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Portfolio Disclosures and Year-End Price Shifts

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ABSTRACT

Commercial paper sells at an extra discount if it matures in the next calendar year but Treasury bills do not. The discount is apparent in downward price shifts before the year-end, and upward price shifts at the turn of the year that are significantly correlated with the simultaneous returns to small stocks, and that cannot reflect tax-loss selling. Cross-sectional and time-series tests on prices, as well as flow of funds evidence on trades by institutional investors, indicate that both the debt and equity patterns reflect agency problems related to portfolio disclosures.

FINANCIAL RESEARCH HAS BROUGHT considerable analysis to bear on the turn of the year in the equity market, but not the money market. Extant literature, starting with Keim and Stambaugh (1986), reports similarities between equity-market and money-market price shifts in January, but has not examined time series and cross sections of money market prices at the high resolution common in studies of the equity market. Repeating tests from the equity literature on money market prices, this article finds a more precise and robust characterization of the price shifts. This characterization, combined with observations of year-end shifts in money market holdings, supports the view that intermediaries move prices with strategic responses to portfolio disclosures.

The main empirical result is that commercial paper pays a higher yield if it matures across the end of the year. That is, it imputes a forward premium for the holding period from the last trading day of one year to the first trading day of the next. This premium is even higher for issues with more default risk and longer maturity (as measured at the end of the year), and has a substantial impact on yield spreads. I argue that the forward premium reflects an abnormally high market price for bearing risk across the year-end, and that this high price reflects the disutility to intermediaries of showing risky portfolios to claimholders or regulators.

The connection between portfolio disclosures and price shifts was proposed by Haugen and Lakonishok (HL) (1988) as an explanation of the equity-market January Effect. As originally documented by Keim (1983) with monthly data,

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the January Effect is the large and consistent upward shift of low-capitalization stock prices relative to large-stock prices in January. Reinganum (1983) and Roll (1983) discovered later in daily data that the bulk of the shifting occurs in a few trading days around the turn of the year, and the first trading day of the year in particular. This timing focuses attention on the distinctive features of the year-end, such as the high concentration of portfolio disclosures scheduled for December 31 (12/31). HL hypothesize that intermediaries consider (long) positions in certain stocks to be signals of high risk or bad judgement, and consequently avoid holding them at moments of disclosure. In this model, which they call the window dressing model, the January Effect reflects the tendency of small stocks to be either riskier, or bad recent performers, or both. They cite the larger January Effect of worse recent performers as further evidence for their model, but allow that the competing tax loss selling model, in which the price shifts reflect the tax benefits of realizing capital losses before 12/31 rather than after, makes the same prediction.

This observational equivalence problem does not apply to the money market, because money market instruments do not generate capital losses. The tax loss model cannot explain the January Effect in the money market, but the window dressing model is still active: money market instruments exhibit cross-sectional variation in default and interest rate risk that may relate to the preferences of intermediaries. Furthermore, the volume outstanding of these instruments is held almost entirely by institutional investors, managing other people's money on their behalf. Some, including every life insurance company, have no choice but to disclose 12/31 portfolios. The money market is a promising environment for widespread year-end window dressing.

The rest of the article is in 7 sections. Section I describes the data. Section II motivates and provides some partitions that address some ambiguities in the definitions of the time series. Section III establishes statistically the existence and size of the year-end premium in money market prices, and Section IV evaluates possible explanations for the results of Section III, including the model in which intermediaries respond strategically to disclosure dates. Section V tests the disclosure-based model on aggregate portfolios of financial industry sectors, Section VI relates the money market results to the equity market literature, and Section VII summarizes and concludes.

I. The Data

Every trading day, several brokers and dealers voluntarily complete the *Daily Report of Offering Rates on Commercial Paper* for the Federal Reserve Bank of New York. The *Daily Report* seeks the posted rates for 1, 7, 15, 30, 60, 90, and 180-day commercial paper as of 10:00 A.M., and advises that

> *Rates reported should be the same rates that are available to the public through inquiry of the firm or rate reporting services. Do not report rates for maturities other than exactly those specified. If there is any maturity for which you are not currently seeking funds, please leave the relevant space blank.*

Reporting brokers and dealers are requested to supply rates on the commercial paper placed for industrial firms whose paper is rated A1 or P1 and whose bond rating is Aa or the equivalent of such ratings.[1]

These instructions are not followed exactly to the letter, since n-day rates are reported for days when no n-day paper could possibly be sold because the alleged maturity date n days later is not a business day (e.g., the 15-day rate reported for any Friday), but the Fed regards the reports as generally accurate, and compiles the average rates into its H15 database.

As published on diskette, the H15 database contains 1-month, 3-month, and 6-month commercial paper (CP, or paper) rates. In fact, these are 30–59 day, 90–119 day, and 120–179 day rates before November 1979,[2] and 30-day, 90-day, and 180-day rates afterward, but for convenience I will refer to them as 30, 90, and 180-day rates for the entire period. Daily data are available back to January 1970 for 180-day paper, and April 1971 for 30 and 90-day paper. Weekly and monthly data are available for earlier years. Provided separately by the Fed are the 60-day rate, starting daily in April 1971,[3] the 15-day rate starting November 1979, and the 7-day rate starting February 1989.[4] I will refer to the n-day rate as CPn in the discussion below.

The H15 diskette also reports 3-month and 6-month Treasury bill (TB, or bill) rates, which are actually 13-week and 26-week bills for the week they are on-the-run. The 13-week rate, which I will refer to as TB13W, is available daily[5] from January 1954, and the 26-week rate, or TB26W, is available daily from December 1958. The end date for all TB and CP series is April 22, 1996, and all rates are quoted on a 360-day discount basis.[6]

Comparing same-maturity bill and paper rates is problematic, since the popular maturities for new paper are far shorter than 13 weeks,[7] and the secondary-market quotes for shorter-maturity bills are often regarded as unreliable. For the most part I compare CP180 with TB26W and CP90 with TB13W, but I make limited use of the daily 1-month bill rates, or TB1M, reported by Bloomberg[8] (starting December 1989), which I compare to CP30.

The spread between CP issues with the same maturity but different credit ratings is easier to observe because the Fed measures it directly. For every month since January 1974, the Fed reports the rate for 30-day P2-rated paper

[1] Federal Reserve form 2957d.

[2] Board of Governors of the Federal Reserve System (BOGFRS) (1990).

[3] It is unclear whether the 60-day rate also refers to a range of maturities (probably 60–89 days, judging from the ranges for the other series) before November 1979. To be safe, I assume that they do, and avoid interpreting them in the earlier period.

[4] I am grateful to Michael O'Malley for providing this data.

[5] "Unweighted average of closing bid rates quoted by at least five dealers." BOGFRS (1990).

[6] Unless otherwise noted, the term *yield* below refers to a 360-day-basis discount rate.

[7] "In practice, most commercial paper has a maturity of between 5 and 45 days, with 30–35 days being the average maturity." Hahn (1993), p. 106.

[8] Bloomberg quotes the one-month bill rate on a bond-equivalent yield basis. I convert this to a 360-day discount basis.

minus the rate for 30-day P1-rated paper.[9] I will refer to this spread below as P2P1.

Observations of aggregate industry portfolio allocations come from the flow of funds (FOF) tables published by the Board of Governors of the Federal Reserve System. These are quarterly observations of the financial holdings, broken down into broad categories, of various investor types. The figures cover the first quarter of 1952 through the third quarter of 1994. The reliability and accuracy of this data vary substantially from one investor type to the next, and are discussed in Section VI below.

The reporting schedules of money market mutual funds are from CDA/Wiesenberger, and equity returns are from the Center for Research in Security Prices (CRSP).

II. Some Notation That Will Prove Useful

Every CP rate reported by the Fed for year y can be classified as either *same-year, next-year,* or *ambiguous year.* Same-year rates are for CP maturing in year y, next-year rates are for CP maturing in year $y + 1$, and ambiguous-year rates are for CP whose year of maturity is ambiguous. The tests in the next section generally involve comparing same-year rates with next-year rates, and disregarding ambiguous-year rates. If all calendar days were business days, the classification would be simple: the n-day rate reported for day d would be same-year if December 31 (12/31) were at least n days after d, and would otherwise be next-year. No rates would be ambiguous-year. To see how the incidence of weekends and holidays complicates the classification, suppose 12/31 falls on a Sunday. The last business and trading day of the year is December 29, and the first of the next year is January 2. Now the last day with same-year CP15 is 12/14, and the first day with next-year CP15 is 12/18. The rate on 12/15 is ambiguous-year, because it is 15 days before a nonbusiness day. It is ambiguous whether it refers to 14-day paper maturing in the same year, or 18-day paper maturing in the next year.

I adjust for these considerations throughout the rest of the article with definitions as follows: an n-day rate is same-year if the last trading day of the year is at least n days away, and is next-year if the first trading day of the next year is no more than n days away. All other rates are ambiguous-year. With these definitions, I associate with each year y eight periods $y_1 \ldots y_8$:

y_1 = Last week in which CP180 is same-year
y_2 = CP7 through CP90 are same-year, CP180 is next year
y_3 = CP7 through CP60 are same-year; CP90 and CP180 are next-year
y_4 = CP7 through CP30 are same-year; CP60 through CP180 are next-year

[9] P1 is Moody's highest rating, and P2 is Moody's second highest rating. Fons and Bergqwist (1994) report that 86.10 percent of rated CP (outstanding in the world) was P1 and 13.03 percent was P2 as of September 30, 1993.

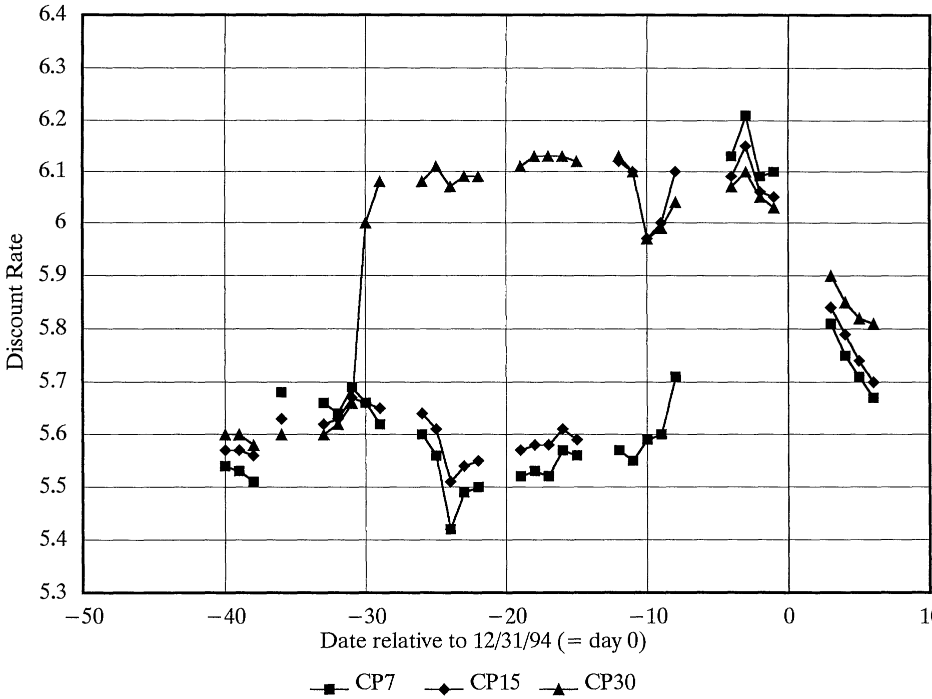

Figure 1. Short commercial paper (CP) rates, 1994–1995. CPn is the n-day CP discount rate reported for the indicated day by the Fed.

y_5 = CP7 and CP15 are same-year; CP30 through CP180 are next-year
y_6 = CP7 is same-year; CP15 through CP180 are next-year
y_7 = CP7 through CP180 are next-year
y_8 = Week beginning with first trading day of following year

This partition is not meaningful in the pre-1980 period when the CP rates referred to wide ranges of maturities, so the tests below focus on the sixteen year ends from 1980–1981 to 1995–1996. Tests involving CP7 begin after February 1989, when it came on-line.

III. The Next-Year Discount for Money-Market Instruments

A. An Example

Figures 1 and 2 illustrate the main points established below. Figure 1 plots CP7, CP15, and CP30 from November 21, 1994 to January 6, 1995. Each rate shows a large shift upward before the end of the year, and a large shift downward at the turn of the year. These shifts are far in excess of the prevailing volatility of interest rates, and follow a simple rule: yields adjust so

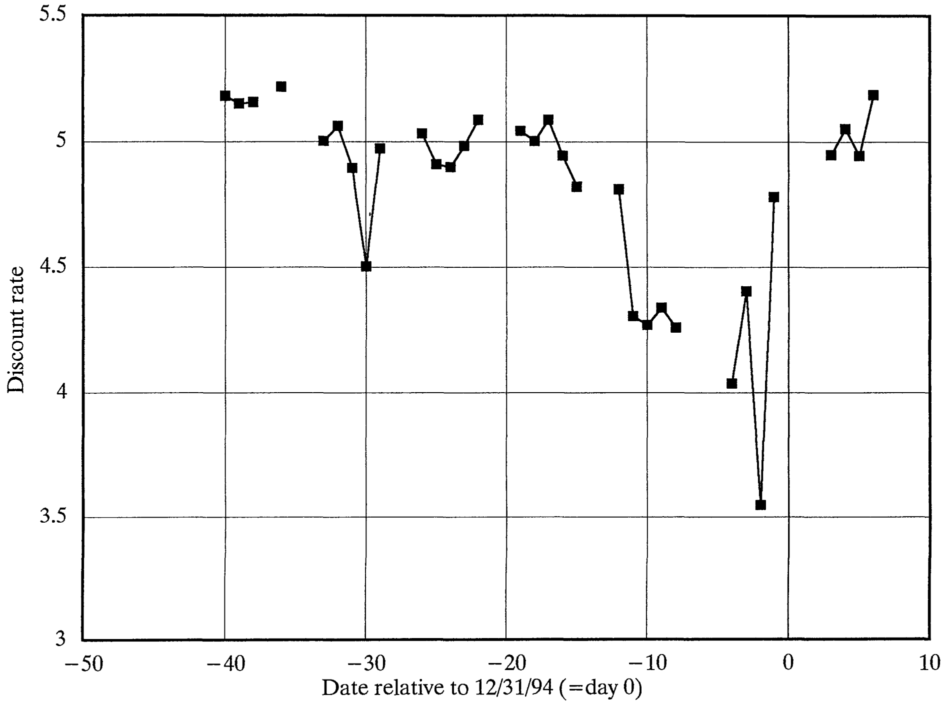

Figure 2. One-month Treasury bill rate, 1994–1995. Figures are one-month Treasury bill yields reported for the indicated days by Bloomberg, converted to discount rates.

that next-year paper sells at a discount to same-year paper. To see this, first note that

1994_4 = 11/3/94 to 11/30/94 (day −58 to day −31),
1994_5 = 12/5/94 to 12/15/94 (day −26 to day −16),
1994_6 = 12/19/94 to 12/23/94 (day −12 to day −7),
1994_7 = 12/27/94 to 12/30/94 (day −4 to day −1), and
1994_8 = 1/3/95 to 1/9/95 (day 3 to day 9),

and then observe that CP30 shifts up relative to the others from 1994_4 to 1994_5, CP15 shifts up from 1994_5 to 1994_6, CP7 shifts up from 1994_6 to 1994_7, and all three shift down from 1994_7 to 1994_8. Moving forward through time, relative prices shift downward at the transition from same-year to next year, and upward at the transition from next-year to same-year. Since the rates are all at the ask, these shifts are not related to the bid/ask spread.

The 1994–1995 price shifts vary across maturities. From 12/30 to 1/3, CP7, CP15, and CP30 discount rates fall 29 bp, 21 bp, and 13 bp, respectively (bp = basis point, 1/100 of 1 percent), which translates to price increases of 0.56 bp,[10] 0.88 bp, and 1.08 bp. That is, 30-day paper with face value $100,000 costs

[10] (29 bp)(7/360) = 0.56 bp.

$10.80 more on 1/3 than on 12/30, 15-day paper costs $8.80 more, and 7-day paper costs $5.60 more.

The next-year/same-year pattern is absent from one-month secondary-market bill rates on the same days, plotted as Figure 2. They are generally lower in December, when they are next-year, than in November or January, and in fact shift upward a little from 12/30 to 1/3.

This section tests across years and maturities for the patterns of Figures 1 and 2.[11] I establish that CP sells at a larger discount if it is next-year rather than same-year, but Treasury bills do not, and then address some follow-up questions: does the discount increase with default risk, or interest-rate risk? Is there an end-of-quarter discount, or an end-of-month discount? How does it relate to existing literature? How long has this been going on?

B. Empirical Evidence of Patterns

The first empirical question I address is whether the 1994–1995 results for short CP rates generalize to the full available set of years and maturities. First I test term spreads for downward price shifts at the transition from same-year to next-year, and then I test for upward price shifts across the year-end.

The first hypothesis is that CPn − CPm shifts upward, as it does in Figure 1, from the last period when CPn is same-year to the first period when it is next-year. For example, CP60 − CPm shifts upward from y_3 to y_4, for any $m \neq 60$. There are 30 yield-spreads in total; Panel A of Table I reports the mean shift between the appropriate periods for each spread,[12] and p-values for the null hypothesis of no positive shift.

The data reject the null hypothesis almost everywhere. All of the spread changes are in the predicted direction, 27 of 30 are significant at the 10 percent level, 26 at 5 percent, and 13 at 1 percent. The p-values are especially small for the more popular short maturities. As in Figure 1, term-structure variation delivers a higher yield for next-year paper.

The second hypothesis is that CP rates shift downward, as in Figure 1, from y_7 when they are all next-year, to y_8 when they are all same-year. I test this hypothesis by calculating the mean shift for each rate from y_7 to y_8, and p-values for the null hypothesis of no negative shift. The results, in Panel B of Table I, complement the results in Panel A: all six are significant at the 5 percent level, and five at the 1 percent level. Prices shift down when they begin referring to next-year paper, and shift up when they stop.

[11] Interested readers can refer to Musto (1995) or earlier versions of this article (available from the author) to see very similar results for bankers' acceptances, Eurodollar time deposits and large domestic time deposits. I limit this version to the CP results to save space, and also on the advice of Federal Reserve employees who indicate that the CP rate quotes (especially for short maturities) are more reliable and representative than those for other instruments. The CP market is also much bigger than the others.

[12] The shift between y_i and y_{i+1} is the average over the trading days in y_{i+1} minus the average over the trading days in y_i.

Table I

Comparisons of Next-Year and Same-Year Commercial Paper (CP) Rates

CPn, the n-day CP rate reported by the Fed, is *same-year* if the last trading day of the year is n or more days later, and *next-year* if the first trading day of the next year is n or fewer days later. Associated with each year y are subperiods $y_1 \ldots y_8$ such that y_1 is the last week when CP180 is same-year, CP180 is next-year in $y_2 \ldots y_7$, CP90 is next-year in $y_3 \ldots y_7$, CP60 is next-year in $y_4 \ldots y_7$, CP30 is next-year in $y_5 \ldots y_7$, CP15 is next-year in $y_6 \ldots y_7$, CP7 is next-year in y_7, and all rates are same-year if not next-year. y_8 is the week beginning with the first trading day of year $y + 1$. The figure for n = N and m = M is the average of $(\text{CPN–CPM})_{y,i} - (\text{CPN–CPM})_{y,i-1}$ for y = 1980 to 1995 (except when N = 7 or M = 7, in which case y is from 1989 to 1995), where y_i is the first period when CPN is next-year, and $(\text{CPN–CPM})_{y,i}$ is the average of CPN–CPM over the days in y_j. For example, CP60–CP7 is an average of 19.29 bp higher in y_4 than in y_3. The p-values, in italics, are for the null hypothesis that the spread does not increase when CPN becomes next-year.

Panel A: Change in CPn–CPm When CPn Becomes Next-Year Paper, in Basis Points

	m = 7	m = 15	m = 30	m = 60	m = 90	m = 180
n = 7	—	87.86	96.43	101.3	103.4	105.0
		*0.0222***	*0.0152***	*0.0173***	*0.0199***	*0.0222***
n = 15	56.71	—	37.44	45.06	50.13	54.94
	*0.0206***		*0.0036**	*0.0015**	*0.0011**	*0.0012**
n = 30	33.29	26.94	—	21.19	22.13	28.88
	*0.0052**	*0.0030**		*0.0003**	*0.0008**	*0.0090**
n = 60	19.29	9.69	12.25	—	12.00	16.34
	*0.0033**	*0.0332***	*0.0052**		*0.0006**	*0.0001**
n = 90	13.57	6.06	5.81	6.00	—	6.06
	*0.0209***	*0.1648*	*0.1195*	*0.0492***		*0.0859****
n = 180	4.57	24.00	21.38	15.19	10.88	—
	0.2037	*0.0209***	*0.0248***	*0.0262***	*0.0384***	

Panel B: Change in CPn Across the year-end, in basis points

The figure for CPn is average of CP$n_{y,8}$ − CP$n_{y,7}$ for y = 1980 to 1995 (except when n = 7, in which case y is from 1989 to 1995), where CP$n_{y,j}$ is the average of CPn over the days in y_j, as defined above in the text. The p-values, in italics, are for the null hypothesis that CPn does not decrease from y_7 to y_8.

CP7	CP15	CP30	CP60	CP90	CP180
−109.00	−75.06	−46.75	−34.00	−25.63	−13.88
*0.0293***	*0.0029**	*0.0009**	*0.0009**	*0.0011**	*0.0016**

Panel C: Tests for next-year discount in Treasury bill rates in basis points

TB26W and TB13W are the 26-week and 13-week Treasury bill rates, respectively, as reported by the Fed. $(X)_{y,i}$ and $(X\text{–}Z)_{y,i}$ are the values of X and X–Z, respectively, averaged over the days in y_i. *mean* is the mean of the indicated statistic for y = 1980 to 1995, $p(+)$ is the p-value for the null hypothesis of a nonpositive mean, and $p(-)$ is the p-value for the null hypothesis of a nonnegative mean.

Statistic	Mean	
$(\text{TB26W–TB13W})_{y,2} - (\text{TB26W–TB13W})_{y,1}$	7.88	$p(+)$: 0.1232
$(\text{TB13W–TB26W})_{y,3} - (\text{TB13W–TB26W})_{y,2}$	−0.88	$p(+)$: 0.5469
$(\text{TB13W})_{y,8} - (\text{TB13W})_{y,7}$	2.81	$p(-)$: 0.8257
$(\text{TB26W})_{y,8} - (\text{TB26W})_{y,7}$	−0.19	$p(-)$: 0.4687

Table I—*Continued*

Panel D: Year-end yield shifts converted to price shifts in basis points

The value for CPn is the yield shift from Panel B converted to a price shift. If x is the yield shift for CPn, the price shift in basis points is $(-1)(n/360)x$. So for example, $-46.75(30/360) = -3.90$, so the average yield shift of CP30 from y_7 to y_8 from $y = 1980$ to $y = 1995$ of -46.75 bp translates to an upward price shift of 3.90 bp.

CP7	CP15	CP30	CP60	CP90	CP180
2.12	3.13	3.90	5.67	6.41	6.94

Panel E: Tests for Next-Year Discount in P2–P1 Yield Spread in Basis Points

P2P1 is the monthly average of the rate for 30-day P2-rated paper minus rate for 30-day P1-rated paper, in basis points. *mean*(P2P1) is the average of P2P1 from 1/1980 to 12/1995. *mean*($\mathrm{P2P1}_{y,12} - \mathrm{P2P1}_{y,11}$) is the average shift from November to December, and the p-value, in italics, is for the null hypothesis that P2P1 does not shift up, for y from 1980 to 1995. *mean*($\mathrm{P2P1}_{y+1,1} - \mathrm{P2P1}_{y,12}$) is the average shift from December to January, and the p-value, in italics, is for the null hypothesis that P2P1 does not shift down, for y from 1980 to 1995.

mean(P2P1)	mean($\mathrm{P2P1}_{y,12} - \mathrm{P2P1}_{y,11}$)	mean($\mathrm{P2P1}_{y+1,1} - \mathrm{P2P1}_{y,12}$)
41.43	13.36	−15.33
	*0.0077**	*0.0022**

* Null rejected at the 1% level.
** Null rejected at the 5% level.
*** Null rejected at the 10% level.

Figure 2 suggests that Treasury bills will test negative for next-year discounts. That is, the shifts of TB26W − TB13W from y_1 to y_2 and of TB13W − TB26W from y_2 to y_3 will not be significantly positive,[13] and the shifts of TB26W and TB13W from y_7 to y_8 will not be significantly negative. This is in fact what happens; I repeat in Panel C the tests from Panels A and B on the Treasury rates, and find insignificance everywhere. Half of the signs are wrong, and all of the p-values are large.

The contrast between the paper and bill results focuses attention on the attributes that distinguish them, one of which is default risk. Bills are generally considered default-risk-free, while paper trades with default risk are measured by credit ratings. If the attribute of CP related to the same-year/next-year shifts is default risk, we should see even bigger shifts for riskier paper. This hypothesis is testable on the P2P1 monthly data. The 30-day paper is almost always next-year in December and same-year in other months, and P2 paper is riskier than P1 paper, so the hypothesis has the spread shifting upward from November to December, and downward from December to Jan-

[13] Since TB26W is not exactly 180 days to maturity, same-year and next-year do not correspond exactly to y_1 and y_2. Similarly, y_2 and y_3 do not correspond exactly to same-year and next-year for TB13W. However, adjusting for this difference has essentially no effect on the results.

uary. I test it over the same 1980 to 1995 period; means and p-values are in Panel E of Table I.

The relative price shifts are significant in the predicted directions. The next-year discount is even larger for paper with more default risk.

The next-year discount is larger for paper with more interest-rate risk in 1994–1995. Interest-rate risk increases from CP7 to CP15 to CP30, and so do the price shifts from 12/30 to 1/3. The average yield shifts from Panel B show the same pattern when converted to the price shifts reported in the first line of Panel D. The relationship between maturity and year-end price shifts is monotonically increasing, from 2.12 bp for CP7 to 6.94 bp for CP180. One way to test this relationship for statistical significance is to compare price shifts of adjacent maturities, and calculate p-values for the null hypothesis that the longer-maturity price does not increase more. Note that the n-day price shifts up relative to the m-day price if $(n/360) \times \mathrm{CP}n$ shifts down relative to $(m/360) \times \mathrm{CP}m$. The results, also in Panel D, find statistical significance at the 5 percent level for three of the pairs, at the 10 percent level for one more, and no significance for the fifth. The results for Treasury bills are similar: 26-week prices shift up 0.80 bp more than 13-week prices from y_7 to y_8, with a p-value of 9.77 percent for the null hypothesis. Especially at the more popular short maturities, the data show bigger next-year discounts for instruments with longer maturity at year-end.

In this context, it is not odd that the upward yield shifts in Panel A are generally much smaller than the downward yield shifts in Panel B, since long-maturity paper sold long before the year-end is short-maturity at year-end. The 60-day paper sold 50 days before the year-end is 10-day paper at year-end, and so pays a smaller next-year discount than 60-day paper sold at year-end.

The end of the year is also the end of the fourth quarter and the end of December. So before asking why the same-year/next-year distinction is so important for money market prices, it is worthwhile to determine whether the same-quarter/next-quarter or same-month/next-month distinctions are also important. This is easily testable over the 85 months of CP7 data, which I divide into three sets: December (7 in total), March, June, and September (22 in total), and all other months (56 in total). As above, I associate four periods $m_1 \ldots m_4$ with each month:

m_1 = Last seven days in which CP15 matures in the same month
m_2 = Days in which CP15 is next-month, and CP7 is same-month
m_3 = Days in which CP7 and CP15 are both next-month
m_4 = Seven days beginning with first trading day of following month

I calculate the average of CP7 and CP15 over the trading days of each period, and test in each set separately whether: 1) CP15–CP7 is higher in m_2 than m_1; 2) CP7–CP15 is higher in m_3 than m_2; 3) CP7 is higher in m_3 than m_4; 4) CP15 is higher in m_3 than m_4, and 5) 15-day paper shifts up in price relative to 7-day paper from m_3 to m_4. Results are in Table II.

Table II

Yield Changes Around Ends of Years, Quarters, and Other Months, in Basis Points March 1989–March 1996

CPn, the n-day commercial paper (CP) rate reported by the Fed, is *same-month* if the last trading day of the month is n or more days later, and *next-month* if the first trading day of the next month is n or fewer days later. Associated with each month m are subperiods $m_1 \ldots m_4$ such that m_1 is the last week when CP15 is same-month, m_2 is when CP15 is next-month and CP7 is same-month, m_3 is when CP7 and CP15 are both next-month, and m_4 is the week beginning with the first trading day of the next month. Δ(CP15–CP7) is the average of $(\text{CP15–CP7})_2$ − $(\text{CP15–CP7})_1$, Δ(CP7–CP15) is the average of $(\text{CP7–CP15})_3$ − $(\text{CP15–CP7})_2$ and ΔCPn is the average of CPn_4 − CPn_3 over the indicated months from March 1989 to March 1996, where X_i is the average of the indicated series over the days in m_i. "Δ(price of CP15 − price of CP7) across end of month" is (−1)((15/360)ΔCP15-(7/360)ΔCP7), the price change of CP15 minus the price change of CP7 from m_3 to m_4. For Δ(CP15–CP7), Δ(CP7–CP15) and Δ(price of CP15 − price of CP7) the p-values are for the null hypothesis that the parameter is not positive, and for ΔCP7 and ΔCP15 the null hypothesis is that the parameter is not negative.

Δ(CP15–CP7)	Δ(CP7–CP15)	ΔCP15	ΔCP7	*N* (obs)
Panel A: December Only				
57.00	87.86	−80.86	−109.00	7
*0.0206***	*0.0161***	*0.0340***	*0.0293***	
Δ(price of CP15 − price of CP7) across end of month:		1.25 bp		
		0.0448**		
Panel B: March, June, and September				
3.14	6.16	−7.32	−9.64	22
*0.0004**	*0.0000**	*0.0004**	*0.0000**	
Δ(price of CP15 − price of CP7) across end of month:		0.12 bp		
		0.0060*		
Panel C: All Other Months				
−0.66	0.02	0.61	0.36	56
0.9208	*0.4811*	*0.6692*	*0.5905*	
Δ(price of CP15 − price of CP7) across end of month:		0.02 bp		
		0.2657		

* Null rejected at the 1% level.
** Null rejected at the 5% level.

There is a quarter-end discount, but no month-end discount. Yields, term-spreads, and prices follow the same pattern at the ends of quarters I, II and III as at the end of quarter IV, though on a much smaller scale. There is no significant interaction between paper rates and the ends of other months.

C. Relationship to Previous Research

The results above complement several earlier studies of money market rates. Keim and Stambaugh (KS) (1986) identify a large and significant downward

Table III

Yield changes in January, in basis points

CPn is the n-day commercial paper (CP) rate and TBnW is the n-week Treasury bill rate as reported by the Fed. TB1M is the one-month Treasury bill rate reported by Bloomberg. "All of January" is the average change from the end of December to the end of January of the indicated variable for y from 1981 to 1996 (1990–1996 for TB1M and CP30–TB1M). "First Day" is the change from the end of December to the first trading day of January, and "Rest of January" is the change from the first trading day to the end of January. The p-values, in italics, are for the null hypothesis of zero average change.

	All of January	First Day	Rest of January	N (obs)
CP30	−46.50	−29.88	−16.63	16
	*0.0131***	*0.0173***	*0.1459*	
CP90	−17.00	−11.81	−5.19	16
	*0.0825****	*0.0031**	*0.5325*	
CP180	−8.38	−5.69	−2.69	16
	0.2734	*0.0035**	*0.7096*	
TB1M	18.28	17.26	1.02	7
	0.2410	*0.0609****	*0.8941*	
TB13W	12.81	5.63	7.19	16
	0.2248	*0.1002*	*0.4150*	
TB26W	0.81	4.13	−3.31	16
	0.8984	*0.052****	*0.5646*	
CP30–TB1M	−66.14	−47.83	−18.31	7
	*0.0294***	*0.0334***	*0.1335*	
CP90–TB13W	−29.81	−17.44	−12.38	16
	*0.0000**	*0.0017**	*0.0020**	
CP180–TB26W	−9.19	−9.81	0.63	16
	*0.0105***	*0.0004**	*0.8829*	

* Null rejected at the 1% level.
** Null rejected at the 5% level.
*** Null rejected at the 10% level.

shift in the one-month CP rate relative to the one-month Treasury rate from the end of December to the end of January, and note that private-issue instruments other than CP (certificates of deposit, bankers' acceptances, etc.) and other maturities deliver the same result. The results here relate to theirs in that the 12/31 to 1/31 change includes the change across the year-end analyzed above, and this raises the possibility that the one-month changes they report actually occur in the first day, reflecting only the transition from next-year to same-year. To address this issue, I partition each January into *First Day* and *Rest of January,* where First Day is the last trading day of December to the first trading day of January, and Rest of January is the first trading day of January to the last trading day of January, and then I calculate yield and spread changes over the whole period and each subperiod. Means and p-values for January 1981 through 1996 (1990 through 1996 for TB1M and CP30-TB1M) are in Table III.

The results for the whole period replicate the KS results, but the subperiod figures isolate most of the action in the first day. Spreads do fall significantly in January, but each one drops more on average at the transition from next-year to same-year than it does in the other days of the month put together. CP yields decrease with low p-values in the first period, but not the second, while TB yields increase with marginal p-values in the first period, but not the second. An explanation of next-year/same-year price shifts would explain most, though maybe not all, of the anomaly KS identify.

Earlier data show the January yield changes to be a recent development. Jones and Wilson (JW) (1989) report negative January CP yield changes for 1971–1986, but not the subperiod before, suggesting that daily data from this earlier period would not replicate the results of Table I. We do not have daily data before 1970, but we do have weekly data going back to 1958 for CP180 and TB26W, where the figure for a week is the average over the seven days ending Friday. In this data, the first same-year rate of the year is generally not the first rate of the year, but instead the rate dated between 1/7 and 1/13, since the week ending 1/6 includes 12/31. The rate two weeks earlier (though generally not one week earlier) is next-year. So we can detect a next-year discount by letting FIRST(y) be the Friday between 1/7/y and 1/13/y and FIRST(y)-2 be the Friday two weeks before, and subtracting ($\text{CP180}_{\text{FIRST}(y)} - \text{TB26W}_{\text{FIRST}(y)}$) from ($\text{CP180}_{\text{FIRST}(y)\text{-}2} - \text{TB26W}_{\text{FIRST}(y)\text{-}2}$). This difference would be positive in periods when next-year CP sells at a discount, and distributed around zero otherwise. Results for $y \in (1959, \ldots, 1996)$ are plotted as Figure 3.

The JW result is easily visible. Before 1970 or so, the transition from next-year to same-year has no systematic effect on CP180–TB26W, but from then onward it has had the effect documented in Table I. We already knew that commercial paper yields decline from the end of December to the end of January, and that they did not decline before the 1970s. Now we can say more: a change in the economic environment around 1970 imposed a discount on commercial paper maturing across the end of the year.

Paper sells at an extra discount if it matures across the end of the year. The discount increases with credit risk and interest-rate risk and there is a similar but smaller-scale discount for issues maturing across the ends of other quarters. The 30-day rate is an average of 46.75 bp higher just before the year-end than just after, which translates to a price difference of 3.90 bp. To put this in perspective, consider that about $850 billion of CP matures across the end of the year, and that 3.90 bp of $850 billion is $331 million. Why do corporations, but not the federal government, pay hundreds of millions more for funding across the year-end than for funding across other days? The sizeable literature on year-end economics offers several possible explanations considered in the next section.

IV. Models with Next-year Discounts

Corporations pay high yields to investors in paper maturing across the year-end, and riskier corporations pay higher yields. This evidence raises two possibilities: either the quantity of risk is higher at the turn of the year, or the price charged to bear it is higher at the turn of the year (or both). I consider the

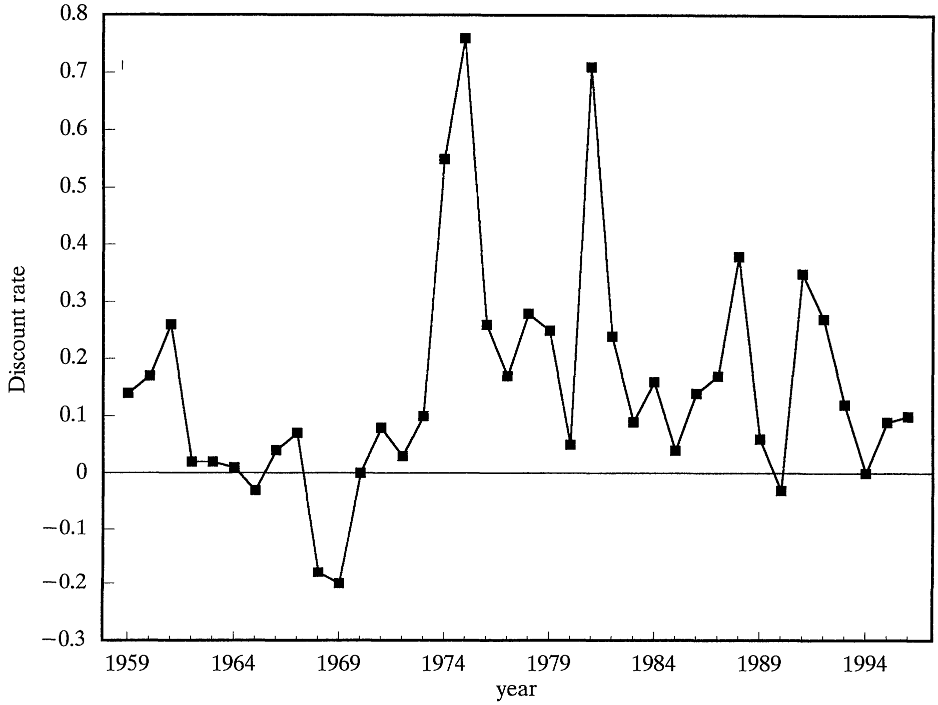

Figure 3. Six-month spread changes across the turn of the year. Figure for year y is the average of CP180–TB26W over the week ending with the Friday between January 7 and January 13 of y subtracted from the average of CP180–TB26W over the week two weeks earlier.

theory and evidence for both possibilities, and whether additional tests might distinguish the high-quantity from the high-price scenario.

If the risk of default is believed to be higher at the turn of the year, then the promised yield of paper maturing across it has to be higher for expected returns to remain constant. If investors require more expected return to bear this additional risk, then promised yields have to be even higher. So in principle, a widespread belief that the day or two around New Years are risky for CP could have generated the tables and figures above.

Unfortunately for this theory, Fons and Bergqwist (1994) do not identify any domestic or foreign defaults on New Years, or anytime in January or December, in their catalogue of rated and unrated CP defaults from 1972 to 1993. This does not entirely rule out the risk-quantity scenario; investors can believe that the turn of the year carries a special risk that has by chance not been realized to date. But without theory or evidence it is not meaningful to assert that a pattern of beliefs can be retrofitted to the pattern in prices.

The theory that risk-bearing is more expensive at the turn of the year dates back at least to Haugen and Lakonishok (1988). In their window dressing model, HL propose that financial intermediaries attempt to manage the opinions of outsiders by holding lower-risk portfolios on disclosure dates, and that so many intermediaries disclose 12/31 portfolios that the market price for risk-bearing is noticeably higher around then. Similarly, the market price for bearing recent losers is also high. In the equity market, they argue, the result is the January Effect.

HL do not address the money market, but the theory applies at least as well. Money market instruments circulate in denominations so large that direct investment is impractical for all but a handful of individuals.[14] Accordingly, consumers hold these securities through intermediaries, some—such as money market mutual funds—organized expressly to facilitate short-term investment, and others—such as nonfinancial corporations—whose cash management is ancillary to their real activity. Many institutions report their money-market holdings in various levels of detail on prearranged days, and can prepare for disclosures with portfolio adjustments. These adjustments can have zero effect on transactions costs, since money market positions must be reinvested at maturity anyway. Every next-year instrument must be held in a portfolio on 12/31, and many intermediaries disclose the compositions of their 12/31 portfolios. In the window dressing model, riskier next-year instruments sell for less because these intermediaries charge more to hold them.

The empirical results of Section III are consistent in several respects with this model. Among next-year instruments they reveal a higher preference not only for TB over CP and P1 paper over P2 paper, but also short-maturity over long-maturity, as measured in year-end reports. The results for quarter-ends are significant but smaller-scale, in line with the significant but smaller-scale role of quarter-ends as disclosure events.

The window dressing model can also resolve the JW result with money market history. The 1970–1971 turn was the first after the June 1970 Penn Central CP default, credited with alerting investors to the risks of CP investment, and triggering major risk-related innovations in money-market investment practices.[15] An increased sensitivity to disclosing riskier positions is consistent with these developments.

A. Explaining the Time-Series Variation of Next-Year Discounts

In the window dressing model, the next-year discount of CP relative to TB represents the marginal cost of substituting out the last dollar from CP to TB; it is the excess return the intermediary had to forgo to invest in the less risky security. With marginal benefit equal to marginal cost, it also represents the marginal benefit of substituting out the last dollar. Looking across years, the variation in next-year discounts reflects the variation in this marginal benefit, and so a measure of the marginal benefit of window dressing should track the price shifts across years if the window dressing model is true. The putative goal of window dressing is to decrease portfolio risk, so a measure of the benefit

[14] "At one big [CP] dealer, the average size of all sales consistently falls around 5MM." Stigum (1990), p. 1024.

[15] See, for example, Calomiris (1994) or Stigum (1990), pp. 1037–1038. After Penn Central, paper without backup credit or credit ratings typically sold at prohibitive discounts.

Table IV

Time-series Regressions on Yield Spreads

SPR is the 180-day commercial paper rate minus the 26-week Treasury bill rate, as reported by the Fed. $SPR_{FIRST(y)}$ is the average of SPR over the week ending with the Friday between January 7 and January 13 of year *y*, and $SPR_{FIRST(y)\text{-}2}$ is the average over the week two weeks earlier. *p*-values are in italics.

y	b_0	b_1	R^2
Panel A: Model is $(SPR_{FIRST(y)\text{-}2} - SPR_{FIRST(y)}) = b_0 + b_1 SPR_{FIRST(y)} + e_y$			
1959–1970	0.0304	−0.0095	0.00%
	0.6193	*0.9337*	
1971–1996	0.0562	0.3394	32.56%
	0.3235	*0.0023**	
Panel B: Model is $(SPR_{FIRST(y)\text{-}2} - SPR_{FIRST(y)}) = b_0 + b_1 SPR_{FIRST(y)\text{-}2} + e_y$			
1959–1970	−0.0175	0.1045	9.65%
	0.7653	*0.3258*	
1971–1996	−0.0156	0.3411	66.82%
	0.6988	*0.0000**	

* Null rejected at the 1% level.

from holding a dollar in TB rather than CP is the risk of CP minus the risk of TB, for which the standard metric is the yield spread. In the window dressing economy, big yield spreads accompany big next-year discounts.

This prediction is testable on the data from Figure 3. If we let SPR = CP180–TB26W, then $SPR_{FIRST(y)\text{-}2}$ is the credit spread plus the next-year discount, and $SPR_{FIRST(y)}$ is just the credit spread, so the window dressing model predicts a positive relationship between $(SPR_{FIRST(y)\text{-}2} - SPR_{FIRST(y)})$ and $SPR_{FIRST(y)}$ in the post-Penn-Central period (i.e. $y > 1970$). There is no prediction for the earlier period. Results from OLS regressions are given as Panel A of Table IV.

The regressions pick up a significant positive relationship in the post-Penn-Central years, and none before. Both the cross section and the time series of next-year discounts conform to the window dressing model.

The rest of Table IV shows how to extract useful predictions from this relationship. We can write $SPR_{FIRST(y)\text{-}2}$ as $SPR_{FIRST(y)} + (SPR_{FIRST(y)\text{-}2} - SPR_{FIRST(y)})$, and we know that $(SPR_{FIRST(y)\text{-}2} - SPR_{FIRST(y)})$ is positively related to $SPR_{FIRST(y)}$, so it stands to reason that $SPR_{FIRST(y)\text{-}2}$ predicts $(SPR_{FIRST(y)\text{-}2} - SPR_{FIRST(y)})$. Panel B reports an R^2 of 67 percent for this regression after Penn Central, and only 10 percent before.

The capital-gains tax is irrelevant to the paper and bills analyzed above, but the income tax is not. Interest earned on both CP and TB is susceptible to federal income tax, but only CP interest is taxed by states. The interest on same-year instruments is taxed in the same year, while the interest on next-year instruments is taxed in the next year, and this could affect the CP-TB spread. Paper maturing in the next year may be relatively more valuable than

Table V

12/31/1992 Portfolio of the Life Insurance Industry in Billions of Dollars

	Dollar Value	Percent of Total
Checkable deposits and currency	$ 4.8	0.30
Money market fund shares	30.3	1.88
Mutual fund shares	70.7	4.38
Corporate equities	121.7	7.54
Treasury securities	88.8	5.50
Agency securities	193.0	11.96
Tax-exempt securities	11.4	0.71
Corporate & foreign bonds	653.9	40.51
Mortgages	246.7	15.28
Open market paper	12.9	0.80
Policy loans	72.1	4.47
Miscellaneous	108.0	6.69
Total	1614.3	

paper maturing in the same year, because the extra tax has a smaller present value. But this implies a premium for next-year paper, rather than the discount we observe.

In the window dressing model, intermediaries move prices with their strategic responses to portfolio disclosures. Cross sections and time series of money market prices show the predicted price movements, but cannot show the strategic responses themselves. These might seem invisible, but they aren't quite. Flow of funds data from the Federal Reserve allow some tests of the window dressing model on portfolio decisions of intermediaries, which are the subject of the next section.

V. Portfolio Adjustments around Disclosure Events

In the window dressing model, disclosed portfolios underrepresent the riskiness of undisclosed portfolios. For example, the 12/31 portfolios of intermediaries who report holdings as of 12/31 but not 9/30 or 3/31 should underrepresent the riskiness of 9/30 or 3/31 portfolios. This hypothesis is testable on the flow of funds (FOF) data from the Fed, which report the aggregate quarter-end portfolios of various industries active in the money market, including one group where 12/31 disclosures are much more common than 9/30 or 3/31 disclosures, and another where all quarter-end portfolios are disclosed. I determine the group to which each industry belongs, and then test the model by comparing their year-end and quarter-end portfolios.

The FOF data for a given industry and a given quarter are dollar amounts invested in each of several asset categories, as in Table V, which shows the 12/31/1992 data for the life insurance industry. Of the twelve categories shown, five can reflect short-term investments: checkable deposits and currency, money market fund shares, Treasury securities, agency securities, and open-market paper (the Fed's term for CP plus bankers' acceptances (OMP)). But most of these categories include both risky and nonrisky instruments; Treasury and agency securities can be either long-term or short-term, money-market funds can be either Treasury-only or unconstrained, and checkable deposits and currency can be either checkable deposits or currency. The OMP data refers only to money market instruments with default risk, and so is the best opportunity to gauge the quarter-to-quarter variation in portfolio risk. An intermediary that window dresses its short-term portfolio on 12/31 but not 9/30 or 3/31 would hold less OMP on 12/31 than on 9/30 or 3/31.

A. Annual Group

Members of the annual group are industries satisfying two criteria:

1. 12/31 disclosures are more common than 9/30 or 3/31 disclosures.
2. FOF data on 9/30 and 3/31 portfolios reflect information on portfolio composition which is not available, or not easily available, to the public.

By the first criterion, there should be more window dressing on 12/31 than on 9/30 or 3/31. By the second, this window dressing should be apparent in the data.

Life insurance companies must report their year-end portfolios to state regulators, which in turn makes them available to the general public. These reports list all money market instruments held on 12/31, but not any money market instruments that were previously in the portfolio but have since matured or been sold.[16] At the ends of other quarters, the aggregate value of the money market portfolio is reported, but its constituent securities are not.[17] The Fed can nonetheless observe the distribution of instruments held by life insurers on these dates because the American Council of Life Insurance (a trade group not affiliated with regulators) conducts quarterly surveys of its members' portfolios and makes aggregate levels for different asset types available to the public.[18]

A private pension fund is obliged by the Employee Retirement Income Security Act of 1974 (ERISA) to report all money market investments held at the end of its fiscal year, but does not have to report bank CDs or high-rated CP held between fiscal year-ends.[19] Plan years generally correspond to employers' fiscal year-ends, so this reporting date is 12/31 more often than not. The *Guide* reports that this annual data "... is converted to quarterly and estimated for current periods using proprietary Trust Universe Comparison Service data on employee benefit plans obtained from Wilshire Associates," (p. 372, BOGFRS (1993)) allowing us to observe the approximate sum of these otherwise unobservable portfolios.

[16] See Schedule DA from the annual statement to the insurance commissioner.

[17] See Schedule DA from the quarterly statement to the insurance commissioner.

[18] All facts about the sources of FOF data come from *Guide to the Flow of Funds Accounts,* Board of Governors of the Federal Reserve System (BOGFRS) (1993).

[19] 29 CFR 2520.103–111.

Public pension funds are exempt from ERISA, but operate in similar reporting environments that vary from one jurisdiction to the next. The Bureau of the Census summarizes their investments in *Government Finances,* an annual publication, and *Finances of Selected Public Employee Retirement Systems,* which is quarterly. The FOF quarterly observations are ". . . based on unpublished data provided by Bureau of the Census from material collected for *Finances of Selected Public Employee Retirement Systems,*" (p. 337, BOGFRS (1993)) so this is another opportunity to observe, in aggregate, quarter-end portfolios that are difficult to observe individually.

Money market mutual funds (MMMFs) operate under the Investment Company Act of 1940, which in section 30(d) requires a balance sheet and ". . . a list showing the amounts and values of securities owned on the date of such balance sheet," at least semiannually. MMMFs therefore have to choose a fiscal year-end and a reporting frequency, which together determine their disclosure dates.

The high frequency of 12/31 and 6/30 disclosures relative to 3/31 and 9/30 disclosures is apparent in the Wiesenberger Financial Services (1977 and 1987) data on money funds. Among the twenty largest funds that invested in nongovernment instruments in 1977, 15 reported their 12/31 and 6/30 portfolios, while only 5 reported their 3/31 and 9/30 portfolios. More to the point, 11 funds reported on 12/31 but not 9/30 or 3/31, while only one fund reported on 3/31 and 9/30 but not 12/31. Of the top twenty in 1987, 9 reported 12/31 portfolios, and of these, 7 did not report on 3/31 or 9/30. Only 3 reported on 3/31 and 9/30 but not 12/31. There is less reporting in all other months.

For a large portion of MMMFs, managing a relatively large portion of the money market instruments outstanding, 12/31 is a big disclosure event while 9/30 and 3/31 are not. The portfolios on these other dates are not entirely unobservable, though. Most MMMFs report their portfolios every week to *Money Fund Report,* a trade publication with a small circulation and a large subscription price ($1195/year for weekly printouts (p. 18, *Money Fund Report* (1994))). The Investment Company Institute summarizes the *Money Fund Report* data, and reports aggregate month-end portfolios of the MMMF industry to the Fed and the general public.[20] So the FOF data allow us to observe aggregated quarter-end portfolios that are expensive, although not impossible, for the public to observe directly.

Other mutual funds[21] are subject to the same regulation. The FOF data reflect reports made by funds to the Investment Company Institute.

[20] The FOF data lump Treasury-only funds together with less restricted funds. Systematic differences between year-end and quarter-end data may reflect substitutions by investors between these types of funds rather than substitutions by managers between types of instruments.

[21] "The mutual funds sector in the (FOF data) cover all open-end investment companies (including unit investment trusts) that report to the Investment Company Institute (ICI) except (MMMFs) and limited-maturity municipal bond funds. . . ." BOGFRS (1993), p. 386.

B. Quarterly Group

Industries in the quarterly group are those for which the FOF data represent quarterly disclosures to regulators or the public. This is a control sample, in which the effect of disclosures is equal across quarter-ends and year-ends.

For a given quarter, the OMP position of commercial banks is the sum across reporting banks of CP and bankers' acceptance holdings listed in the *Report of Condition*.[22] The OMP position of brokers and dealers is the "[l]evel from SEC tabulation of FOCUS (*Financial and Operational Combined Uniform Single Report*) and FOGS (*Finances and Operations of Government Securities Brokers and Dealers*) reports, Bankers acceptances, certificates of deposit, and commercial paper," BOGFRS (1993), p. 400.

The FOF data also reports the Fed's own holdings. This series reflects their abandoned policy of supporting the acceptance market, showing small positions before 1978 and zero afterward, and comes directly from public portfolio disclosures. Federal home loan banks (FHLBs) disclose their end-of-quarter OMP positions to their regulatory agency (the Federal Housing Finance Board). The FOF data for government-sponsored enterprises is the sum of these positions across the FHLBs, as reported in the quarterly combined statement of condition.[23]

C. Quarter-End Versus Year-End OMP Investment

The window dressing model predicts lower OMP investment on 12/31 than on 9/30 or 3/31 for the annual industries in the post-Penn-Central years with next-year discounts. Quarterly industries, on the other hand, should see the next-year discount as a bargain if it reflects window dressing, and hold more OMP at year-end. If the discount reflects higher risk, and not window dressing, there is no reason they should hold more.

I conduct two tests on the FOF data. Letting $\mathrm{OMP}_{i,y,q}$ be the OMP position of industry i at the end of quarter q of year y, I first subtract $(\mathrm{OMP}_{i,y,3} + \mathrm{OMP}_{i,y+1,1})/2$ from $\mathrm{OMP}_{i,y,4}$ for each year with available data for industry i, and test whether the difference is negative for annual industries and positive for quarterly industries. For the second test, I define $\mathrm{TOT}_{i,y,q}$ to be the total investment of industry i in financial assets at the end of quarter q of year y, and OMPPER to be $(\mathrm{OMP}/\mathrm{TOT}) \times 100$, and test whether $\mathrm{OMPPER}_{i,y,4} - (\mathrm{OMPPER}_{i,y,3} + \mathrm{OMPPER}_{i,y+1,1})$ is negative for annual industries and positive for quarterly industries. The first test measures how much OMP the industry holds at year-end relative to adjacent quarter-ends, whereas the second test measures the industry's year-end portfolio weight in OMP relative to adjacent quarters. In each case I measure the statistical significance of the mean difference and the number of positive *versus* negative differences. There are 24 data points for some industries (i.e., y from 1970 to 1993), and fewer for most.

[22] BOGFRS (1993), pp. 244, 262, and 278.
[23] BOGFRS (1993), p. 211.

Table VI

Year-End vs. Quarter-End Investment in Open-Market Paper

OMP is open-market paper, the Fed's term for commercial paper plus bankers' acceptances. $OMP_{i,y,q}$ is the OMP investment of industry i at the end of quarter q of year y. *mean* is the average of $OMP_{i,y,4} - (OMP_{i,y,3} - OMP_{i,y+1,1})/2$ for the years in $y \in (1971, \ldots, 1994)$ with data available for i, *prob* ≤ 0 is the p-value for the null hypothesis that 12/31 investment is not higher on 12/31, *prob* ≥ 0 is the p-value for the null hypothesis that 12/31 investment is not lower on 12/31, *pos*/(*pos* + *neg*) is (number of positive observations)/(number of positive or negative observations), and B(X, N, 0.5) is the probability that a variable following a binomial with $p = 0.5$ and $n = N$ would be $\leq X$. $OMPPER_{i,y,q}$ is the percent of industry is portfolio allocated to OMP at the end of quarter q of year y. *mean* is the average of $OMPPER_{i,y,4} - (OMPPER_{i,y,3} - OMPPER_{i,y+1,1})/2$ for the years in $y \in (1971, \ldots, 1994)$ with data available for i.

Panel A: Summary of $OMP_{i,y,4} - (OMP_{i,y,3} - OMP_{i,y+1,1})/2$, in $Billion

Annual Industries	Mean	Prob $\geq$ 0	Pos/(pos + neg)	B(pos,pos + neg,0.5)
Life insurance	−1.86	0.0000*	1/24	0.0000*
Private pension funds	−0.45	0.0712***	7/21	0.0946***
State & local pension funds	−0.22	0.1232	3/11	0.1133
Money market mutual funds	−2.47	0.0073*	4/20	0.0059*
Other mutual funds	−1.34	0.0078*	6/24	0.0113**
Quarterly Industries	**Mean**	**Prob $\leq$ 0**	**Pos/(pos + neg)**	**B(neg,pos + neg,0.5)**
Commercial Banks	0.89	0.0002*	20/24	0.0008*
Brokers and Dealers	1.29	0.0102**	15/18	0.0038*
Government-Sponsored Enterprises	0.41	0.0263**	13/21	0.1917
Monetary Authority	0.84	0.0466**	5/7	0.2266

Panel B: Summary of $OMPPER_{i,y,4} - (OMPPER_{i,y,3} - OMPPER_{i,y+1,1})/2$, in Percent

Annual Industries	Mean	Prob $\geq$ 0	Pos/(pos + neg)	B(pos,pos + neg,0.5)
Life insurance	−0.33	0.0000*	1/24	0.0000*
Private pension funds	−0.02	0.2027	8/22	0.1431
State & local pension funds	−0.00	0.4806	4/11	0.2744
Money market mutual funds	−0.69	0.1119	9/20	0.4119
Other mutual funds	−0.32	0.0497**	7/24	0.0320**
Quarterly Industries	**Mean**	**Prob $\leq$ 0**	**Pos/(pos + neg)**	**B(neg,pos + neg,0.5)**
Commercial Banks	0.05	0.0042*	19/24	0.0033*
Brokers and Dealers	1.46	0.0148**	12/18	0.1189
Government-Sponsored Enterprises	0.08	0.0302**	13/22	0.2617
Monetary Authority	0.07	0.0491**	5/7	0.2266

* Null rejected at the 1% level.
** Null rejected at the 5% level.
*** Null rejected at the 10% level.

The results, summarized in Table VI, support the window dressing model. All signs are in the right direction, and many p-values are significant at standard rejection levels. The annual industries hold less paper exactly when it costs less, and the quarterly industries hold more.

Evidence of year-end window dressing is strongest, by all measures, for the life insurance industry, the only of the five annual industries where 12/31 disclosures are mandatory.[24] The weaker evidence for the other industries may reflect their latitude to choose fiscal year-ends when window dressing is cheaper. The migration away from 12/31 fiscal year-ends between 1977 and 1987 in the MMMF industry is consistent with the industry discovering and adapting to the cost of year-end window dressing.

The portfolio decisions of institutional investors support the window dressing model. Comparisons between investor types indicate that intermediaries charge more to bear risk during disclosures, and that the next-year discount represents a bargain when disclosures are controlled for. These facts distinguish the window dressing model as a source of accurate predictions of money market behavior.

VI. Relationship to the January Effect

The literature on the January Effect has benefitted from reports on January price shifts in other countries, markets, and eras. They serve as control tests, determining whether the effect is robust to variations in the investment-decision environment. The money market results above are in that tradition; the next-year discount delivers price increases for commercial paper relative to Treasury bills on the same schedule as the price increases for small relative to large stocks. This correspondence is suggestive, but is there any other reason to believe that the two patterns represent the same economic force? Considering that the popular tax-loss explanation for the January Effect is irrelevant to the next-year discounts, a closer look is in order.

Let DECi_p and β_i be the period p return and beta (relative to some stock market index) of the ith size decile of New York Stock Exchange (NYSE) stocks, where decile 1 has the smallest stocks. In the window dressing model, portfolio managers with 12/31 disclosure events cause the January Effect when they charge a higher price to bear riskier stocks and recent losers across the turn of the year. The effect on decile 1 stocks relative to decile 10 stocks reflects both their lower recent returns and their larger contributions to portfolio risk; the finance literature has demonstrated repeatedly that $\beta_1 > \beta_{10}$, and to a first approximation the reduction in portfolio variance from tilting away from decile 1 and toward decile 10 is proportional to $(\beta_1 - \beta_{10})\sigma^2_{\mathrm{M}}$, where σ^2_{M} is the current variance of the stock market. When σ^2_{M} is bigger, the reduction is bigger. Since the reduction is the marginal benefit of window dressing and the January Effect measures the marginal cost of the last dollar of window dressing, the January Effect should be bigger too.

New methods for tracking σ^2_{M} make this a testable prediction. Specifically, the assessment of Whitelaw (1994) that the spread between six-month CP and TB rates is "the primary predictor of stock market volatility" means it should

[24] The only year-end when the life insurance industry did not move out of OMP, 1989–1990, is the only one of the 24 years for which Figure 3 shows a spread *decrease* across 12/31.

Table VII

Regressions of Decile Returns on Spreads and Spread Changes

SPR is the 180-day commercial paper rate minus the 26-week Treasury bill rate, as reported by the Fed. $SPR_{FD,y}$ is SPR on the first trading day of year y, $\Delta SPR_{FD,y}$ is $SPR_{FD,y}$ minus SPR on the last trading day of year $y-1$, and $\Delta SPR_{m,y}$ is the change in SPR over month m of year y. $DECi_{m,y}$ is the return of New York Stock Exchange (NYSE) capitalization decile i in month m of year y, where the smallest stocks are in decile 1, and $DECi_{FD,y}$ is the return on the first trading day of year y. $y \in (1971, \ldots, 1995)$ in each regression. The t-statistics are in parentheses.

January				
$(DEC1_{1,y} - DEC10_{1,y})$	=	0.0019	$+0.1645SPR_{FD,y}$	$R^2 = 37.59\%$
		(0.06)	(3.72)*	N = 25
$(DEC1_{1,y} - DEC10_{1,y})$	=	0.0313	$-0.3367\Delta SPR_{1,y}$	$R^2 = 62.40\%$
		(1.82)***	(−6.18)*	N = 25
First Trading Day				
$(DEC1_{FD,y} - DEC10_{FD,y})$	=	0.0093	$+0.0227SPR_{FD,y}$	$R^2 = 42.93\%$
		(2.51)**	(4.16)*	N = 25
$(DEC1_{FD,y} - DEC10_{FD,y})$	=	0.0158	$-0.0669\Delta SPR_{FD,y}$	$R^2 = 16.29\%$
		(4.10)*	(−2.12)**	N = 25
February through December (i.e. $m \in (2, \ldots, 12)$)				
$(DEC1_{m,y} - DEC10_{m,y})$	=	−0.0030	$-0.0070\Delta SPR_{m,y}$	$R^2 = 0.31\%$
		(−1.14)	(−0.93)	N = 275

* Significantly different from zero at the 1% level.
** Significantly different from zero at the 5% level.
*** Significantly different from zero at the 10% level.

correlate across years with the January Effect. Since this is the same prediction derived above for the next-year discount for CP180, it also means that January Effects and contemporaneous changes in SPR (defined as in Section IV) should be correlated across years. To test this prediction I let $DECi_{FD,y}$ and $\Delta SPR_{FD,y}$ be the decile i return and change in SPR in the first trading day of year y, $DECi_{m,y}$ and $\Delta SPR_{m,y}$ be the return and change in month m of year y, $SPR_{FD,y}$ be SPR on the first trading day of year y, and fit ordinary least squares (OLS) models for $y \in (1971, \ldots, 1995)$. Results are reported in Table VII.

The regressions bear out the predictions of the window dressing model. Year-to-year variation in the January Effect is significantly correlated with variation in the six-month spread and with variation in the next-year discount for six-month paper.[25] This result holds for returns across the turn of the year and across all of January and is far from the usual relationship between the markets, as evidenced by the regression for all months *except* January.

The window dressing model does not predict an offsetting December Effect. Recall that n-day paper becomes next-year sometime around n days before 12/31, and that the window dressing model predicts a downward shift in the relative price of n-day paper when that happens. This prediction is testable

[25] Since default spreads are generally higher after market declines, this result can explain the observation of Dyl and Maberly (1992) and others—which they take to be evidence of tax-loss selling—that January Effects are bigger when recent returns are lower.

because the transition to next-year is identifiable. The same is not true for equities, because there is no point at which a common stock becomes next-year. The onset of window dressing should depress prices before year-end, but exactly when is not known.

The prediction that the decile returns would support is that window dressing begins after the end of the third quarter. Over the 1971–1995 period, we observe (t-statistics for difference from zero in parentheses):

DEC1 return minus DEC10 return in 1971–1995

Fourth Quarter			January		February to September
1st day	October	Entire Quarter	1st day	Entire Month	
−0.49%	−3.41%	−4.13%	2.16%	9.07%	0.93%
(−2.63)*	(−3.26)*	(−2.30)*	(7.21)*	(3.91)*	(0.35)

* Significantly different from zero at the 5% level.

There is a significant downward shift in the fourth quarter, larger than the upward shift across the year-end, but smaller than the return across all of January.[26] Price shifts are significant on the first day and in the first month of the fourth quarter, and small in November and December. The data are consistent with a transfer of riskier stocks soon after 9/30 from intermediaries who disclose on 12/31 but not 9/30 to those who disclose on 9/30 but not 12/31.[27]

The results of this section are new evidence that at least some of the January Effect represents window dressing by portfolio managers, and not tax-loss selling. Time series comparisons show it to be not only synchronized but also highly correlated across years with next-year discounts in the money market. This would be an odd coincidence if the patterns were economically unrelated, but is a natural feature of a window dressing economy. The patterns coincide because disclosure dates coincide, and they vary together because one variable measures the effect of window dressing on portfolio risk in both markets.

VIII. Summary and Conclusion

The main empirical result of this article is that commercial paper sells at a discount if it matures in the next year, but Treasury bills do not. The discount is bigger for paper with more default or interest-rate risk at the end of the year. This pattern is consistent with either the quantity of risk, or the price charged to bear risk, being higher at the end of the year. A higher price for bearing risk is predicted by the window dressing model.

[26] HL postulate that window dressing-related trading would have a bigger overall effect on prices before the year-end if it weren't so diffuse, and that window dressing-related trading is not diffuse after the year-end because intermediaries regard the affected stocks as short-lived bargains.

[27] Sias and Starks (1997) observe that stocks underrepresented in third-quarter portfolio disclosures subsequently have larger January Effects.

In the window dressing model, intermediaries choose portfolios for disclosure dates which underrepresent the riskiness of portfolios held on nondisclosure dates. They are willing to trade some value for the benefits which accrue from the underrepresentation. Evidence of this tradeoff is apparent in both the time series of discounts and the variation of portfolio adjustments across intermediary types. The evidence for window dressing by life insurance companies, which manage about $2 trillion, is especially strong.

The next-year discounts are not only cosynchronous but also highly correlated across years with the January Effect of the stock market, but the tax loss model often connected with the January Effect cannot explain the discounts. The correlation, which is far from the usual relationship between the two markets, is endogenous to the window dressing model because the default spread in the money market is a good estimate in both markets of the effect of window dressing on current portfolio risk.

There are at least two areas for future research indicated by these results. First, the evidence of window dressing would be easier to interpret with a formal model in which intermediaries know, or at least believe, that window dressing is optimal. It is often assumed that such a model would have to involve irrational behavior; it would be useful to know whether this is really necessary. Second, the evidence that window dressing moves prices in the money market indicates that nonwindowdressers are not willing to hold arbitrarily much paper at the same price. Their demand curves slope down, and it would be interesting to know why.

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