it was in prior research. It is possible that brand value adds explanatory value that captures both the future earnings potential of "Brand Value" companies as well as differentials in the representational faithfulness of balance sheets.

Another important finding from the results of the regression is that the adjusted R2 of the model is 0.517 which is considerably higher than the 0.40 reported by Kerin and Sethuraman (1998) using only a brand value variable. The adjusted R2 of the regression model in their study, using only the BRAND variable, is 0.409. This finding suggests that brand value is important (and, perhaps most important) in explaining variations in PRBV, but that other variables do add significantly to the explanatory power of the model.

The signs of the coefficients of the variables were as expected and consistent with the findings of other research. The coefficients of both the RISK and SIZE variables were negative. This suggests that firms with higher betas and larger companies tend to have lower PRBV's regardless of the value of the firms' brands. Collinearity diagnostics, Belsley, Kuh, and Welsch (1980), reveal that the model is well-conditioned.

Given that the regression model's R2 is 0.535, it is obvious that there are other important variables that enhance the explanation of variances in PRBV. For example, Roos, Roos, Edvinsson, and Dragonnetti (1997) theorize that the difference between a firm's market value and its book value is represented by "intellectual capital."

This "intellectual capital" may consist of "human capital", representing the quality of a firm's management and the skill and knowledge of its key employees, and "structural capital" which includes factors such as brand value and the replacement value of a firm's assets. Thus, further research is needed to explore these added dimensions.

CONCLUSIONS

Our study shows that companies with high brand value have significantly higher price to book ratios than companies with little or no brand value. If one accepts the premise that high price to book value ratios are sometimes indicative of the systematic under-reporting of assets, then our findings suggest that the balance sheets of companies with high brand value may not be representationally faithful due to the omission of some measure of brand value.

The problem of the representational faithfulness of traditional balance sheets, previously found to be associated with knowledge and service based companies, may extend to more traditional manufacturing and wholes/retail business if systematic under-reporting is prevalent. Accounting standards may need to consider including reliable measures of intangible assets, like brand value, to enhance the representational faithfulness of balance sheets.

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APPENDIX A: SAMPLE COMPANIES

"Brand Value" Company Name	Industry	"Zero Brand Value" Company Name	Industry
Amer. Express	FINANCL	Allegheny Energy	UTILEAST
Anheuser-Busch	ALCO-BEV	ALLETE	UTILCENT
AOL Time Warner	ENTRTAIN	Alliant Energy	UTILCENT
Apple Computer	COMPUTER	Amer. Elec. Power	UTILCENT
Boeing	DEFENSE	Amer. States Water	WATER
BP PLC ADR	OILINTEG	Ameren Corp.	UTILCENT
Canon Inc.	ADR ELECFGN	Avista Corp.	UTILWEST
Caterpillar Inc.	MACHINE	Black Hills	UTILWEST
Cisco Systems	TELEQUIP	California Water	WATER
Citigroup Inc.	FINANCL	Cen. Ver Pub. Serv.	UTILEAST
Coca-Cola	BEVERAGE	CH Energy Group	UTILEAST
Colgate-Palmolive	HOUSEPRD	Cinergy Corp.	UTILCENT
DaimlerChrysler	AUTO	Cleco Corp.	UTILCENT
Dell Inc.	COMPUTER	Consol. Edison	UTILEAST
Disney (Walt)	ENTRTAIN	Constellation Energy	UTILEAST
Eastman Kodak	INSTRMNT	Dominion Resources	UTILEAST
Ericsson ADR	TELEFGN	DTE Energy	UTILCENT
Exxon Mobil Corp.	OILINTEG	Duke Energy	UTILEAST
FedEx Corp.	AIRTRANS	Duq Light Hldgs	UTILEAST
Ford Motor	AUTO	Edison Int'l	UTILWEST
Gap (The) Inc.	RETAILSP	El Paso Electric	UTILWEST
Gen'l Electric	ELECEQ	Empire Dist. Elec.	UTILCENT
Gillette	COSMETIC	Energy East Corp.	UTILEAST
Goldman Sachs	BROKERS	Entergy Corp.	UTILCENT
Harley-Davidson	RECREATE	FirstEnergy Corp.	UTILEAST
Heinz (H.J.)	FOODPROC	FPL Group	UTILEAST
Hewlett-Packard	COMPUTER	Green Mountain Pwr.	UTILEAST
Honda Motor ADR	AUTO	G't Plains Energy	UTILCENT

APPENDIX A: SAMPLE COMPANIES (continued)

"Brand Value" Company Name	Industry	"Zero Brand Value" Company Name	Industry
Intel Corp.	SEMICOND	Hawaiian Elec.	UTILWEST
Int'l Business Mach.	COMPUTER	IDACORP Inc.	UTILWEST
Johnson & Johnson	MEDSUPPL	MDU Resources	UTILWEST
JPMorgan Chase	BANK	MGE Energy	UTILCENT
Kellogg	FOODPROC	NiSource Inc.	UTILCENT
McDonald's Corp.	RESTRNT	NSTAR	UTILEAST
Merck & Co.	DRUG	OGE Energy	UTILCENT
Merrill Lynch & Co.	BROKERS	Otter Tail Corp.	UTILCENT
Microsoft Corp.	SOFTWARE	Pepco Holdings	UTILEAST
Morgan Stanley	BROKERS	PG&E Corp.	UTILWEST
Motorola Inc.	SEMICOND	Pinnacle West Cap	UTILWEST
NIKE Inc. 'B'	SHOE	PNM Resources	UTILWEST
Nokia Corp. ADR	TELEFGN	Progress Energy	UTILEAST
Oracle Corp.	SOFTWARE	Public Serv. Enter	UTILEAST
PepsiCo Inc.	BEVERAGE	Puget Energy Inc.	UTILWEST
Pfizer Inc.	DRUG	SCANA Corp.	UTILEAST
Polo Ralph Lau	APPAREL	Sempra Energy	UTILWEST
Reuters ADR	PUBLISH	Southern Co.	UTILEAST
Sony Corp. ADR	ELECFGN	TECO Energy	UTILEAST
Starbucks Corp.	RESTRNT	TXU Corp.	UTILCENT
Sun Microsystems	COMPUTER	UIL Holdings	UTILEAST
Tiffany & Co.	RETAILSP	Vectren Corp.	UTILCENT
Toyota Motor	AUTO	Westar Energy	UTILCENT
Wrigley (Wm.) Jr.	FOODPROC	Wisconsin Energy	UTILCENT
Xerox Corp.	OFFICE	WPS Resources	UTILCENT
Yahoo! Inc.	INTERNET	Xcel Energy Inc.	UTILWEST

WHAT PUTS THE CONVENIENCE IN CONVENIENCE YIELDS?

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ABSTRACT

We examine heating oil and gasoline futures prices to determine what factors drive deviations from the cost-of-carry model – what puts the convenience in convenience yields? We estimate a model that includes commodity supplies, macroeconomic variables, OPEC decisions, political unrest and seasonal controls. Our model explains up to 87% of variation in monthly forward yields for heating oil, and 68% for gasoline. Moreover, we investigate the degree to which the term structure of futures prices is informative. We find that a decomposed term structure of forward yields explains variations in refining capacity and inventories far better than near-horizon convenience yields alone.

INTRODUCTION

We investigate the information content of the term structure of heating oil and gasoline futures prices. We focus on two questions: (i) What factors cause deviations from the cost-of-carry model, i.e., what puts the convenience in convenience yields?[1] (ii) To what degree is the term structure of futures prices informative? These important questions are only partially addressed in the literature. This study attempts to overcome these shortcomings.

It is reasonable to suggest that in frictionless markets, arbitrage pressures will ensure that differences in spot and futures prices of storable commodities will arise only from the time variation in interest and warehousing expenses. However, large deviations from the cost-of-carry model are commonly observed in commodity markets, with spot prices often above interest-rate-adjusted futures prices.[2] The long-standing resolution to this problem is to explain such deviations by the existence of convenience yields, the marginal benefits obtained from physical ownership of the commodity (for instance, Kaldor (1939), Working (1949), and Brennan (1991)).[3] It is argued that convenience yields are related to net demand – rising when inventories are low and falling when the commodity is plentiful (for instance, Fama and French (1987, 1988)).[4]

Such arguments open the door to several questions which remain largely unresolved. To wit, to what extent do deviations from the cost-of-carry model actually reflect commodity fundamentals?

Similarly, to what extent are commodity producers/processors and speculators responding to factors that are reflected in these deviations? For these agents, does the information content differ across futures maturities, or is the term structure of prices largely redundant?

The line of questioning we pursue follows and extends prior research. For instance, Fama and French (1988) examine the relative behavior of spot and futures prices of various metals and suggest a close relationship between inventories and convenience yields. French (1986) and Fama and French (1987) find that spot-futures price spreads help forecast spot price changes for several commodities. They demonstrate the importance of seasonality in convenience yields to their findings. Routledge, Seppi, and Spatt (2000) suggest a complex relationship exists between futures prices of varying maturities and the levels of inventories and current demand.

Several studies examine related issues. Bessembinder, Coughenour, Seguin, and Smoller (1995) employ futures returns to examine the nature of mean reversion in spot prices for various commodities. De Roon, Nijman and Veld (1998) investigate the nature of risk premia in futures prices for commodities and currencies. Others, including Gibson and Schwartz (1990a, 1990b)), Amin, Ng, and Pirrong (1995), Carr and Jarrow (1995), Schwartz (1997), Miltersen and Schwartz (1998), and Hilliard and Reis (1998), develop stochastic processes to model the term structure of convenience yields.[5]

Our study differs from prior work, both in its focus and implementation, in important ways. (1) We examine the behavior of yields in the context of commodity supply and disposition data.[6] To do this, we empirically investigate the determinants of the term structure of futures prices while considering the potential for the endogeniety of variables such as private inventories. (2) We examine information in the term structure within the context of key agents such as speculators and processors by examining the relationship between convenience yields and private inventories and refining capacity. With this approach we are able to make direct inferences about several issues; e.g., whether one part of the term structure is more informationally important than another. (3) Our investigation is in the context of marginal or forward convenience yields. Just as the convenience yield for some maturity m is commonly defined by the relation between spot and the maturity m futures price, the forward yield between maturity m and n may be defined by the relation between m-maturity and n-maturity futures prices.[7]

A finding that deviations from the cost-of-carry model arise from fundamental factors is consistent with long-standing ideas on convenience yields, and obviously inconsistent with alternative arguments that suggest deviations are essentially a noisy residual arising from insufficient arbitrage pressures in commodity markets. Similarly, a finding of an informative term structure will be in line with arguments that suggest that commodity futures prices adjust to reflect future equilibrium prices, and provide information to current producers, processors, hoarders, and consumers of the commodity (e.g., McKinnon (1967), Black (1976), and Routledge, Seppi, and Spatt (2000)).[8] The answer to whether the forward yields are informative will also help evaluate the nature of risk-premia in the term structure of futures prices. For instance, a one-factor term structure model will be supported if we find that forward yields are informationally redundant, providing no insights beyond what can be garnered from the spot price and the price of a single (say, nearby) futures contract. In this respect, our evidence will represent a test of robustness of the findings of De Roon, Nijman and Veld (1998). The authors are unable to reject a special case of a one-factor model for the risk premium in heating oil futures. Specifically, in their study a Vasicek-like (Vasicek (1977)) term structure process is supported, where the risk premia are constant for each maturity.

Our study employs over 17 years of daily data for heating oil and gasoline. Apart from being important in economic terms, the two commodities represent excellent vehicles for analyzing issues relating to futures term structure.[9] The contracts for both commodities, traded on the New York Mercantile Exchange (NYMEX), have monthly expirations with fairly robust trading up to six contracts out, giving us access to six daily futures prices for the two commodities. When dealing with daily settlement prices for the two commodities, we are not faced with problems encountered by either commodity trading in the limit.[10] The two contracts have unambiguous delivery terms, unlike the crude contract, and call for delivery in New York harbor, the principal cash-market trading center.[11] Thus we may employ spot prices in conjunction with futures prices to obtain a reliable and complete picture of the futures term structure. Also, reliable, high-frequency data exist on production and inventories for the two commodities, allowing us to better observe the relationship between convenience yields and key fundamental factors such as supply. Finally, despite their common origins, the two commodities have vastly different consumption patterns. While weather patterns play a key role in the demand for heating oil, the performance of the economy plays a large role in the demand for gasoline.

We address the first question - what puts the convenience in convenience yields - by fitting a partial equilibrium model for forward yields, with controls for OPEC decisions on crude production, and controls for political unrest. The model relies on the common argument that convenience yields reflect net demand and expected net demand of the commodity. With seasonal indicator variables, the model explains up to 87% (68%) of the variation in the monthly forward yields for heating oil (gasoline). The explanatory power of the model without seasonal dummies ranges from 8% to 59% for heating oil, and from 9% to 40% for gasoline, with explanatory power improving systematically with contract maturity. For both commodities, we document clear seasonal patterns in convenience yields, similar to Fama and French (1987). Moreover, the seasonal patterns are found to be nonsynchronous across the term structure of yields. In the last part of the analysis we highlight the problems these seasonal patterns might pose for the application of traditional term-structure methods in commodity markets.

To address the question of the information content of the term-structure of prices we use two sets of tests. In the first set, we test for the relationship between forward yields and private inventories and refining capacity for heating oil and gasoline. Our findings show that a decomposed term structure of forward yields (i.e., the entire spectrum of forward yields) explains the variation in seasonally filtered and detrended refining capacity and inventories far better than the near-horizon convenience yield alone. In the second set of tests, we follow the general approach of Fama and French (1988) in examining the relationship between spot price variability and convenience yield. For these tests we employ price variability as a proxy for information arrival (see Ross (1989) and Andersen (1996)). The results from these tests indicate that forward yields of multiple horizons explain conditional variance of daily spot returns better than the convenience yields implied by the short-horizon contract alone. These findings are also consistent with an informative futures term structure.

In Section 1 we describe the data and provide some stylized facts about convenience yields and forward yields in the heating oil and gasoline markets. Our main findings are reported in Section 2. We first report the estimates of our model of convenience yields. Results for private inventories and refining capacity are presented next with the aim of testing for the information content (alternatively, informational redundancies) of forward yields. We then report the results from GARCH estimation of the relationship between price variability and yields. Finally, we present some results relating to potential pitfalls in employing traditional term-structure methods for examining the nature of risk premia in commodity markets. Section 3 concludes the paper.

DATA AND SUMMARY STATISTICS

DATA

The study employs end of day (2:30 pm E.T.) prices on gasoline and heating oil futures traded on the NYMEX over the period 01/02/1986-02/28/2003. The data are obtained from Tick Data Inc., with settlement data compiled from official exchange-time and sales records. The synchronous spot prices are for New York harbor fungible No.2 heating oil and reformulated gasoline (87 octane index), on which the contracts are written. Corresponding daily 30-day, 90-day, and 180-day Eurodollar LIBOR rates over the interval are extracted from the *Federal Reserve Statistical Release H.15.*

Each maturing contract is rolled over into the next-to-expire contract on the first business day of the expiring month. We employ data for the six nearest contracts (with one to six months to expiration) for heating oil and gasoline. We determine from our examination of intraday NYMEX data that the farther-away contracts have relatively infrequent trading, so that the settlement prices are often stale. For ease of exposition, we refer to the first maturity as "near-horizon", the sixth maturity as "far-horizon" and the middle maturities as "mid-horizon".

We also employ low-frequency data pertaining to supply and disposition for heating oil, gasoline and crude, and to the economic and political environment for the two commodities. Monthly figures on production, imports, exports, and private inventories are obtained from the *Monthly Energy Review* of the Energy Information Administration. Weekly figures on refining capacity and capacity utilization are obtained from the same source over the shorter interval, January

1990 through February 2003. Monthly figures on US industrial production, money supply, the broad dollar index, and consumer price index, are obtained from the Federal Reserve Bank Data files. OPEC announcements of changes in production levels, and instances of political strife that were reported to influence the supply of crude are obtained from the Energy Information Administration. We note that over the sample period, there were 7 announcements to increase production and 9 announcements to decrease production. We also identify 17 months of geo-political events that are likely to have influenced crude supply.[12]

CONVENIENCE YIELDS AND FORWARD YIELDS

From the cost of carry model (with continuous compounding), the *m*-period convenience yield is formulated in the standard manner as:

$$y_t^m = \frac{\ln(p_t / f_t^m)}{m} + r_t^m, \tag{1}$$

where p represents the spot price, f^m is the m-maturity futures price, and r^m is the m-maturity interest rate (see example, Telser (1958) and Brennan (1991)). We assume that warehousing costs are constant and that they can be ignored.

Similarly, the forward yield between m and n is given by:

$$y_t^{m,n} = \frac{\ln(f_t^m / f_t^n)}{n-m} + r_t^{m,n}, \qquad r_t^{m,n} = \frac{n * r_t^n - m * r_t^m}{n-m}, \tag{2}$$

where $r^{m,n}$ is the forward rate of interest. We employ the 30-day and 90-day LIBOR to obtain forward yields for (m=1/12, n=2/12) and (m=2/12, n=3/12), while we use the 90-day and 180-day rates to obtain forward yields for (m>2/12, n>3/12). Although we use the above formulation in our study, it is notable that the results remain essentially unchanged when we employ the definition of yields that excludes interest rates.

In Table 1 we report summary statistics and correlation coefficients for the daily forward yields. With the exception of the nearby yield for gasoline, forward yields for all maturities are positive and quite large for both commodities. This is consistent with well-documented evidence on backwardation and even strong backwardation in petroleum markets (for instance, see Litzenberger and Rabinowitz (1995) and Edwards and Canter (1995)).[13] We also note some evidence of a decline in yield from lower to higher maturities. This is generally consistent with the notion that futures markets are priced under the expectation that shocks in demand or supply will be smoothed over time (see for instance, Samuelson (1965), Fama and French (1988)).

Table 1: Forward Yield Summary Statistics

Statistics are for daily data from January 1986 through February 2003 (4318 observations). Skew and Kurt are for excess skewness and excess kurtosis respectively. ADF is the Augmented Dickey Fuller statistic without trend. Lag lengths for computing these statistics are set as the highest significant (with 95% confidence) lag order from either the autocorrelation- or the partial autocorrelation function. a and b represent significance levels of 1 and 5 percent, respectively

	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$
A. Heating oil						
Mean	0.155	0.094	0.097	0.097	0.095	0.093
Std Dev	0.680	0.310	0.291	0.269	0.258	0.242
Skew	2.365[a]	1.175[a]	0.921[a]	0.781[a]	0.748[a]	0.690[a]
Kurt	9.022[a]	1.082[a]	-0.001	-0.399[a]	-0.406[a]	-0.483[a]
ADF	-6.382[a]	-6.765[a]	-7.165	-7.505[a]	-7.653[a]	-8.366[a]
Correlation						
$y^{0,1}$	1.000					
$y^{1,2}$	0.556[a]	1.000				
$y^{2,3}$	0.254[a]	0.868[a]	1.000			
$y^{3,4}$	-0.023	0.563[a]	0.850[a]	1.000		
$y^{4,5}$	-0.218[a]	0.214[a]	0.552[a]	0.849[a]	1.000	
$y^{5,6}$	-0.328[a]	-0.113[a]	0.175[a]	0.535[a]	0.830[a]	1.000
B Gasoline						
Mean	-0.001	0.129	0.135	0.128	0.126	0.114
Std Dev	0.738	0.355	0.338	0.327	0.309	0.323
Skew	0.259	-0.992[a]	-1.054[a]	-0.849[a]	-0.707[a]	-1.253[a]
Kurt	1.301[a]	2.854[a]	3.189[a]	2.276[a]	1.569[a]	3.019[a]
ADF	-5.275[a]	-6.299[a]	-6.187	-6.384[a]	-6.581	-6.649[a]
Correlation						
$y^{0,1}$	1.000					
$y^{1,2}$	0.397[a]	1.000				
$y^{2,3}$	0.171[a]	0.525[a]	1.000			
$y^{3,4}$	-0.018	0.341[a]	0.552[a]	1.000		
$y^{4,5}$	-0.124[a]	0.147[a]	0.350[a]	0.543[a]	1.000	
$y^{5,6}$	-0.229[a]	-0.040	0.135[a]	0.309[a]	0.491[a]	1.000

The standard deviation of the yields generally falls with maturity, from about 68% to less than 25% for heating oil, and from about 74% to 30% for gasoline. Bartlett's homogeneity tests confirm that there are significant differences in the variances of the yields. The third and fourth moments of the distributions also vary quite dramatically. For heating oil, skewness declines with maturity, but remains positive. The positive skewness in yields is generally in line with the theory of commodity prices which predicts that, in the presence of rational storage, spot prices will have sharp-peaks and shallow-valleys, i.e., a censored left tail of the price distribution (e.g., Deaton and

Laroque (1992)).[14] Kurtosis for oil futures is sharply above that of the normal distribution for the two nearby maturities, but is below that of the normal distribution for the maturities beyond. For gasoline, the yields are mostly leptokurtic and negatively skewed, which is not easily explained. The Augmented Dickey-Fuller (ADF) statistics indicate that yields for both commodities are stationary in their levels, which is not surprising given that the underlying commodities themselves are known to have strong reversion tendencies. In alternate tests, we document strong reversion tendencies in both commodities.[15]

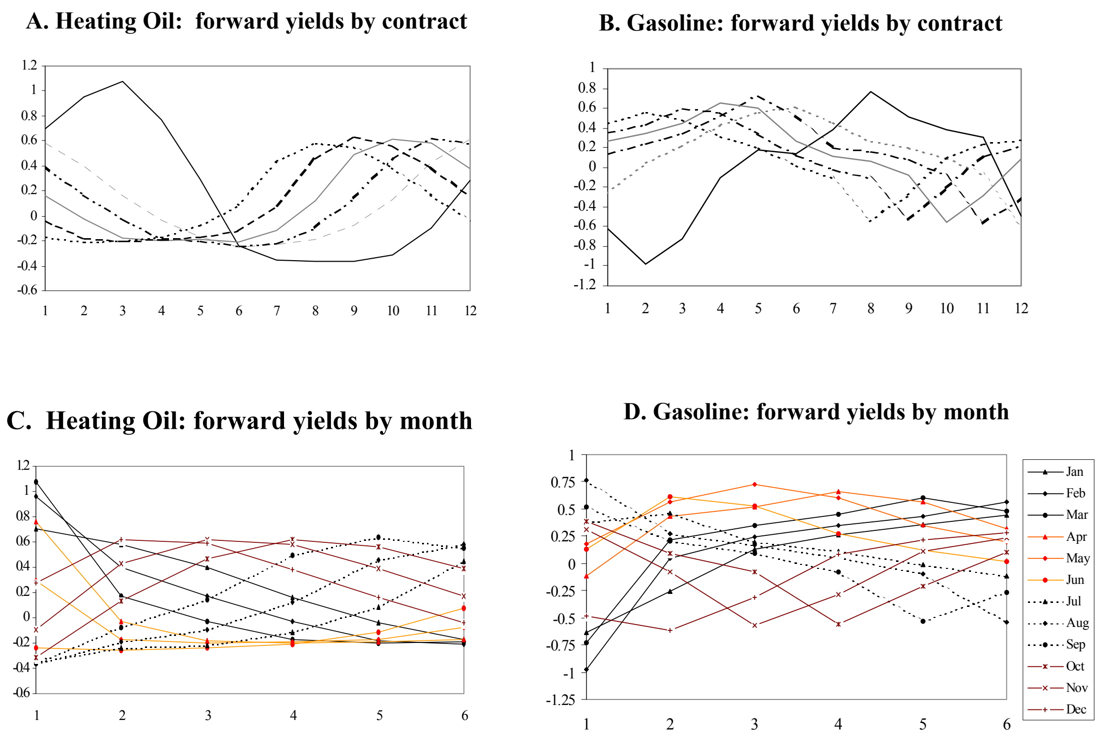
Estimated correlation coefficients between the yields of varying maturities are also reported in Table 1. The correlations range from high and positive (high of 0.87 for heating oil and 0.55 for gasoline) to moderate and negative (low of -0.33 for heating oil, and -0.23 for gasoline).[16] An intriguing pattern emerges in that there is often a high positive correlation among yields that are one to three months (maturities) apart, and a weak (even negative) correlation for yields corresponding to maturities of more than four months apart. For instance, the heating oil $y^{5,6}$ is highly positively correlated with $y^{3,4}$, $y^{4,5}$, and negatively correlated with $y^{1,2}$ and $y^{0,1}$. Similar patterns are observed for gasoline.

We investigate the extent to which the pattern of diminishing correlations across the term structure reflects differences in seasonal patterns of forward convenience yields across various maturities. Plots of the one-maturity-ahead forward yields by month of year are in Figure I. Notice that the plots take a lattice-like form indicating nonsynchronous variations in yields. In the gasoline plot, for instance, the yields by contract over April, May, and June are generally positive and rising sharply for the first few maturities, whereas the yields for October, November, and December are generally negative and falling. This pattern, while anecdotal, is consistent with the notion that yields rise (fall) with the expectation of high (low) expected demand: it is well known that gasoline demand is high in the summer months relative to the winter months. Similar evidence emerges for heating oil. For instance, the corresponding plot for heating oil shows that the yield in July (when heating oil is in low demand) is low for early maturities, but sharply higher and positive for maturities six and seven months out (corresponding to the winter months).

We also compute correlation coefficients for proxies for deseasonalized yields, the residuals from the regression of the forward yields on monthly dummy variables.[17] The patterns of low correlations among yields corresponding to distant maturities are only partially diminished following the seasonal control. While the correlations among the deseasonalized yields are consistently positive, the differences in magnitude of the coefficients remain very large. For instance, for heating oil, the correlation coefficient is 0.61 for the $\{y^{0,1}, y^{1,2}\}$ pairing, but only 0.19 for the $\{y^{0,1}, y^{6,7}\}$ pairing.

To sum up, descriptive statistics and correlations, some of which are reported in Table 1, suggest that at least one of the following is true: (a) the impact of common factors driving the forward yields is varied across the term structure; (b) there are (some) unique (uncommon) factors driving the forward yields obtained from varying maturities.

Figure 1. Seasonality in the Forward Yields



CORRELATION OF FORWARD YIELDS AND COMMODITY FUNDAMENTALS

In Table 2 we report coefficients of correlation between monthly average forward yields and lagged, contemporaneous, and future inventories, supply, and disposition, using deseasonalized and detrended data.[18] Likelihood ratio tests imply significance at the 5% level if individual correlations exceed 0.14. The results for heating oil indicate that yields are negatively related to inventories, with some evidence of predictive power. For instance, while the correlations between the forward yields ($y^{1,2}$, … ,$y^{5,6}$) and contemporaneous inventories are generally insignificant, they are generally significant for the $t+1$, …, $t+6$ inventories. Similar patterns of fairly strong negative correlations emerge for the forward yields and commodity supply. As mentioned earlier, convenience yields are thought to be positively related to net demand, elevated when supplies are low. For disposition, the correlation coefficients are generally positive but weaker in significance. Fairly similar patterns emerge for gasoline. In summary, the patterns in Table 2 are in line with theory and provide some evidence of forecasting power (*vis a vis* the commodity fundamentals).[19]

Table 2: Correlations for Monthly Forward Yields and Commodity Fundamentals

The correlation coefficients are for monthly pre-whitened forward yields and commodity inventories, total supply, and disposition over the period January 1986 through February 2003. The pre-whitened forward yields are the residuals from the OLS regression of the monthly forward yield on its lagged values (order=2), eleven monthly dummy variables, and a constant. The regressions employed in obtaining the residuals for the other variables included a trend term. Cor(x) denotes correlation between adjusted yields and variable x. Inventory is the average for the month, Supply is the lagged ending inventory plus production plus net imports for the month, and Disposition is the Supply minus the ending inventory. a and b represent significance levels of 1% and 5%.

Heating Oil (HO)																		
	Cor(HO Inventory)						Cor(HO Supply)						Cor(HO Disposition)					
Mo	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$
t-1	-0.22[a]	-0.16[b]	-0.16[b]	-0.09	-0.15[b]	-0.15[b]	0.13[b]	-0.07	-0.02	-0.10	-0.06	-0.17[a]	0.17[a]	0.03	0.09	-0.01	0.08	0.00
t	-0.29[a]	-0.06	-0.00	0.01	-0.07	-0.08	-0.29[a]	-0.11	-0.13[b]	-0.01	-0.11	-0.11	0.18[a]	-0.09	-0.13[b]	-0.09	-0.04	-0.10
t+1	-0.18[a]	-0.23[a]	-0.24[a]	-0.22[a]	-0.19[a]	-0.20[a]	-0.15[b]	0.04	0.04	-0.02	-0.04	-0.05	0.02	0.29[a]	0.25[a]	0.20[a]	0.07	0.07
t+2	-0.21[a]	-0.14[b]	-0.13[b]	-0.11	-0.11	-0.13[b]	-0.15[b]	-0.25[a]	-0.18[a]	-0.18[a]	-0.10	-0.13[b]	0.04	0.06	0.11	0.03	0.03	0.04
t+3	-0.21[a]	-0.27[a]	-0.15[b]	-0.14[b]	-0.09	-0.09	-0.20[a]	-0.17[a]	-0.11	-0.00	-0.06	-0.06	0.02	0.09	0.05	0.13	0.03	0.03
t+4	-0.19[a]	-0.27[a]	-0.24[a]	-0.16[b]	-0.19[a]	-0.17[a]	-0.15[b]	-0.20[a]	-0.16[b]	-0.17[a]	-0.07	-0.12	0.03	0.07	0.10	0.04	0.15	0.07
t+5	-0.15[b]	-0.25[a]	-0.23[a]	-0.19[a]	-0.12	-0.12	-0.14[b]	-0.22[a]	-0.21[a]	-0.10	-0.12	-0.02	0.00	-0.00	0.02	0.07	0.02	0.10
t+6	-0.08	-0.27[a]	-0.26[a]	-0.24[a]	-0.18[a]	-0.17[a]	-0.10	-0.20[a]	-0.20[a]	-0.21[a]	-0.15[b]	-0.14[b]	-0.04	0.04	0.05	0.04	0.03	0.02
Gasoline (Gas)																		
	Cor(HO Inventory)						Cor(HO Supply)						Cor(HO Disposition)					
Mo	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$
t-1	-0.24[a]	-0.24[a]	-0.21[a]	-0.19[a]	-0.13[b]	-0.21[a]	-0.15[b]	-0.10	-0.16[b]	-0.12	-0.15[b]	-0.07	0.10	0.12	0.04	0.06	0.00	0.22[a]
t	-0.25[a]	-0.23[a]	-0.19[a]	-0.16[b]	-0.15[b]	-0.12	-0.22[a]	-0.20[a]	-0.05	-0.10	-0.05	-0.18[a]	-0.12	-0.07	0.01	-0.03	-0.02	-0.12
t+1	-0.12	-0.02	-0.07	-0.06	-0.03	-0.11	0.03	-0.00	-0.07	0.01	0.02	0.03	0.04	-0.12	-0.12	-0.04	-0.04	-0.03
t+2	-0.18[a]	-0.08	-0.02	-0.12	-0.03	-0.10	-0.11	0.07	0.01	-0.08	0.00	-0.07	0.08	0.17[a]	-0.03	-0.00	0.01	-0.05
t+3	-0.13[b]	-0.19[a]	-0.07	-0.10	-0.13[b]	-0.10	-0.14[b]	-0.16[b]	0.01	-0.08	-0.12	-0.04	-0.06	0.05	0.09	-0.02	0.00	0.01
t+4	-0.11	-0.08	-0.16[b]	-0.07	-0.08	-0.15[b]	-0.02	-0.10	-0.11	-0.01	-0.07	-0.14[b]	0.04	-0.11	0.04	0.02	-0.06	-0.02
t+5	-0.13[b]	-0.08	-0.05	-0.14[b]	-0.08	-0.11	-0.10	-0.00	-0.10	-0.10	0.00	-0.07	-0.01	0.02	-0.14[b]	0.02	0.05	-0.03
t+6	-0.12	-0.23[a]	-0.13[b]	-0.08	-0.13[b]	-0.06	-0.12	-0.12	-0.01	-0.11	-0.10	-0.01	-0.06	0.10	0.06	-0.10	0.00	-0.01

EMPIRICAL RESULTS

YIELD DETERMINANTS: EVIDENCE FROM A PARTIAL EQUILIBRIUM MODEL

We begin this section by reporting on the determinants of forward yields. Given the prior hypothesized relationship between yield and storage, which we revisit shortly, we develop a partial equilibrium model estimated using an instrument-variables technique.

Let $I_{i,t}$ and $O_{i,t}$ represent, respectively, the current period inventory and production plus net imports for commodity *i*. As total supply is fixed and inelastic at t, the demand function can be estimated from data. With no deterioration in the commodity under storage, total supply at *t* is given by

$$s_{i,t} = O_{i,t} + I_{i,t-1}, \tag{3a}$$

with the market clearing at

$$d_{i,t} + I_{i,t} = s_{i,t}, \quad (3b$$

where $d_{i,t}$ is the consumption demand. Following Fama and French (1988), among others, the m-period convenience yield at t is a function of the current and expected net demand between t and $t+m$. Let the convenience yield function be given by the equation

$$y_{i,t}^{m} = a_{i,0} + d_{i,t}\,(a_{i,1} + \alpha_i X_t) + \kappa_t X_t + \varepsilon_{i,t}, \tag{4}$$

where X_t represents a matrix of macroeconomic variables such as industrial production and political strife, $\varepsilon_{i,t}$ is the unexplained portion of the yield, and the coefficients to be estimated are a_0, a_1, α, and κ, the latter two being vectors. The yield is influenced by demand and its interaction with general economic and political conditions.

From (3) and (4), substituting for $d_{i,t}$, we have

$$y_{i,t}^{m} = a_{i,0} + a_{i,1} z_{i,t} + \alpha_i z_t X_t + \kappa_t X_t + \varepsilon_{i,}, \tag{5}$$

where $z_{it} = s_{i,t} - I_{i,t}$. Equation (5), which represents a partial equilibrium-equation, is consistent with recent ideas on commodity price behavior that focus as much on the supply-side as on the demand side (for instance, Deaton and Miller (1996)).

Note that the macroeconomic variables (X_t) are likely to be informative for the qualitative expectations of future demand, $E(d_{t+m})$, so that (5) will apply to forward yields as well. Nonetheless, the convenience yield- and forward yield functions for gasoline (heating oil) are likely to be better specified by models that include the supply and disposition of crude and its other major output, heating oil (gasoline). This follows from the obvious dependence of future supply (and pricing) of gasoline (heating oil), on the current net demand for crude and heating oil (gasoline). Thus, (5) may be extended to include the inter-commodity z_t variables and their interaction terms.

In the framework of the theory of commodity prices, ordinary least squares (OLS) estimation of (5) is likely to lead to simultaneity problems. According to theory, inventories are endogenous (see for instance, Williams and Wright (1991), Deaton and Laroque (1992), and Chambers and Bailey (1996)), and we cannot explain the behavior of the yield (more specifically, the [spot – expected spot] differential) unless inventories are explained. In other words, we must estimate yield and inventory jointly.[20] With these concerns in mind, for each of the two commodities we fit variations of the instrumental-variables model

$$y_t^{n,m} = a_0 + \sum_j^2 a_j \hat{z}_{j,t} + \sum_j^2 \alpha_j \hat{z}_{j,t} X_t + \kappa_i X_t + u_t, \quad 6)$$

where subscript j=2 represents the data for crude, and the instruments are 1, $s_{j,t}$, $s_{j,t}X_t$, and the one-period lagged values of $s_{j,t}$, $s_{j,t}X_t$.[21]

We estimate several variations of (6) using two-stage least squares (2SLS), the results for which are reported in Table 3. In the interest of space, the coefficients and t-statistics are from a relatively parsimonious specification, which does not include the inter-commodity terms, $\hat{z}_t X_t$. However, we report the adjusted r-squared (r^2) coefficients from other, lengthier, specifications with an aim to indicate the sensitivity of the model's overall fit to mixing variables, polynomial allowances, and seasonal controls.

There are several noteworthy features in the results. First, there are pronounced differences in r^2, with fairly high values in the near-horizon and far-horizon yields, and low values for the mid-horizon yields. For instance, the largest two r^2 coefficients for heating oil correspond to $y^{1,2}$ (0.43) and $y^{5,6}$ (0.28), while the smallest two coefficients are for $y^{4,5}$ (0.05) and $y^{3,4}$ (0.03). A similar pattern is noted for gasoline, where r^2 ranges from 0.04 ($y^{3,4}$) to 0.14 ($y^{5,6}$). These patterns remain when we employ the lengthier specifications by including in the model the inter-commodity mixing terms, $\hat{z}_t X_t$ (as may be noted from r^2(mix)), or by including k^{th}-order polynomials for the $\hat{z}_t$ and $\hat{z}_t X_t$ terms (as may be noted from r^2(poly)).[22]

Second, the monthly seasonal dummies (included in the X_t terms) appear to explain much of the variability, whereas the other "fundamentals" fail to do so. The r^2(seasonal) ranges from 0.41 to 0.66 for heating oil, and 0.33 to 0.63 for gasoline. The largest improvements in the explanatory power for the model are for the mid-horizon yields, $y^{3,4}$ and $y^{4,5}$ for heating oil, and $y^{2,3}$ and $y^{3,4}$ for gasoline. Further improvements to the model are obtained when we allow polynomial terms alongside seasonal controls (r^2(poly,seasonal)). Surprisingly, seasonal controls appear to be much more important in explaining gasoline yields than heating oil yields.

Third, the yields across the term structure are influenced by fundamental, economic, and political factors in notably different ways. For instance, the crude oil $\hat{z}_t$ variable is negatively associated with heating oil near-horizon yields ($y^{0,1}$), but positively related to the heating oil far-horizon yields ($y^{5,6}$). An almost identical pattern is evidenced for the relationship between the heating oil $\hat{z}_t$ and gasoline yields. Moreover, for gasoline, variables such as industrial production, dollar, and OPEC decisions have a significant effect on far-horizon yields alone. For heating oil, the near-horizon yields (in particular, $y^{1,2}$) appear to have a greater dependence on these variables.

We recognize that our set of fundamental variables is incomplete. In particular, it is difficult to capture the qualitative expectations of expected net demand. Moreover, while it is not doubted that seasonal controls will reflect some of these fundamentals, the extent to which they do so is unclear. Nonetheless, the results in Table 3 suggest large differences in the determinants of yields across the contracts' maturities. Notably, the fundamental, macroeconomic, political, and seasonal variables appear to have the largest effect on the near-horizon and the far-horizon yields. The mid-horizon yields appear to be driven mainly by the season.

Table 3: 2SLS Estimation of the Partial Equilibrium Model for Forward Yields

The main results are for $y_t^{n,m} = a_0 + \sum_j^2 a_j \hat{z}_{j,t} + \kappa_i X_t + u_t$, where $y^{m,n}$ is the forward yield between the m^{th} and n^{th} maturities, $\hat{z}c$, $\hat{z}h$, and $\hat{z}g$ are the predicted [supply minus inventories] variable for crude, heating oil, and gasoline, respectively, and X represents a vector of macroeconomic and geo-political variables. The data are monthly and the interval is 1/1986–2/2003. The macro variables are in their natural log differences. OPEC(rise) (OPEC(Cut)) is the dummy pertaining to the OPEC decision to raise (cut) production. Strife is the dummy for political strife affecting world crude supplies. The r^2 coefficients are the degrees-of-freedom adjusted squared correlations between the predicted and actual values of the dependent variable. r^2(mix) is from the model where the two $\hat{z}$ terms are allowed to mix with the macro variables. r^2(poly) is from the 2nd order polynomial model. r^2(seasonal) is from the model that allows seasonal dummies. r^2(poly, seasonal) includes the polynomial order and the seasonal controls. Figures in () are t-statistics, and a and b represent significance levels of 1 percent and 5 percent, respectively.

Heating Oil	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$
$\hat{z}h$	0.030[a] (5.23)	0.023[a] (10.05)	0.017[a] (6.57)	0.006[a] (2.24)	-0.004 (-1.80)	-0.015[a] (-7.04)
$\hat{z}c$	-0.016[a] (-8.01)	-0.007[a] (-9.08)	-0.005[a] (-4.91)	-0.001 (-0.80)	0.003[a] (3.37)	0.005[a] (7.65)
Money	26.841 (1.66)	-4.162 (-0.64)	-8.004 (-1.10)	-4.828 (-0.62)	-2.588 (-0.35)	1.770 (0.29)
Dollar	2.879 (1.08)	-0.216 (-0.16)	-0.710 (-0.46)	-0.702 (-0.43)	-1.232 (-0.80)	-1.650 (-1.51)
IndProd	-16.643 (-1.50)	-9.392 (-0.69)	-7.390 (-0.25)	3.643 (0.06)	9.62 (0.74)	14.94 (1.75)
CPI	32.784 (1.36)	5.902 (0.61)	6.445 (0.59)	9.200 (0.80)	11.286(1.03)	5.877 (0.66)
OPEC(Rise)	-2.108 (-0.66)	0.778 (0.56)	1.479 (0.97)	1.691 (1.05)	1.864 (1.20)	1.794 (1.83)
OPEC(Cut)	2.536 (-1.02)	0.332 (0.27)	2.341 (1.74)	2.795[b] (1.97)	1.921 (1.40)	0.620 (0.55)
Strife	0.351 (1.69)	0.211[a] (2.76)	0.194[b] (2.08)	0.179 (1.82)	0.154 (1.64)	0.100 (1.31)
Intercept	4.057[a] (4.93)	0.993[a] (3.02)	0.377 (1.01)	-0.169 (-0.43)	-0.783[b] (-2.10)	-0.916[a] (-3.01)
r^2	0.265	0.431	0.229	0.031	0.054	0.279
Alternate Specifications						
r^2(mix)	0.289	0.497	0.321	0.088	0.058	0.374
r^2(poly)	0.324	0.528	0.330	0.094	0.062	0.388
r^2(seasonal)	0.414	0.544	0.572	0.629	0.582	0.660
r^2(poly,seasonal)	0.553	0.728	0.774	0.807	0.826	0.870
Gasoline	$y^{0,1}$	$y^{1,2}$	$y^{2,3}$	$y^{3,4}$	$y^{4,5}$	$y^{5,6}$
$\hat{z}g$	-0.007 (-0.90)	0.005 (1.64)	0.004 (1.21)	0.001 (0.57)	0.009[a] (3.33)	0.002 (1.00)
$\hat{z}c$	0.005 (0.87)	-0.001 (-0.70)	-0.002 (-0.76)	-0.002 (-1.10)	-0.008[a] (-4.46)	-0.006[a] (-3.27)
Money	-8.796 (-0.44)	6.268 (0.70)	-0.458 (-0.05)	7.101 (0.83)	8.230 (1.10)	11.745 (1.52)
Dollar	-4.677 (-1.08)	0.895 (0.46)	1.834 (1.01)	3.018 (1.70)	4.715[a] (2.91)	3.897[a] (2.72)
Ind.Prod	-15.778 (-1.12)	-3.870 (-0.61)	-0.296 (-0.04)	-3.917 (-0.65)	-8.138 (-1.54)	-4.680 (-0.86)
CPI	66.509[b] (2.19)	64.022[a] (4.71)	50.201[a] (3.86)	31.950[b] (2.46)	28.894[b] (2.05)	24.882[b] (2.00)
OPEC(Rise)	0.034 (0.08)	0.086 (0.49)	0.269 (1.63)	0.223 (1.35)	0.321[b] (2.22)	0.293[b] (1.97)
OPEC(Cut)	-0.703[b] (-2.03)	-0.163 (-1.05)	0.047 (0.31)	0.053 (0.36)	0.103 (0.79)	-0.130 (-0.97)
Strife	0.121 (0.46)	0.032 (0.27)	0.171 (1.52)	0.183 (1.64)	0.111 (1.13)	0.028 (0.28)
Intercept	-0.402 (-0.39)	-0.630 (-1.38)	-0.186 (-0.42)	0.607 (1.39)	1.454[a] (3.82)	2.079[a] (5.29)
r^2	0.035	0.083	0.057	0.035	0.140	0.144
Alternate Specifications						
r^2(mix)	0.209	0.229	0.068	0.036	0.267	0.467
r^2(poly)	0.201	0.256	0.088	0.047	0.259	0.433
r^2(seasonal)	0.332	0.488	0.449	0.632	0.605	0.535
r^2(poly,seasonal)	0.595	0.621	0.648	0.672	0.768	0.679

INFORMATION CONTENT OF THE TERM STRUCTURE: PRIVATE INVENTORIES

We base an assessment of the information content of the yield term-structure on the empirical relationship between inventories and yields. The theory of commodity prices (Williams and Wright (1991), Deaton and Laroque (1992), Chambers and Bailey (1996), among others) suggests a negative relationship between inventories held by speculators and the difference between current prices and the futures price adjusted for carrying charges and deterioration. Specifically, if there is no deterioration or spoilage in inventories, the cost of holding inventories over the interval *n-t* is then given by $1/(1+r+w)^n=\theta^n<1$, where *w* is the warehousing costs. Profit maximization yields the following relationship between inventory, I_t, and the price term-structure:

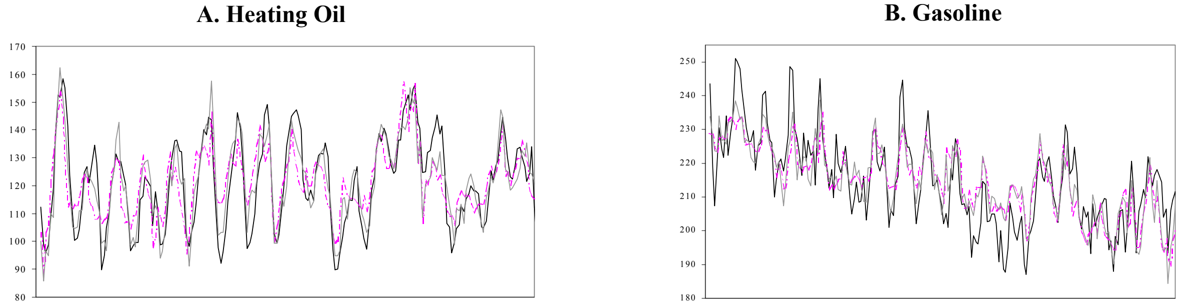
$$p_t > \theta^n E_t(p_{t+n}),\ \ I_t = 0,\ \ p_t = \theta^n E_t(p_{t+n}),\ \ I_t \geq 0. \tag{7}$$

The arguments state that no private inventories will be held when current prices are greater than expected prices reduced by the storage-related costs, and inventories will be raised as long as there are expected profits from doing so ($p_t<\theta^n E_t(p_{t+n})$), until current prices are bid up to the point where marginal profits from holding inventories are zero ($p_t= \theta^n E_t(p_{t+n})$) (see Deaton and Laroque (1992)).

If futures prices provide unbiased estimates of future spot prices, (7) implies that inventories will be smaller when the convenience yield is high (positive), with a regime-switch for inventories at yields equal to zero. However, the prediction in (7) of inventories falling to zero (when the convenience yield is positive) is unlikely to be fulfilled. As can be noted from Figure 2, the private inventories of heating oil and gasoline were always far above stockout over the 1/1986-3/2003 interval; at their lowest levels, the stocks were more than more than 50% of their peak levels. Nonetheless, (7) provides the basis for a formal framework for the empirical testing of the relationship between private inventories and convenience yields.

Figure 2. Monthly private inventories (bold line) and their predicted values from models with the nearby-yield (broken line) and full spectrum of forward yields (solid line)

A. Heating Oil **B. Gasoline**



To test this relationship, we follow the regime switching framework in (7) by estimating the regression

$$I_t = \lambda_0 + \mu T_t + \lambda_1 y_t^{m,m+1} + \lambda_2 y_t^{m,m+1} D_t^{m,m+1} + \lambda_3 D_t^{m,m+1} + u_t \qquad (8)$$

where I_t is the month-ending inventory[23], T_t is the trend, $y_t^{m,m+1}$ is the forward yield, and $D_t^{m,m+1}$ is a dummy variable taking the value of 1 if $y_t^{m,m+1}$ is greater than zero. Equation (8) controls for the known regime-switch as suggested in (7) while allowing for a non-linear relationship between inventories and yields. We expect inventories to decline in the convenience yield. When yields are positive, we expect this negative relationship to be less intense, as various entities consider the future shortages implied in the yield. In summary, we expect λ_1<0, λ_2>0, and λ_3<0.[24]

To investigate the usefulness of forward yields in predicting inventory levels, an extended version of (8) takes the form

$$I_t = \mu_0 + \mu_1 T_t + \sum_i \beta_i y_t^{m,m+1} + \sum_i \omega_i y_t^{m,m+1} D_t^{m,m+1} + \sum_i \delta_i D_t^{m,m+1} + u_t \ , \qquad (9)$$

where forward yields are introduced into the model systematically. An assessment of the adjusted r-square statistic will indicate the extent to which the spectrum of forward yields are redundant *vis a vis* explaining the inventory levels. An alternate specification of (9) employs seasonally filtered yields, provided by the residuals of the regression of forward yields on a constant and eleven monthly dummies

Table 4 reports the results for (8). The t-statistics are computed employing the Newey and West correction for autocorrelated errors. For both commodities, the nearby convenience yield (m=0) explains inventory levels far better than forward yields from farther maturities (m >0). For heating oil, for instance, the adjusted r-square for heating oil is 0.54 for the estimation with m=0, and less than 0.20 for the other estimations. For both commodities, the estimation with the nearby yield produces a λ_1 coefficient that is negative and significant, in line with commodity price theory. Further, the λ_2 coefficient for both commodities is positive (with $\lambda_2 < \lambda_1$), indicating a weaker (negative) relationship between inventories and yields when yields are positive. These results are generally in line with our expectations.

While the relationship between the inventories and yields appear to be strongest for the nearby yield, the results from the estimation of (9) indicate that the forward yields from farther maturities are useful in the prediction. The adjusted r-squared coefficient from this specification r^2*(9a)* is found to increase with the inclusion of forward yields: the coefficient increases from 0.54 (m=0) to 0.77 (m=0,1,..,5) for heating oil, and 0.59 to 0.65 for gasoline. Similar gains in explanatory power are evident from the r-square coefficients, r^2*(9b)*, obtained from seasonally filtered yields. Figure 2 provides further indications of the explanatory contributions in the farther yields. More noticeably for heating oil, the inventory level predicted by the nearby yield employing equation (8) (broken-line) fail to trace the actual inventory level (bold line) with the efficiency of the inventory levels predicted by the cumulative forward yields employing regression (9) (solid line).

Table 4: Private Inventories and Forward Yields

The estimates are from regression model (8):

$$I_t = \lambda_0 + \mu T_t + \lambda_1 y_t^{m,m+1} + \lambda_2 y_t^{m,m+1} D_t^{m,m+1} + \lambda_3 D_t^{m,m+1} + u_t,$$

where I_t is the month ending inventory, T_t is the trend, $y_t^{m,m+1}$ is the forward yield, and $D_t^{m,m+1}$ is a dummy variable taking the value of 1 if the yield is greater than zero. r^2(9a) is the adjusted r-square from the regression model (9). For instance, r^2(9a) for $(m,m+1)$=5,6 is from the model with the entire spectrum of forward yields included in the model. r^2(9b) is from (9) employing deseasonalized yields. Figures in () are t-statistics and employ the Newey and West heteroskedasticity-consistent covariance matrix and autocorrelation-consistent matrix. a and b represent significance levels of 1 and 5 percent respectively.

i,i+1=	0,1	1,2	2,3	3,4	4,5	5,6
Heating Oil						
Trend	0.020	0.043	0.042	0.034	0.029	0.036
	(1.27)	(1.82)	(1.72)	(1.48)	(1.27)	(1.49)
$y_t^{m,n}$	-37.659[a]	-36.896[a]	-25.470	-10.097	-15.618	-27.758
	(-9.21)	(-3.27)	(-1.71)	(-0.49)	(-0.76)	(-1.54)
$y_t^{m,n} D_t^{m.n}$	32.125[a]	34.124[a]	29.301	13.153	15.542	27.892
	(7.24)	(2.65)	(1.78)	(0.60)	(0.70)	(1.40)
$D_t^{m,n}$	0.231	6.062	9.217[b]	13.098[a]	16.799[a]	14.308[a]
	(0.08)	(1.49)	(2.01)	(2.81)	(3.62)	(3.26)
Intercept	113.47[a]	110.83[a]	109.23[a]	109.76[a]	108.59[a]	108.08[a]
	(36.73)	(27.60)	(24.14)	(25.71)	(24.41)	(25.42)
r^2	0.536	0.058	0.059	0.159	0.195	0.108
r^2 (9a)	0.536	0.703	0.716	0.715	0.739	0.770
r^2 (9b)	0.202	0.354	0.369	0.363	0.364	0.401
Gasoline						
Trend	-0.176[a]	-0.134[a]	-0.134[a]	-0.131[a]	-0.134[a]	-0.133[a]
	(-12.46)	(-9.17)	(-8.49)	(-8.43)	(-8.66)	(-8.25)
$y_t^{m,n}$	-8.693[a]	-0.285	-1.685	3.851	3.765[b]	7.239[a]
	(-6.54)	(-0.07)	(-0.45)	(1.94)	(1.99)	(2.98)
$y_t^{m,n} D_t^{m.n}$	5.133[a]	-1.823	0.138	-8.181	-5.411	-3.047
	(2.85)	(-0.34)	(0.02)	(-1.45)	(-0.96)	(-0.49)
$D_t^{m,n}$	-2.070	-6.494[a]	1.057	4.973	5.048	0.247
	(-1.05)	(-2.59)	(0.41)	(1.89)	(1.95)	(0.10)
Intercept	231.99[a]	233.78[a]	228.36[a]	226.72[a]	226.25[a]	228.33[a]
	(113.60)	(86.60)	(86.65)	(105.80)	(107.40)	(132.90)
r^2	0.589	0.417	0.346	0.379	0.385	0.379
r^2 (9a)	0.589	0.606	0.613	0.631	0.632	0.648
r^2 (9b)	0.437	0.469	0.473	0.470	0.477	0.495

Are the systematically improving $r^2(9a)$ and $r^2(9b)$ statistics indicative of an informative term structure of futures prices? To answer this question, it is first worth noting that the relationship between inventories and yields can be couched in the framework of "booking" of profits, rather than on spot price expectations (as in (7)). For instance, when yields (and forward yields) are negative, buying at the spot price (holding stocks) and selling futures contracts will be profitable. When yields (and forward yields) are positive, these profits disappear. Thus, it is possible that the pattern of improving adjusted r-squared statistics, $r^2(9a)$ and $r^2(9b)$, is merely a reflection of traders having varying horizons for unwinding their arbitrage positions. In other words, these results could be considered as necessary but not sufficient conditions for an informative term structure of futures prices. We now turn to tests of the relationship between refining capacity and yields. These results are relatively free of the problem of inextricability of "information effects" from "profit booking effects" alluded to above.

INFORMATION CONTENT OF THE TERM STRUCTURE: REFINING CAPACITY

Following a similar approach to that in the preceding section, we assess the relationship between the information in forward yields with decisions on US refining capacity. Refining capacity, measured by the daily processing capacity of crude distillation units, has well known seasonal patterns. For many refineries, the number of refining runs tends to mirror the overall demand for gasoline, by far the dominant product recovered from distillation.[25] As refiners move out of the 'gasoline season' (the warmer months), they routinely perform maintenance, with the depth and length of these cutbacks affected by the obvious fundamental factors: the state of current and expected net-demand. For instance, when inventory levels are high, and current and anticipated demand are low, the maintenance season is likely to be deeper. These well known variations in capacity provide an opportunity to examine the degree to which the term structure represents these collective fundamentals.

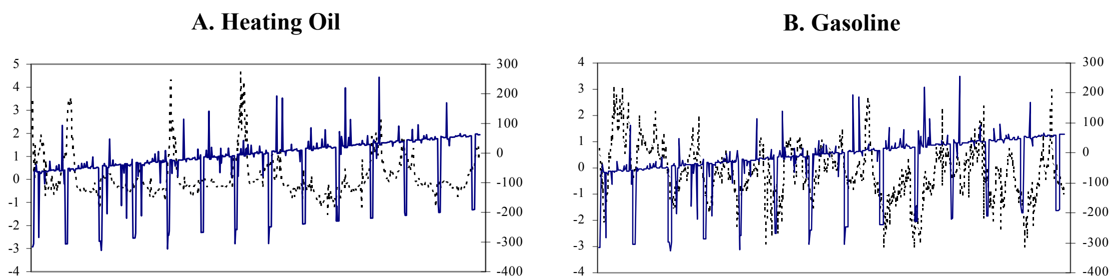
Since one can expect routine seasonal variations in refining capacity, our investigation employs the deseasonalized and detrended changes in the variable. In Figure 3 we plot the detrended/deseasonalized changes in capacity along with the nearby convenience yields for the two products. It is notable that most of the cuts in capacity fall around the. period when the gasoline yields are relatively low. Similarly, graphs of the far-horizon yields (not shown for brevity) suggest a fairly close correspondence between the forward yields and large positive changes to refining capacity.

These relationships are formulated in the regression model:

$$C_t^* = \alpha_1 U_t + \omega_1 {}_{(HO)} y_{t-1}^{0,1} + .. + \omega_6 {}_{(HO)} y_{t-1}^{5,6} + \lambda_1 {}_{(G)} y_{t-1}^{0,1} + .. + \lambda_6 {}_{(G)} y_{t-1}^{5,6} + e_t, \tag{10}$$

where C_t^* denotes demeaned/detrended/deseasonalized changes in refining capacity, U_t is the capacity utilization level, and *HO* and *G* denote heating oil and gasoline, respectively. In alternate versions of (10), the utilization variable is allowed to mix with the other right-hand-side variables, and utilization is treated as endogenous to the model.[26]

Figure 3. Capacity Changes (solid line) and the nearby convenience yield



The results are reported in Table 5. The utilization coefficient is positive, consistent with the intuition that capacity cutbacks (improvements) are more likely when capacity utilization is low (high). The yield coefficients generally indicate that the far-horizon yields are positively related to changes in capacity. A cursory examination of the adjusted r^2 statistics indicates that, similar to the results in the preceding section, the yields provide a superior explanation of the changes in capacity on a collective basis. Specifically, the changes in capacity are better explained by the spectrum of yields than by the short yield alone. In fact, it is apparent from comparing the r^2 values from columns (1) and (2) that the nearby convenience yield offers no improvements (over utilization) in explaining the variation in capacity changes. This is not surprising, since capacity changes are obviously not intended to overcome immediate shortfalls. On the other hand, r^2 rises fairly systematically with the addition of mid- and far-horizon forward yields. These patterns are generally consistent with the notion that the forward yields reflect future commodity fundamentals.

EVIDENCE FROM GARCH SPECIFICATIONS

The ARCH model of Engle (1982), the GARCH model of Bollerslev (1986), and their numerous extensions, often provide good descriptions of second-order dynamics for many assets, including commodities (for instance, see Baillie and Myers (1991)). It is widely believed that the ARCH effects present in returns data are a manifestation of information clustering, i.e., large quantities of information reaching the market in clusters. For instance, Lin, Engle, and Ito (1994) show that information (information spillover) is the source of volatility clustering (volatility spillover) across international stock exchanges.

Table 5: Regressions of Refining Capacity on forward yields

The results are from

$$C_t^* = \alpha_1 U_t + \omega_1 (HO) y_{t-1}^{0,1} + .. + \omega_6 (HO) y_{t-1}^{5,6} + \lambda_1 (G) y_{t-1}^{0,1} + .. + \lambda_6 (G) y_{t-1}^{5,6} + e_t ,$$

where C^* is the demeaned, detrended and deseasonalized change in weekly refining capacity weekly changes in refining capacity, U is the capacity utilization level, and $y^{m,n}$ are the forward yields for heating oil (HO) and gasoline (G). The sample interval is January 1990 through February 2003. r^2 is the adjusted r-squared coefficient. r^2 (mix) is from the model that allows utilization to mix with the yield terms. Figures in () are t-statistics and are estimated employing the Newey and West (1987) variance estimator for autocorrelated disturbances. a and b represent significance levels of 1 percent and 5 percent, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
U	662.71^{a}	639.38^{a}	548.41^{a}	550.42^{a}	538.80^{a}	559.44^{a}	589.77^{a}
	(6.69)	(6.15)	(5.40)	(5.60)	(5.40)	(5.42)	(5.79)
$y^{0,1}$ (HO)	-3.401	-7.318	7.848	7.490	8.471	8.127	
	(-0.69)	(-1.44)	(1.14)	(1.06)	(1.22)	(1.12)	
$y^{1,2}$ (HO)	-3.867	-88.790^{b}	-64.615	-76.249	-66.956		
	(-0.27)	(-2.16)	(-1.31)	(-1.59)	(-1.43)		
$y^{2,3}$ (HO)	82.117^{a}	29.850	44.905	19.161			
	(3.06)	(0.52)	(0.71)	(0.31)			
$y^{3,4}$ (HO)	36.017	-31.564	-31.720				
	(1.32)	(-0.56)	(-0.49)				
$y^{4,5}$ (HO)	80.529^{a}	65.613					
	(2.78)	(1.16)					
$y^{5,6}$ (HO)	45.131^{b}						
	(1.97)						
$y^{0,1}$ (G)	2.663	-4.560	-10.808^{a}	-11.594^{a}	-14.758^{a}	-14.195^{a}	
	(0.75)	(-1.20)	(-3.03)	(-3.26)	(-4.07)	(-4.03)	
$y^{1,2}$ (G)	41.931^{a}	50.221^{a}	47.886^{a}	41.566^{a}	33.315^{a}		
	(4.30)	(4.30)	(4.07)	(3.63)	(2.74)		
$y^{2,3}$ (G)	-13.262	-12.507	-19.353^{b}	-23.104^{b}			
	(-1.55)	(-1.53)	(-2.25)	(-2.42)			
$y^{3,4}$ (G)	0.228	-2.416	-5.527				
	(0.23)	(-0.27)	(-0.64)				
$y^{4,5}$ (G)	33.792^{a}	35.633^{a}					
	(3.39)	(3.58)					
$y^{5,6}$ (G)	27.149^{a}						
	(2.61)						
r^2	0.103	0.102	0.159	0.182	0.185	0.205	0.211
r^2	(mix)	0.110	0.178	0.194	0.199	0.242	0.265

We find significant ARCH effects in the spot and futures returns for both heating oil and gasoline. For instance, the Engle (1982) Lagrange multiplier test statistic for ARCH(6) errors (χ^2, 6 degrees of freedom) is a highly significant 153.9 for heating oil and 206.3 for gasoline. Moreover, as we shall demonstrate, the relatively parsimonious univariate GARCH(1,1) model is found to explain the large linear and non-linear dependencies in the returns.[27] Subsequently, we estimate simple extensions of this model to test the information-content of forward yields.
The model is:

$$r_t = b_0 + b_1 r_{t-1} + \varepsilon_t,$$

$$\varepsilon_t \mid \Psi_t \sim N(0, h_t),$$

$$h_t = a_0 + a_1 \varepsilon_{t-1}^2 + a_2 h_{t-1} + \sum_{m=0}^{5} c_m \Delta y_{t-1}^{m,m+1} + \sum_{m=0}^{5} g_m (\Delta y_{t-1}^{m,m+1})^2 + \nu_t, \tag{11}$$

where r_t is the natural log of relative daily closing spot prices (scaled by 100). The $\{\Delta y^{m,m+1}, (\Delta y^{m,m+1})^2\}$ terms are introduced in (11) by contract maturity so as to systematically gauge the marginal contribution of the forward yields in explaining conditional variance. Marginal contributions are evaluated by using likelihood ratio tests. This approach to evaluating the explanatory power of the term structure allows us to test directly the implication of constant risk premia, that the term structure would not be informative over and above the near-horizon yield.

In Table 6 we report results from maximum likelihood estimation of (11).[28] The t-statistics employ robust standard errors, so that conditional normality of the errors is not assumed. The results in the first column are for the model without yields in the conditional variance equation. The return equation shows some persistence, with the b_1 coefficients significant for both commodities. The sum of the a_1 and a_2 coefficients is close to one for both commodities, indicating the presence of an integrated GARCH effect (Engle and Bollerslev (1986)), a phenomenon that is widely documented for financial assets. The model appears to perform reasonably well in capturing the large linear and nonlinear dependencies in return errors. The Lung-Box Q-statistics for autocorrelation in the standard residuals (Q_1) and squared standard residuals (Q_2) are not statistically significant. Moreover, the small sign-bias test statistic (Engle and Ng (1993)) suggests an absence of asymmetry in the relationship between return shocks and variance.

Columns (2) through (7) are from the specification with the lagged values of $\{\Delta y^{m,m+1}, (\Delta y^{m,m+1})^2\}$ in the conditional variance equation. For comparative purposes, these terms are standardized by their means. As can be seen from column (2) for either commodity, the addition of the dynamics of the lagged nearby yield produces large likelihood ratio statistics (47.2 and 51.1), and highly significant c_0 and g_0 coefficients. For heating oil, further marginal improvements are obtained by including the dynamics of $y^{1,2}$, $y^{2,3}$, and $y^{5,6}$ gauging from the significance of the likelihood ratio test statistics in column (3), (4) and (7). This would indicate that these forward yields have some power in explaining the conditional variance over and above what can be explained by the nearby convenience yield ($y^{0,1}$) alone. On the other hand, the likelihood ratio tests in columns (5) and (6) are not significant, suggesting that the corresponding "mid-horizon" yields do not represent additional information *vis-a-vis* future variance.

Table 6: Spot ReturnVariance and Forward Yields: GARCH(1,1) Results

$$r_t = b_0 + b_1 r_{t-1} + \varepsilon_t,$$

$$h_t = a_0 + a_1 \varepsilon_{t-1}^2 + a_2 h_{t-1} + \sum_{m=0}^{5} c_m \Delta y_{t-1}^{m,m+1} + \sum_{m=0}^{5} g_m (\Delta y_{t-1}^{m,m+1})^2 + \nu_t.$$

The estimates are from end of day data. Figures in () are t-statistics. Robust standard errors are obtained from method prescribed in White (1982) and Bollerslev (1986). $s\text{-}b \sim F(3, 4311)$ is the joint sign-bias test (see Engle et al. 1993). Q_1 and Q_2 are Ljung-Box statistics of order 24 for the standard residual and the square of the standard residual respectively. L is the log-likelihood function. $LR \sim c^2(2)$, is the likelihood ratio test for the null hypothesis that the specification provides an improvement over the preceding specification. *a* and *b* represent significance at the 1 and 5 percent level, respectively.

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Heating Oil							
mean equation							
b_0	0.016 (0.57)	0.044 (1.54)	0.042 (1.44)	0.039 (1.35)	0.037 (1.29)	0.036 (1.23)	0.033 (1.12)
b_1	0.036^b(2.17)	0.041^b (2.45)	0.040^b (2.38)	0.041^b (2.44)	0.041^b (2.42)	0.042^b (2.44)	0.041^b (2.42)
variance equation							
a_0	0.103^a (7.08)	0.128^a (7.42)	0.127^a (7.37)	0.130^a (6.99)	0.124^a (6.80)	0.119^a (6.64)	0.111^a (6.53)
a_1	0.107^a (19.72)	0.095^a (17.9)	0.090^a (15.5)	0.090^a (15.7)	0.089^a (15.6)	0.088^a (15.6)	0.085^a (15.2)
a_2	0.881^a (135.8)	0.872^a (109.1)	0.872^a (106.2)	0.870^a (100.7)	0.867^a (101.3)	0.872^a (102.7)	0.876^a (108.5)
$c_0\{y^{0,1}\}$	.	2.378^a (6.07)	2.499^a (5.90)	2.497^a (5.50)	2.451^a (5.34)	2.367^a (5.13)	2.411^a (5.22)
$c_1\{y^{1,2}\}$	.	.	-1.833(-1.88)	-0.272(-0.20)	-0.065(-0.04)	-0.257 (-0.18)	-0.658 (-0.45)
$c_2\{y^{2,3}\}$	.	.	.	-3.055^b (-2.22)	-3.563(-1.77)	-3.563 (-1.71)	-3.244 (-1.62)
$c_3\{y^{3,4}\}$	.	.	.	.	0.231 (0.15)	0.792 (0.37)	0.139 (0.06)
$c_4\{y^{4,5}\}$	.	.	.	.	.	-1.519 (-0.99)	0.625 (0.33)
$c_5\{y^{5,6}\}$	.	.	.	.	.	.	-3.343^b (-2.10)
$g_0\{(y^{0,1})^2\}$	.	0.108^a (5.23)	0.099^a (4.87)	0.098^a (4.74)	0.096^a (4.61)	0.101^a (4.75)	0.100^a (4.84)
$g_1\{(y^{1,2})^2\}$	.	.	0.030^a (2.83)	0.018 (1.76)	0.013 (1.22)	0.007 (0.65)	0.006 (0.52)
$g_2\{(y^{2,3})^2\}$	.	.	.	0.028^a (3.06)	0.023^b (2.26)	0.024^b (2.28)	0.020^b (2.13)
$g_3\{(y^{3,4})^2\}$	.	.	.	.	0.010 (1.31)	0.002 (0.28)	0.001 (0.16)
$g_4\{(y^{4,5})^2\}$	.	.	.	.	.	0.016^b (2.01)	0.006 (0.90)
$g_5\{(y^{5,6})^2\}$	.	.	.	.	.	.	0.020^a (2.93)
L	-5495.9	-5472.3	-5467.1	-5463.2	-5462.6	-5460.3	-5455.5
$LR(c^2(2))$	-	47.21^a	10.44^a	7.80^b	1.23	4.59	9.58^a
Std-error Diagnostics							
S-B(F)	1.05	0.72	0.70	0.68	0.67	0.70	0.68
$Q_1(24)$	22.4	22.3	22.7	23.0	23.1	23.6	22.7
$Q_2(24)$	22.9	30.6	28.7	31.7	30.8	31.0	31.8
Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
B. Gasoline							
mean equation							
b_0	-0.004 (-0.12)	-0.003 (-0.09)	-0.002 (-0.07)	-0.001 (-0.01)	-0.002 -0.06)	0.001 (0.01)	-0.003 (-0.09)
b_1	0.068^a (4.22)	0.070^a (4.27)	0.068^a (4.17)	0.069^a (4.19)	0.067^a (4.15)	0.068^a (4.18)	0.067^a (4.12)

Table 6: Spot ReturnVariance and Forward Yields: GARCH(1,1) Results							
variance equation							
a_0	0.243^a (21.6)	0.166^a (8.05)	0.154^a (7.47)	0.154^a (7.26)	0.157^a (7.97)	0.157^a (7.80)	0.163 (8.10)
a_1	0.099^a (15.0)	0.080^a (14.7)	0.077^a (13.6)	0.078^a (13.1)	0.072^a (12.0)	0.072^a (12.0)	0.073 (12.0)
a_2	0.865^a (116.2)	0.876^a (112.2)	0.879^a (112.7)	0.879^a (109.2)	0.884^a (113.4)	0.885^a (113.4)	0.883 (112.5)
$c_0\{y^{0,1}\}$	.	0.760^a (2.74)	0.859^a (3.10)	0.959^a (3.48)	1.114^a (3.92)	1.118^a (3.86)	1.099 (3.79)
$c_1\{y^{1,2}\}$	.	.	-0.991 (-1.74)	-1.330 (-1.93)	-3.851^a (-5.33)	-3.774^a (-5.24)	-4.043 (-5.43)
$c_2\{y^{2,3}\}$	.	.	.	-1.202 (-1.55)	- 1.243 (-1.33)	1.664 (1.53)	2.051 (1.89)
$c_3\{y^{3,4}\}$	.	.	.	.	-0.006 (-0.04)	4.766^a (4.85)	5.341 (5.57)
$c_4\{y^{4,5}\}$	.	.	.	.	.	5.304^a (6.24)	2.391^b (1.99)
$c_5\{y^{5,6}\}$	.	.	.	.	.	.	0.401 (1.70)
$g_0\{(y^{0,1})^2\}$	.	0.143^a (7.11)	0.134^a (6.46)	0.133^a (6.44)	0.124^a (6.29)	0.121^a (6.07)	0.122^a (5.99)
$g_1\{(y^{1,2})^2\}$	.	.	0.025^a (2.65)	0.028^a (3.04)	0.046^a (4.89)	0.044^a (4.81)	0.044^a (4.72)
$g_2\{(y^{2,3})^2\}$	.	.	.	-0.013^b (-2.26)	-0.056^a (-2.97)	-0.056^a (-6.45)	-0.059^a (-6.64)
$g_3\{(y^{3,4})^2\}$	.	.	.	.	0.033 (1.57)	0.036^b (2.00)	0.039^a (3.73)
$g_4\{(y^{4,5})^2\}$	.	.	.	.	.	0.033^a (4.50)	0.011^b (2.18)
$g_5\{(y^{5,6})^2\}$	.	.	.	.	.	.	0.008^b (1.99)
L	-5896.4	-5870.9	-5867.3	-5864.7	-5863.2	-5850.2	-5847.6
$LR(c^2(2))$	-	51.10^a	7.20^a	2.60	3.00	26.10^a	5.2^b
Std-error Diagnostics							
$S\text{-}B(F)$	1.62	1.63	1.60	1.57	1.61	1.63	1.61
Q_1	19.5	19.9	19.5	19.4	18.8	18.9	18.9
Q_2	10.1	12.6	12.2	11.8	13.0	13.2	12.9

A similar pattern emerges for gasoline. There is a large improvement in specification when $y^{0,1}$ is introduced in the conditional variance equation (likelihood ratio statistic of 51.10). Marginal improvements are noted for $y^{1,2}$ and $y^{4,5}$, but not as much for the others. The results in Table 6 suggest that the forward yields from the term structure are not equally informative. The dynamics of the forward yields corresponding to near-horizon and far-horizon maturities augment information in the near-horizon convenience yield more than the yields from the mid-horizon maturities.

Given our earlier results on the prominent seasonal variation in the yields, we also estimate the GARCH model with controls for seasonality in the variance and in the relationship between the variance and yields. Here, quarterly seasonal dummies are included in the variance equation and allowed to interact with the yield terms in (11). The results, not reported in the interest of brevity, remain materially unchanged from those in Table 6. To summarize, the GARCH results suggest that the term-structure of prices is informative, and reflects more than just the seasonal tendencies in information clustering. Moreover, there are indications that the near-horizon and far-horizon yields are more informative (at the margin) than the mid-horizon yields for high frequency data.

TRADITIONAL TERM-STRUCTURE MODELS AND PETROLEUM YIELDS

De Roon, Nijman, and Veld (1998) find evidence that supports the absence of time-varying risk premium in heating oil futures prices. Following the traditional approach to gauging risk premium in forward price spreads (see Fama (1984a, 1984b, 1986) and Fama and French (1987)), De Roon, et al. (1998) estimate the pair of "premium" regressions:

$$f_{t+1}^{n-1} - p_{t+1} = \alpha_1 + \beta_1 (f_t^n - f_t^1) + \eta_{1,t+1}, \text{ and} \tag{12a}$$

$$(p_{t+1} - f_t^1) - (f_{t+1}^{n-1} - f_t^n) = \alpha_2 + \beta_2 (f_t^n - f_t^1) + \eta_{2,t+1}, \tag{12b}$$

employing both, monthly and daily data. They employ the nearby futures contract as a proxy for the spot price. The complimentary regressions are employed to study the extent to which variation in the risk premium is reflected in forward price spreads. Time variation in the risk premia will be indicated if the β_2 coefficient is 0, or equivalently, β_1=1. Moreover, only if β_2=0 (β_1=1), will α_2 (-α_1) provide a direct estimate of the risk premia.[29]

The regression approach in (12) has a well known problem of overlapping errors (for instance, see Campbell and Shiller (1991)). Here, we demonstrate another issue of concern – seasonal variations in the spot-futures and futures-futures spreads. While, there are econometric methods to overcome the overlap in standard errors, the problem of seasonal tendencies is likely to require more specialized attention.

Following our findings on seasonality in yields, and especially those on the differences in seasonal tendencies across maturities, we estimate the following extended version of (12):

$$f_{t+1}^{n-1} - p_{t+1} = \alpha_1^{/} + \beta_1^{/} (f_t^n - f_t^1) + \sum_{s=1}^{11} \gamma_s (f_t^n - f_f^1) D_{s,t} + \sum_{s=1}^{11} \delta_s D_{s,t} + \eta_{1,t+1}^{/}, \tag{13a}$$

$$(p_{t+1} - f_t^1) - (f_{t+1}^{n-1} - f_t^n) = \alpha_2^{/} + \beta_2^{/} (f_t^n - f_t^1) + \sum_{s=1}^{11} \mu_s (f_t^n - f_f^1) D_{s,t} + \sum_{s=1}^{11} \kappa_s D_{s,t} + \eta_{2,t+1}^{/}, \tag{13b}$$

where D_s represents monthly dummy variables. Here the coefficients γ_s and μ_s indicate whether the predictive power of the forward spread is dependent on the season, and thus whether there is seasonal variation in the risk premium in the futures term structure. For instance, the rejection of the hypothesis that all μ_s are zero would indicate monthly variation in the risk premium.

We estimate (12) and (13) alternately employing monthly and daily data, and (as in De Roon, Nijman, and Veld (1998)) employing the nearby price as a proxy for the spot price. As the results for the monthly and daily samples are fairly similar, we report only the results for the latter in Table 7. For heating oil, the hypothesis β_1=1 is rejected for maturities 2 and 3, but not 4 and 5. For gasoline, the hypothesis is rejected for all maturities.

Seasonal variations in the predictive power of the forward spread is noted for both commodities. The test statistic in the final column is highly significant for all maturities. Thus, the absence of seasonal variation in the risk premium is rejected even where the standard premium regressions (namely, equation (12)) fail to do so. The results from monthly data (omitted for the sake of brevity) also demonstrate this inconsistency. For that sample, the standard regressions fail to reject the absence of a time-varying premium for three of four maturities for heating oil, and two of four maturities for gasoline. On the other hand, as with daily data, we find significant seasonal variation for all maturities employing monthly data. In summary, the traditional tests for risk premia in commodity prices fail to capture the strong seasonal variations that are apparent when we extend these tests. At the very least, this result indicates problems with the regression approach in assessing the risk premium in the futures term structure for commodities with large seasonals.

Table 7: Premium Regressions: Daily Data

$$f_{t+1}^{n-1} - p_{t+1} = \alpha_1 + \beta_1(f_t^n - f_t^1) + \eta_{1,t+1},$$

$$(p_{t+1} - f_t^1) - (f_{t+1}^{n-1} - f_t^n) = \alpha_2 + \beta_2(f_t^n - f_t^1) + \eta_{2,t+1},$$

k is fixed at one month. The spot price p_t is proxied by the nearby futures price. $r^2 1$ and $r^2 2$ are the adjusted r-square coefficients from the two estimations. The $c^2 1$ statistic (1 d.f.) tests b_1=1 (or equivalently, b_2=0). The $c^2 2$ statistic (11 d.f.) is from the seasonal-control model (Equation 13) and tests for all $D_{i,t} b_1$= 0, where $D_{i,t}$ represents the dummy variable for month i. t-statistics, in (), employ the Newey and West (1987) variance estimator with autocorrelated disturbances. a and b represent significance levels of 1 and 5%, respectively

Contract	a_1, $(-a_2)$	b_1, $(1-b_2)$	$r^2 1$	$r^2 2$	$\chi^2 1(b_1=1)$ $\chi^2 1(b_2=0)$	$\chi^2 2(D_{i,t}\, b_1=0)$ $\chi^2 2(D_{i,t}\, b_2=0)$
~~Heating Oil~~						
n = 2	0.0004[b]	0.943[a]	0.83	0.02	21.36[a]	186.75[a]
	(2.30)	(76.09)				
n = 3	0.0007[b]	0.972[a]	0.86	0.01	7.04[a]	221.10[a]
	(2.35)	(93.72)				
n = 4	0.0007	0.978[a]	0.88	0.00	4.61	222.03[a]
	(1.58)	(107.0)				
N = 5	0.0006	0.991[a]	0.89	0.00	1.11	187.45[a]
	(1.22)	(113.8)				
Gasoline						
n = 2	-0.0004	0.916[a]	0.76	0.03	25.49[a]	182.17[a]
	(-1.20)	(55.07)				
n = 3	-0.0014[a]	0.936[a]	0.81	0.02	34.18[a]	118.28[a]
	(-3.23)	(84.82)				
n = 4	-0.0020[a]	0.954[a]	0.83	0.01	21.20[a]	117.78[a]
	(-3.06)	(95.15)				
n = 5	-0.0032[a]	0.955[a]	0.83	0.01	20.43[a]	112.07[a]
	(-4.67)	(93.95)				

CONCLUSION

To determine what puts the convenience in convenience yields, we fit a partial equilibrium model for forward yields, with control variables that include macroeconomic indicators and variables that reflect OPEC decisions on crude production, and political unrest. The model explains the majority of the variation in the forward yields for heating oil and for gasoline. Forward yields for the near- and the far-away maturities are better explained than those for the mid-maturities.

We take a multi-pronged approach in examining the information content of the term-structure. First, we turn to the theory of commodity prices that relates relative commodity price levels to private inventories. We find that a decomposed term structure of forward yields explains the future inventories substantially better than the near-horizon convenience yield alone. Similar results are obtained when examining the changes in refining capacity. Second, we adopt the common notion that the return variance is a proxy for information arrival. Results from GARCH estimation indicate that forward yields of multiple horizons explain conditional variance better than the convenience yields implied by the short horizon contract alone. The evidence of an informative futures term-structure is generally consistent with the time-variation in risk-premium in futures prices. Additional testing shows that the traditional term-structure models may be unsuited for commodity markets, where unsynchronized seasonal variations in spot-futures and futures-futures spreads tend to be severe.

ENDNOTES

1 Henceforth, the terms – convenience yields, yields, and the deviations from the cost-of-carry model - are employed interchangeably.

2 For instance, Gibson and Schwartz (1990), Culp and Miller (1995), and Litzenberger and Rabinowitz (1995) find significant inversion or backwardation in the futures prices for crude oil and its derivatives.

3 In fact, it is now standard to write the cost of carry model with allowances for convenience yields (for instance, see Hull (2003)).

4 An alternate explanation for the deviation from the cost-of-carry model is that speculators expect to earn risk premia for holding futures positions, which may be manifested in futures prices that are lower than the interest and warehousing- adjusted spot prices (for instance, see Keynes (1930), Dusak (1973), Chang (1985), and Bessembinder (1992)).

5 Gibson and Schwartz (1990a) indicate that a constant convenience yield is an inappropriate assumption when pricing oil indexed bonds, and Gibson and Schwartz (1990b) use a mean-reverting stochastic convenience yield to price oil futures contracts. Amin, Ng, and Pirrong (1995) and Carr and Jarrow (!995) employ the term structure of commodity prices to develop their stochastic processes that are consistent with no-arbitrage. Schwartz (1997), Miltersen and Schwartz (1998), and Hilliard and Reis (1998) deploy stochastic convenience yields and interest rates to model commodity futures, forwards, and options.

6 Most studies on the subject of yields presume that convenience yields will be high when inventories are low. For instance, Fama and French (1988) employ the convenience yield as an inverse proxy of inventories. They demonstrate that, when convenience yields are high, the interest-adjusted spread of futures and spot prices is more variable, and the relative volatility of the spot prices is high.

7 The forward convenience yield can be thought of the expected benefits of holding the commodity at *m*, rather than the *n*-maturity futures contract. Evaluating the term structure of forward yield, rather than that of standard convenience yields, could hold an important advantage. Samuelson (1965) shows that if spot prices are a mean reverting process, then spot prices are more variable than futures prices, and futures price variability will be a decreasing function of maturity. The relatively high spot-price variability may overwhelm the price behavior of long maturity futures contracts, so that differences in the behavior of futures prices across the maturity spectrum may be better picked up by forward yields.

8 McKinnon (1967) takes the view that "the distant futures market would yield useful information (not otherwise available) for determining what the long-run equilibrium price actually is. This would provide important "external" benefits to producers in general, whether or not they actually use the market for hedging" (pp. 859). Black (1976) suggests that commodity futures "…provide a wealth of valuable information for those who produce, store, and use commodities. Looking at futures prices…., participants in the market can decide on the best time to plant, harvest, buy for storage, sell from storage, or process the commodity" (pp. 174).

9 Gasoline is the largest refined product sold in the US, accounting for about half of the nations oil consumption. After gasoline, heating oil accounts for the second largest cut of a barrel of crude.

10 While NYMEX imposes a price fluctuation limit of $0.25 for both commodities, the trading is halted for five minutes only. When trading resumes, the limit is expanded so that settlement prices reflect that of the standard trading session, which guarantees synchronous daily pricing throughout the term structure.

11 For pricing purposes, the NYMEX contract for "light, sweet crude" is based on a blend (or index) of oils classified by sulphur content and density. It becomes difficult, therefore, to point to a particular spot price underlying the crude contract.

12 Selecting geo-political events that may affect the supply of crude entails a degree of arbitrariness. Some events are more obvious than others. We control for the several events such as the major offensives in the Iran-Iraq war in 2/1986 and 5/1986, the Exxon Valdez spill in 3/1989, Iraq's invasion of Kuwait in 8/1990, the run into the first Gulf war between 12/1990 and 2/1991, the coup attempt against Gorbachev in 8/1991, the collapse of the Soviet Union in 12/1991, US strikes on Iraq in 9/1996, Iraq's actions to deny access to UN arms-inspectors in 2/2002, and the Venezuelan strike in the state oil company in 4/2002.

13 Weak backwardation is said to occur when spot prices are above the cost-of-carry adjusted (discounted) futures prices, and strong backwardation implies that spot price is above the (unadjusted) futures price.

14 Since we can expect convenience yields to be at high levels when spot prices are at high levels, and vice versa, positively skewed spot prices can be expected to be accompanied by positively skewed yields

15 To gauge the mean reverting tendencies of the underlying heating oil and gasoline markets, we follow Bessembinder, Coughenour, Seguin, and Smoller (1995) in regressing futures returns of varying maturities on spot returns. The estimates are less than unity suggesting mean reversion. The elasticity estimates suggest that about 50% (58%) of the shock in heating oil (gasoline) is reversed in six months. These results are available from the authors.

16 As shown in Morrison (1967), the significance of correlation coefficients is based on the likelihood ratio test $-2*\log(\lambda)$,where $\lambda = |R|^{0.5*N}$, where $|R|$ is the determinant of the correlation matrix and N is the sample size. The test statistic is distributed as χ^2 with 1 degree of freedom.

17 These results are available upon request.

18 Henceforth, detrended and deseasonalized data refer to the residual from the OLS regression of the variable on a trend term and a set of eleven monthly dummies.

19 Not surprisingly, similar results are obtained for the correlations between the forward yields of either commodity and the inventories, supply, and disposition of crude oil. These results are available from the authors.

20 In commodity price theory, expected prices are themselves a function of storage, since the amount stored influences the amount produced in the future. Given the recursiveness of the problem, optimal storage is often thought of as a dynamic programming problem (for instance, see and Deaton and Laroque (1992)).

21 For brevity, and since the models are equally applicable to either commodity, we drop the subscript *I*.

22 The polynomial specification is

$$y_t^{n,m} = a_0 + \sum_j^2 \sum_k^2 a_{j,k} \hat{z}_{j,t}^k + \sum_j^2 \sum_k^2 \alpha_{j,k} \hat{z}_{j,t}^k X_t + \kappa_i X_t + u_t,$$

with 1, s_t, s_t^2, $s_t X_t$, and $s_t^2 X_t$ as instruments. Higher order polynomials provided negligible improvements.

23 Employing end-of-month (rather than monthly average) inventory levels is expected to alleviate the potential of the problem of simultaneity between yields and inventories.

24 The argument becomes more complex when we consider the relationship between inventories and the forward yield, $y^{i,i+1}$, I>0 For instance, it is plausible that when the convenience yield implied by the short maturity contracts is high, the commodity will be in short supply. On the other hand, the impact on speculative inventories of marginal convenience yields implied in distant futures contracts is less certain. High marginal convenience yields in distant contracts could be interpreted as expected future shortages, which may provide the incentive for speculators to raise inventories for future sale. In other words, maturity may play an important role in the relationship between inventories and forward yields.

25 Less dense crude oils (like Arab light) result in the recovery of a higher share of light hydrocarbons like gasoline. Heavier crudes produce a greater share of lower valued products, like heating oil. However, after all processing, the finished product, even for heavy crudes, is likely to have a mix of at least 50 percent gasoline.

26 We find that treating the utilization variable as endogenous does not materially change the results. These 2SLS estimation results are available from the authors.

27 The extensions to the GARCH(1,1) model were found to have excellent convergence properties for both commodities, despite the large number of variables introduced in the conditional variance equation. We also estimated variations of the ARCH-in-mean models of Engle, Lilien, and Robins (1987), but find no improvements from that specification.

28 The iterative estimation procedure uses the Berndt, Hall, Hall, and Hausman (1974) algorithm.

29 The premise is that the presence of time-variation in any risk-premium will diminish the power of the forward yield in predicting the future spread, resulting in a β_1 coefficient not being equal to 1. See De Roon, Nijman, and Veld for a more complete description of the tests.

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THE IMPACT OF CURRENT TAX POLICY ON CEO STOCK OPTION COMPENSATION: A QUANTILE ANALYSIS

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ABSTRACT

The increase in stock option compensation has become controversial as disclosures emerge that executives have abused stock option compensation. The Omnibus Budget Reconciliation Act of 1993 gives stock options preferential tax treatment, allowing options to not be subject to the cap on corporate tax deductions for salaries exceeding $1 million. To examine whether this increases CEO stock option compensation, we use S&P's ExecuComp data from 1992-2000. We use quantile regressions to examine whether the position in the distribution affects behavior. Findings show that the salary cap has increased stock option compensation; strongest effects are at the bottom of the distribution.

INTRODUCTION

The increase in stock option grants during the 1990s is becoming increasingly controversial as disclosures emerge that senior executives of companies such as Enron Corp. and Global Crossing reaped millions of dollars in profit by exercising their stock options as the public held onto stock that became worthless. For example, Global Crossing reported a negative net income of $10,500,000, while they still issued the CEO, Mr. Annunziata, $182,000,000 worth of stock options. In addressing the corporate scandals, Senator Carl Levin recently suggested that stock option pay encourages firms and executives to push tax law to the limit.

Our current tax code gives stock options preferential tax treatment. The Omnibus Budget Reconciliation Act of 1993, Section 162(m) of the Internal Revenue Code (IRS par. 9001B, sec. 1.162) increases the incentive of firms to pay executives in the form of stock options. Specifically, Section 162(m) allows "performance-based pay," such as stock options, to not be subject to the limits or the cap on corporate income tax deductions for salaries exceeding $1 million. To ensure the full tax deductibility of top executives' pay, companies may shift any amount in excess of $1 million to "performance based pay," such as stock options.

In this paper, we use annual data from Standard & Poor's ExecuComp on the CEO of 2,412 firms from 1992 to 2000 to examine if the 1993 SEC Section 162(m) cap on salary compensation reform has altered the mix of compensation that firms pay executives. In our analysis, we control for the changes in the stock market, firm size, firm performance and financial structure. Results will help determine to what extent the 1993 salary cap encourages firms to pay executives in stock options to obtain a tax advantage. Since companies may behave differently dependent on their position in the distribution, we then use a quantile regression technique.

STOCK OPTIONS TAX TREATMENT

Currently, a nonqualified stock option is taxed under Code Section 83, stating that an employer is allowed to deduct the full value of the employee's income from the exercise and sale of stock options. While companies can deduct stock options from their corporate taxes, salary is limited on the amount that it can be deducted from taxes. The Omnibus Budget Reconciliation Act of 1993 (OBRA 1993), Section 162(m) of the Internal Revenue Code (IRS par. 9001B, sec. 1.162), eliminated the deductibility of executive salary compensation in excess of $1 million. This regulation limits the corporate tax deduction for compensation paid to the top five highest-paid executive officers to a 1$ million cap each. However, "qualified performance based pay" was exempt by (IRS par. 9001B, sec. 1.162-7[e][1]).[1]

While this supposedly constrains executive compensation, it may have just altered the mix of compensation towards "performance based pay." For stock options to qualify for an exemption from this limit, the total number of options and the limit of their reward must be approved by the outside directors. The exemption requirements are much stricter for bonus and long-term incentive plans. As opposed to salary and bonuses, stock options are generally not subject to the limits of Section 162(m). To ensure the full tax deductibility of top executives pay, companies may shift any amounts in excess of $1 million to incentive based forms of compensation, such as stock options.

LITERATURE REVIEW

There have been few studies examining if the recent salary cap imposed by Section 162(m) has altered the mix of CEO compensation and the tax effects of stock option compensation.[2] Among those studies, Rose and Wolfram (2002) and Hall and Liebman (2000) examine if the million dollar cap has decreased the use of salary compensation by affected firms and increased their use of stock options compensation. Both studies find evidence that the salary cap has lowered the potential growth of CEO salaries, however they find differing results regarding if this cap has increased the use of stock options. While Rose and Wolfram find little support for an increase in performance based pay, Hall and Liebman (2000) found support for the salary cap creating an increase in the use of stock option compensation. They suggest that most firms that reduced salaries from above the $1 million cap to below, cite that Section 162 (m) is the reason for such compensation adjustments. Hall and Liebman (1998) find that the median CEO receives 1.1 million in salary and that for executives earning in excess of $1 million, the growth rate in their salary between 1993 -1998 is zero.

Hall and Liebman (2000), along with Goolsbee (2000), examine how current tax policy impacts the use of stock options and shifting forms of executive compensation. Goolsbee shows that the short-run elasticity of marginal tax rates comes exclusively from stock options, suggesting that if one excludes stock options there is no role for tax policy in reducing executive compensation. Hall and Liebman show that the shift in executive compensation towards stock options is caused more by increases in the stock market and the market value of the firm. For example, they find that a 10 percent increase in the market value of a firm leads to an increase in stock options by $1.25 million and that the S&P 500 index alters the mix much more than changes in the tax policy.

ECONOMETRIC TECHNIQUE AND DATA

Due to Section 162 (m), businesses can no longer deduct salaries greater than $1 million from their tax payments. To maximize the tax benefits, firms may pay executives their first million in salary and then through performance-based pay, like stock options. This may increase the share of stock option compensation. To empirically investigate if the salary cap has altered stock option pay, we regress the CEO compensation measures on the salary cap for affected firms. This equation is represented by:

$$ln(StockOptions_i) = \alpha_0 + \alpha_1 affected_i + \alpha_2 affected_i * Cap + \sum_k \alpha_i x_{k.i} + \varepsilon_i \qquad (1)$$

where $StockOptions_i$ is the natural logarithm of the Black-Scholes value that a CEO received in a particular year. The x_i are regressors to control for factors such as the overall performance of the stock market (we include the mean value of last year's S&P 500 index), firm performance (a firm's lagged market value and the return on assets), and the size of the company (we include one dummy variable each for companies which are S&P 500 companies or part of the S&P SmallCap, respectively), the α's are parameters and ε_i is an error term.

Even after including these control variables, we may not be able to fully capture the factors, which determine how much stock option pay a CEO receives. Thus, we include a variable which takes on the value of one if a CEO, based on pre-cap salary, is predicted to would have received in excess of $1 million in salary had the salary cap not been enacted, zero otherwise. The $affected_i$ variable is used to capture the relationship between the level of salary and bonus compensation and the growth rate of salary and bonus. The $affected_i$ dummy is one for firms with predicted total CEO compensation exceeding the $1 million cap, zero otherwise. Following Rose and Wolfram (2002), we construct predicted total compensation for the years after the 1994 cap by estimating an AR(1) model using data prior to 1994.[3] *Cap* is a dummy variable for the years that the $1 million dollar cap is in place. The *affected*$_i$ * *Cap* interaction term is used to capture the differential growth rate of this compensation after the cap is put into place.

However, it may very well be the case that the effects of the salary cap are not the same for all CEOs. In fact, we suspect that there are pronounced differences based on a CEO's position in the distribution of stock option compensation. Thus, we estimate the effects of the salary cap—while controlling for a number of other factors—on CEOs' stock option compensation using a quantile regression technique. That is, we estimate the conditional median (rather than the conditional mean in an OLS regression) for various parts of the distribution of the dependent variable. More specifically, we carry out the same estimation for nine different quantiles of the distribution of stock option compensation to obtain estimates for the conditional median as well as the 10th, 20th, 30th, etc. percentiles.

After examining the effect of the salary cap on CEO's stock option compensation, we address an additional issue: If it is indeed the case that CEO's stock option compensation increased in response to the enactment of the salary cap, one might expect that it is simply a shift from salary compensation to stock option compensation, i.e., one would expect a decrease in salary at the time of the stock option compensation increase. In order to investigate this issue, we estimate the following equation:

$$ln(Salary_i) = \beta_0 + \beta_1 affected_i + \beta_2 affected_i * Cap + \sum_k \beta_i x_{k.i} + \eta_i \qquad (2)$$

where *Salary*$_i$ is the annual salary of the i^{th} CEO and all the regressors are as defined in the estimation for stock option compensation in equation (1) above. Again, we first carry out an OLS regression followed by a quantile regression analysis in order to obtain estimates for the conditional median as well as the 10th, 20th, 30th, etc. percentiles.

Table 1: Summary Statistics of Variables Included in Estimations

Variable	Mean	Standard Deviation
Affected	0.424	0.494
S&P 500 index (lagged)	752.4	309.4
Market Value ($ million)	6,162.9	18,721.0
ROA	3.1	13.3
S&P500 firm	0.322	0.467
S&P SmallCap firm	0.201	0.401

We collect annual compensation data from Standard and Poor's ExecuComp database from 1992 to 2000. Thus, we can examine the changes in tax law, which took place after the Section 162 (m) tax law change in 1993 that created a salary cap limit, favoring "performance based pay" over salary from a tax perspective. One advantage of the ExecuComp database is its large size. It follows a total of 2,412 companies over time, which are or were a member of the S&P 1,500 (consisting of the S&P 500, the S&P MidCap 400, or the S&P SmallCap 600). Since each company must provide information about the top five executives in each year, the overall number of records is substantial. After imposing some restrictions (most notably the restriction to CEOs as well as the exclusion of firms whose fiscal year does not end in December in order to properly account for any tax change effects and the exclusion of executives whose reported value of stock options granted in a certain year is missing), there are 6,062 individual-year observations that are included in our estimations of equation (1) and 8,235 observations in our estimations of equation (2).[4]

RESULTS

Estimation results from the OLS regression of the stock option compensation equation (equation (1)) are shown in Table 2. The two variables of main interest show the following patterns: Before the salary cap went into effect, "affected" firms paid their CEOs approximately 15 percent less in stock options, *ceteris paribus*. After the cap went into effect, CEO stock option compensation was substantially higher in affected firms after controlling for a number of other factors. The average affected firm issued approximately 33 percent (48.3 percent minus 15.3 percent) more in stock options to their CEO than the unaffected firms. That is, in contrast to results found in Rose and Wolfram (2002), our results suggest a significant increase in the use of "performance based compensation" for affected firms. Our results are consistent with those found in Hall and Liebman (2000). With the exception of the dummy variable indicating an S&P500 firm, all estimates of the control variables are highly statistically significant. The effect of return on assets is negative which may have to do with low-performing firms that try to attract a CEO who can turn a company around by offering a substantial amount of stock options. S&P500 companies issue their CEOs close to 3 percent more in stock options, all else equal, but this is the one estimate with a large p-value. Small companies, on average, issue approximately 16 percent less in stock options to their CEOs than do their larger peers. Our results support Hall and Liebman's (2000) findings that past stock market performance has a positive impact on the average CEO's stock option compensation. Similarly, there is also a positive relationship between a firm's market value and the value of stock options granted. Our results indicate that a 10-percent increase in the market value of the firm is associated with a 37-percent increase in CEO stock option compensation. Evaluated at the mean of the data, this result corresponds with an increase of approximately $1 million, a finding that is remarkably close to Hall and Liebman's result of $1.25 million. Unlike Hall and Liebman, our results continue to show that the salary cap has increased the use of stock option compensation even after including these control variables.

We now take a closer look at the two variables of main interest in our study using a quantile analysis. As previously discussed, estimation via OLS may obscure some important differences in firm/CEO behavior. More specifically, firms at the bottom of the distribution may show different results from those around the median or at the top of the distribution. These issues can be addressed with the use of quantile regression. To indicate pre-cap behavior, the dummy variable ("*affected*") predicts salary compensation in excess of $1 million had the salary cap not been instituted. Estimates are presented in the second column of Table 3. The estimates for the first five quantiles are small in magnitude and not statistically significant at any conventional level. The results for the upper four quantiles are quite different: For that top part of the distribution, we find that affected firms (i.e., those whose predicted post-cap CEO salary is in excess of $1 million), on average, pay their CEOs approximately 21 to 26 percent less in stock options, all else equal. This may be due to the fact that before the salary cap was enacted, a larger share of CEO compensation was paid in the form of salary.

Table 2: OLS Regression Results for Stock Option Compensation
(Standard Errors in Parentheses)

	Ln(Black-Scholes value of SO)
Affected	-0.153
	(0.085)
Affected*cap	0.483
	(0.083)**
S&P 500 index (lagged)	0.001
	(0.000)**
Ln(MV) ($ million)	0.367
	(0.015)**
ROA	-0.004
	(0.001)**
S&P500 firm	0.029
	(0.042)
S&P SmallCap firm	-0.165
	(0.045)**
Constant	-3.691
	(0.101)**
Observations	6,062
R-Squared	0.31

* significant at 5%
** significant at 1%

An even more interesting finding, in our opinion, emerges when the behavior of CEOs of affected firms in response to the enactment of the salary cap is examined. The full effect is captured by the sum of the estimates of the dummy variable for affected firms and the interaction term of that dummy with the salary cap term, which indicates whether the cap was in or not in effect. The total impact is presented in column 3 of Table 3 as well as in Figure 1.[5]

Table 3: Effect of the Salary Cap on Stock Option Compensation by Quantile			
Quantile	Pre-Cap Effect on Stock Options (Affected Firms)	Post-Cap Effect on Stock Options (Affected Firms)	Pseudo R-Squared
1	-0.106	0.606	0.18
2	-0.065	0.493	0.19
3	-0.036	0.389	0.19
4	-0.027	0.343	0.20
5	-0.043	0.286	0.20
6	-0.240	0.223	0.19
7	-0.244	0.134	0.19
8	-0.214	0.115	0.18
9	-0.256	0.196	0.16

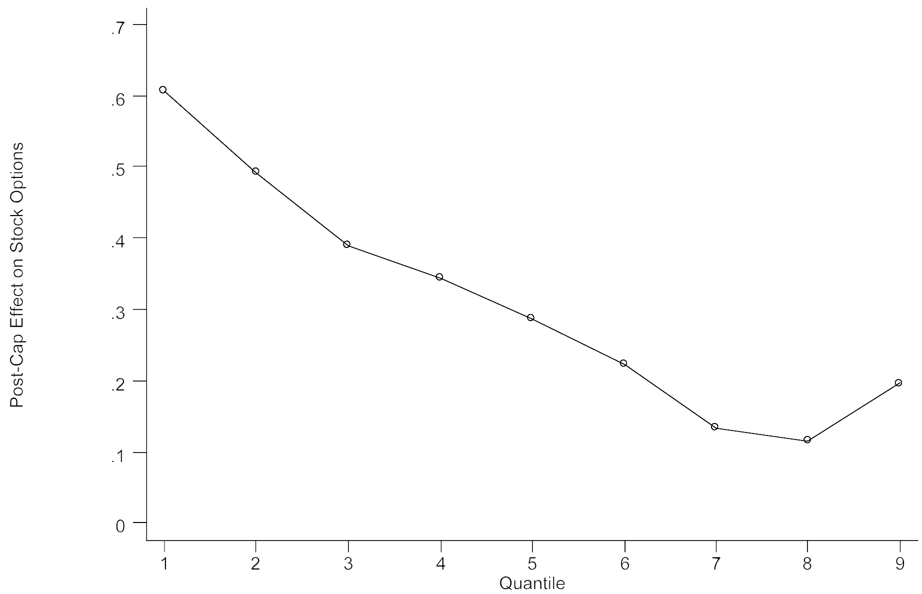
The full effect exhibits a very clear downward trend over almost the entire distribution. The largest effect is shown for CEOs in the bottom quantile. The combined effect is estimated to be 0.61, i.e., our results indicate that after the salary cap went into effect, the average CEO of an ”affected” firm received 61 percent more in stock options than a CEO at a firm that was not affected by the salary cap. The estimated effect is strictly monotonically declining over the entire distribution with the exception of the top quantile.

The statistical precision of the estimates of the interaction term between the dummy variable showing affected firms and the dummy variable which indicates whether the cap was in or not in effect is noteworthy: All nine estimates have p-values of less than 0.01. Keeping in mind that the (negative) estimates of the “*affected*” dummy have high p-values for the bottom five quantiles, we can conclude that the effects shown in Figure 1 for the bottom half of the distribution are in fact lower bounds; they might well be larger than what is shown in the table and the figure.

Since we estimate a separate regression for each of the nine quantiles, we do not present all the estimates for the control variables. Instead, we briefly summarize the results for our control variables. In the quantile regressions for stock option compensation, none of the estimates of the dummy for S&P 500 companies is statistically significant at any conventional level, and they are small in magnitude. The estimates for the effect of being a S&P SmallCap company have p-values from 0.26 to 0.85 for the lowest four quantiles. The p-values for the other five quantiles are less than

0.01. These precisely estimated effects for the top half of the distribution are all negative and strictly monotonically increase (in absolute value) from –0.14 for the median quantile to –0.36 for the top quantile. The estimated effects of the lagged S&P 500 and a firm's market value are positive and highly statistically significant in all nine regressions. The coefficient estimate (rounded to the third decimal place) is 0.001 in all nine regressions. The estimate of a firm's return on assets is negative, but relatively small in size and, in the case of the lowest two quantiles, not statistically significant.

Figure 1: Post-Cap Effect of Salary Cap on Stock Options Cap by Quantile



In order to see whether the increase in stock option compensation coincided with a decrease in CEO salaries, we then estimate the salary compensation equation (equation (2)). Results of the OLS regression are presented in Table 4. The estimate for the "*affected*" dummy variable (which captures whether a firm is predicted to be affected by the salary cap) shows that the CEOs of affected firms, on average, receive a salary, which is almost 50 percent higher than the salary of CEOs at unaffected firms. This large positive (and highly statistically significant) estimate is to be expected since the "*affected*" dummy variable takes on the value "one" whenever we predict that a CEO receives a large salary (based on our auxiliary AR(1) regression). Examination of the estimate for the interaction term reveals that, interestingly, the enactment of the salary cap had virtually no effect on salary compensation. The estimated reduction of approximately one percent is clearly not statistically significant (p-value = 0.82). That is, it is not the case that the increase in stock option compensation shown previously occurred in conjunction with a decrease in salary compensation. Instead, stock option compensation rose substantially in response to the enactment of the salary cap while mean salaries were virtually unaffected. Unlike, Rose and Wolfram (2002), who found that the salary cap greatly reduced CEO salaries, our results show that the salary cap has had very little impact on CEO salary compensation. This is consistent with Hall and Liebman's (1998) finding that the median CEO salary between 1993 and 1998 was close to $1 million. Interestingly, this corresponds perfectly with the $1 million salary cap creating no incentive to lower the majority of CEO salaries. Results also support Hall and Liebman (2000), again showing that a firm's market value has a highly statistically significant, positive impact on a CEO's compensation. As they suggest, this is due to CEO compensation being based on firm performance, with good performance reaping higher compensation. CEOs of small companies, *ceteris paribus*, receive approximately 8 percent lower salaries than their counterparts in medium-sized corporations (the omitted category).[6]

Table 4: OLS Regression Results for Salary Compensation
(Standard Errors in Parentheses)

	Ln(Salary)
Affected	0.492
	(0.044)**
Affected*cap	-0.010
	(0.044)
S&P 500 index (lagged)	0.001
	(0.001)
Ln(MV) ($ million)	0.104
	(0.007)**
ROA	0.001
	(0.001)
S&P500 firm	0.035
	(0.022)
S&P SmallCap firm	-0.079
	(0.022)**
Constant	-1.658
	(0.051)**
Observations	8,235
"R-Squared"	0.22

* significant at 5%
** significant at 1%

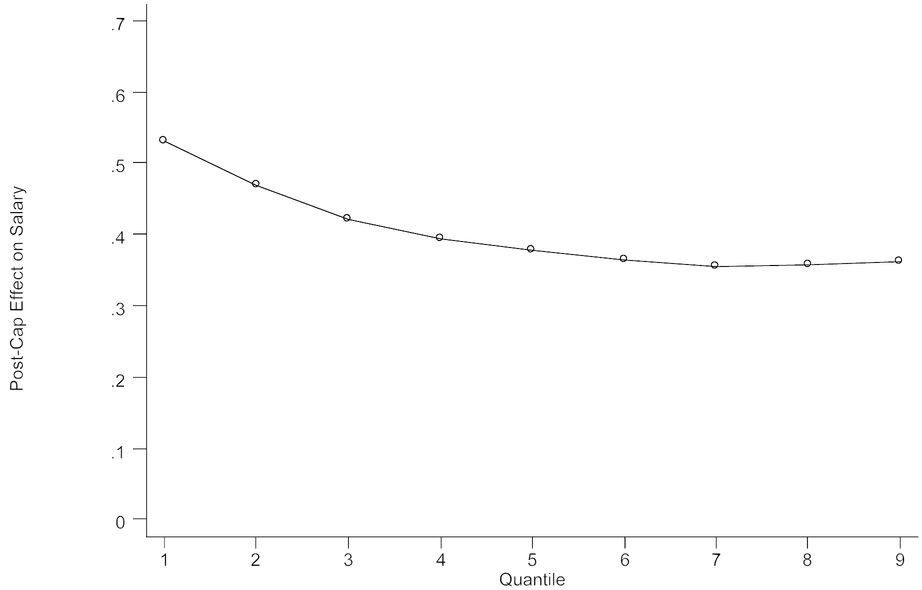
We now estimate equation (2) using quantile regressions in order to examine whether there are distinctly different patterns dependent on the position in the distribution. As can be seen from the second column in Table 5,[7] the effect of an affected firm is most pronounced for the lowest quantiles, then decreases somewhat and is virtually constant for the top six quantiles. In order to examine the effect of the enactment of the salary cap, the combined impact of the dummy variable and the interaction term must be considered. As can be seen from Table 5, the second and the third columns of numbers are almost identical. This implies that the estimates for the interaction term are very small. In fact, the range of estimates is from –0.029 to +0.019. Not a single one of these nine estimates is statistically significant (p-values range from 0.15 to 0.98.) This means that the post-cap behavior in terms of salary is, for all practical purposes, the same as the pre-cap behavior. Thus, our previous finding that stock option compensation increased substantially while salary compensation was virtually unaffected by the enactment of the salary cap approximately applies to all quantiles of the distribution.

Table 5: Effect of the Salary Cap on Salary Compensation by Quantile

Quantile	Pre-Cap Effect on Salary (Affected Firms)	Post-Cap Effect on Salary (Affected Firms)	Pseudo R-Squared
1	0.528	0.530	0.24
2	0.451	0.470	0.31
3	0.418	0.421	0.34
4	0.389	0.394	0.36
5	0.377	0.378	0.37
6	0.375	0.364	0.37
7	0.380	0.355	0.37
8	0.387	0.358	0.35
9	0.372	0.362	0.31

To summarize the results, we find that overall, the salary cap has increased the use of stock option compensation for affected firms. More importantly, however, we have been able to show that there exist very distinct patterns dependent on the part of the distribution that is being estimated. For example, the total effect of the salary cap is more than five times as high for the bottom quantile as it is for the second-highest quantile. Moreover, this result may even understate the true effect because of the varying degrees of precision of the estimates as discussed above. Additionally, we were able to demonstrate that the increase in stock option compensation due to the salary cap did not occur simultaneously with a decrease in salaries. Instead, salary compensation, surprisingly, remained virtually unaffected by the salary cap.

Figure 2: Post-Cap Effect of Salary Cap on Salary by Quantile



CONCLUSIONS AND POLICY IMPLICATIONS

There has been a tremendous increase in executive stock option compensation during the 1990s. During the same time period, a tax law change created a salary cap for tax deductions. By analyzing the effects of the tax cap, we can consider if tax treatment of compensation influences stock option compensation. Using a quantile analysis allows us to further examine if CEO compensation differences based on a CEO's position in the compensation distribution.

Our results suggest that the salary cap has increased the use of stock options as a form of executive compensation. This is especially true for companies and their CEOs at the bottom of the distribution. However, our results show very little change in salary compensation, regardless of the CEO's position in the respective distribution. This suggests that the salary cap has not reduced CEO salary compensation, but has greatly increased their stock option compensation, especially at the lower end of the distribution. This also suggests that since the implementation of the salary cap in 1993, most increases in CEO compensation have taken the form of stock option compensation. While CEOs may not be representative for the general public, their response to current tax policy may be interesting in its own right, especially considering the magnitude of their overall incomes. Additionally, CEO compensation has received substantial attention in light of the current scandals. Presumably, the government's intention in 1993 was to limit executive compensation. However, we find that CEO salary compensation was not affected by the enactment of the salary cap. Moreover, stock option compensation increased substantially after the salary cap went into effect. In summary, the salary cap was not only ineffective in curbing executive compensation; it may actually have led to the opposite effect, i.e., a substantial increase in overall CEO compensation.

ENDNOTES

1 See Rose and Wolfram (2002).

2 It should be noted that agency theorists such as Jensen and Meckling (1976), Rosen (1990), and Brookfield and Phillip (2000) have addressed how stock options impact the principal-agent dilemma, while Sanders (2001), Mehran (1995), and Dhillon and Ramirez (1994), addressed whether the growing number of stock options impact firm performance. However, they all neglect to address whether current federal tax policy limiting tax deductible salary compensation alters the mix of executive compensation.

3 Section 162 (m) states that only predetermined "performance based pay" that is voted on by outside members of the board are qualified to be exempt for the million dollar cap. Rose and Wolfram found that while almost all stock option grants are qualified, the majority of bonuses are not predetermined and thus are not qualified. Results are robust if we only examine affected firms based on salary compensation and are available upon request

4 The difference in the number of observations in the two sets of regressions is due to the fact that a number of CEOs received zero stock options in a particular year which results in a missing value for the constructed natural logarithm of that variable.

5 While the second column presents estimates of α_1 from the nine quantile regressions, the third column shows the *sum* of α_1 and α_2, i.e., the α_2 can be obtained by forming the difference between the third column and the second column.

6 The estimates of the other control variables are not statistically significant at any conventional level.

7 Analogously to the earlier set of quantile regressions, the second and third columns are the estimates of β_1 as well as the *sum* of β_1 plus β_2 so that β_2 can be obtained by forming the difference between the two columns.

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