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The Effect of a Rating Downgrade on Outstanding Commercial Paper

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ABSTRACT

Diamond (1991) argues that a firm's reputation determines whether it borrows directly or through an intermediary. We test the Diamond model by examining the quantity response of commercial paper issued by bank holding companies to a rating downgrade. From 1986 to 1991, cumulative abnormal declines averaged 6.69 percent in the first two weeks after the downgrade and 11.05 percent in the subsequent 12 weeks. In contrast to commercial paper issued by bank holding companies, large CDs issued by affiliated banks did not change significantly in the period around a downgrade, suggesting that deposit insurance may have removed market discipline from the CD market.

THE OBJECTIVE OF THIS study is to test Diamond's (1991) theory of corporate capital structure in which a firm's reputation determines whether it borrows directly or through an intermediary. In Diamond's model, a firm without an established reputation will borrow through, and be monitored by, an intermediary. By building a good reputation, a firm may gain access to the nonintermediated markets, such as the commercial paper market, and, consequently, avoid the cost of monitoring. In the process of maintaining its reputation, a firm may eliminate the conflict of interest between borrowers and lenders about the choice of risk in investment decisions. Such firms have an incentive to maintain their reputation because the reputation itself has become a valuable asset that reduces borrowing costs. In the model, a firm that loses its reputation will find the cost of placing debt directly prohibitively expensive.

Using event study methodology, we test the Diamond model by examining the quantity response of commercial paper (CP) to a rating downgrade of the issuing company. We focus on ratings because firms that borrow in the CP market usually have high ratings. In part, these ratings reflect the firms' reputation for selecting safe investments. In the Diamond framework, if credit ratings proxy for reputation, then a rating downgrade may be associated with a decline in the amount of outstanding CP. This change in capital structure may occur relatively rapidly because outstanding CP typically has a

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maturity of only 20 to 45 days. However, the adjustment may be spread out over several weeks, rather than occurring immediately, because the quantity of CP cannot decline until existing paper matures.

We use a sample of outstanding CP of bank holding companies (BHC) to analyze the announcement impact of 41 rating downgrades in the 1986 to 1991 period. For each BHC that Moody's downgraded, we estimate a model of outstanding CP over a two-year, preevent period. The coefficient estimates from this model are used to estimate expected and unexpected changes in outstanding CP for the period surrounding the rating change. The results from the study indicate that outstanding CP declined markedly in the weeks after a downgrade. Cumulative unexpected declines average 6.69 percent in the first two weeks after a downgrade and 11.05 percent from the second to the thirteenth week after the downgrade. The amount of CP did not fall significantly before the downgrade, a result indicating that the market did not anticipate the news associated with the downgrade. This evidence is consistent with the predictions of the Diamond model.

In an alternative test of the model, we examine the amount of large uninsured certificates of deposit (CDs) issued by the bank subsidiaries of BHCs in the period around rating downgrades. Bank CDs carry de facto Federal Deposit Insurance Corporation (FDIC) insurance, whereas BHC CP is strictly the obligation of the issuing firm. In the Diamond framework, this difference between CDs and CP becomes important if investors in CDs rely on the reputation of the FDIC, rather than the reputation of the issuing bank. In contrast to outstanding CP, outstanding CDs did not change significantly after a downgrade. This finding suggests that FDIC insurance of large CDs may have removed market discipline from the CD market.

Previous research on rating changes has examined price reactions in the stock and bond markets. Weinstein (1977) finds that corporate bond returns were unaffected by rating changes, which suggests that market participants view ratings as reflecting information that is already available. Davidson and Glascock (1985) draw similar conclusions in their study of the reaction of stock prices to preferred stock rating changes. However, the evidence in other studies suggests that rating announcements provide valuable information to investors. Hand, Holthausen, and Leftwich (1992) find significant bond and stock price effects associated with additions to Standard & Poor's CreditWatch list and with actual rating changes by Moody's and Standard & Poor's. Likewise, Wansley and Clauretie (1985) find that a firm's bond and stock prices respond significantly to an announcement of a CreditWatch placement.[1]

Although we also study rating announcements, our paper differs fundamentally from the previous research. In examining price reactions, the previous research tested whether ratings convey new information to investors and

[1]Other studies on the information content of rating changes include Ederington, Yawitz, and Roberts (1987), Grier and Katz (1976), Griffen and Sanvicente (1982), Hettenhouse and Sartoris (1976), Holthausen and Leftwich (1986), Ingram, Brooks, and Copeland (1983), Katz (1974), and Pinches and Singleton (1978).

whether markets react efficiently to ratings announcements. By focusing on quantity reactions, we use rating announcements to test a firm-specific theory of capital structure.[2] The reputation theory that we test relies on asymmetric information about a borrower's investment opportunities to explain the choice of financing decisions.

The paper is organized as follows. Section I describes the Diamond model and presents background material on the CP and CD markets. Section II describes the sample of CP and CDs and the data on Moody's rating changes. Section III discusses the event study methodology. Section IV presents empirical results, and the concluding section summarizes the findings.

I. Background

CP is a short-term senior note issued by a corporation. The Securities Act of 1933 exempts CP from registration requirements if note maturities do not exceed nine months and if the proceeds are used to finance current transactions. At year-end 1991, money market mutual funds, the largest single investor group, held about 40 percent of the $530 billion in outstanding CP. Other major investors include insurance companies, bank trust departments, and nonfinancial corporations.[3]

A. Credit Ratings and Reputation in the Commercial Paper Market

Virtually all U.S. CP programs are rated by at least one nationally recognized credit rating agency. Moody's Investors Services, for example, employs four rating designations: Prime-1 (P-1), Prime-2 (P-2), Prime-3 (P-3), and Not Prime (NP). Paper rated P-1, P-2, or P-3 is considered investment grade. At year-end 1991, programs rated P-1 or P-2 accounted for 97 percent of all CP rated by Moody's. According to Moody's, firms with low ratings seldom borrow in the CP market. Rather than issuing CP, low-rated nonfinancial firms rely almost exclusively on banks and finance companies for short-term funding. For low-rated financial corporations, asset securitization has become a major source of funding.

These stylized facts about the CP market are difficult to reconcile with the Modigliani and Miller (1958) theory of corporate capital structure, in which information is perfect, financing decisions do not matter, and financial intermediaries are irrelevant. Other capital structure theories have introduced asymmetric information to explain financing decisions and the existence of financial intermediaries. When borrowers possess private information about the prospects of their investment projects and lenders cannot sort borrowers

[2]An optimal capital structure exists at the firm level in Diamond's model. This firm-specific capital structure theory differs from other theories, such as Miller (1977), in which a firm's capital structure decision is irrelevant, although an equilibrium aggregate debt-to-equity ratio exists.

[3]The commercial paper market is described in greater detail in Crabbe and Post (1992), Dawson (1990), Fons and Kimball (1991), and Lucas and Noe (1989).

by available projects, then borrowers have an incentive to choose risky projects over safe ones. In response to these incentives, financial intermediaries may form to monitor the outcomes of risky projects (see Diamond (1984)).

Diamond (1991) develops a model in which a firm's reputation determines whether it borrows directly or through an intermediary. In the Diamond model, some firms may choose to establish a reputation for consistently selecting safe projects. Firms with a solid reputation have a lower cost of capital because they raise funds in the direct markets, such as the CP market, rather than through intermediaries who receive a monitoring fee. Firms without a good reputation find financing in the direct markets prohibitively expensive, and they therefore choose to raise funds through intermediaries.

Diamond's model gives rise to testable predictions about how a firm will change its capital structure in response to exogenous developments. For example, in response to a mean-preserving increase in the risk to outcomes of investment projects, a firm may choose riskier projects, rather than maintain its reputation. In this process, as firms lose their reputation, they shift their financing away from the direct (nonintermediated) markets. In the case of the CP market, the Diamond model predicts that a firm will reduce CP borrowing as its reputation declines.[4] The Diamond model also predicts complementary adjustments in other financial quantities. For a nonfinancial firm, the model predicts a switch from CP to the intermediated markets, such as the bank loan and private placement markets. For a financial firm, the model predicts a substitution to asset securitization.[5]

In our event study, we argue that ratings serve as a proxy for a firm's reputation, as firms with high ratings typically have established a history of choosing safe investment projects. A rating change, therefore, may capture new information about the reputation of the borrower. In the 1980s, for example, the rating agencies often downgraded BHCs after announcements of

[4]In the steady state of the Diamond (1991) model, firms do not finance partly in the direct markets and partly in the intermediated markets; rather, the choice of financing in the direct markets is an all-or-nothing decision. Our event study intends to capture a firm's adjustment to a new steady state. It is worth noting that the all-or-nothing feature of Diamond's model is the result of its highly stylized nature with only three types of firms. More realistically, with a continuum of firm types, a spectrum of reputations and ratings may exist. Moreover, rating agencies and lenders often have differing opinions about a borrower's reputation. These complications may give rise to an equilibrium in which a firm finances partly in both markets.

Microdata on the distribution of short-term funding is difficult to obtain, but available data for finance companies are generally consistent with the all-or-nothing prediction of the Diamond model. According to the March 31, 1991 "Domestic Finance Company Report of Consolidated Assets and Liabilities," 40 percent of the companies surveyed had no CP outstanding, while 49 percent relied on CP for 85 percent or more of their short-term funding, and 32 percent relied on CP for all of their short-term funding.

[5]Asset-backed securities, which typically have triple-A ratings, are legally structured as a sale of assets. As a result of this structure, the riskiness of an asset-backed security has no direct relationship to the riskiness and reputation of the seller of assets.

large provisions for problem loans at their subsidiary banks. Such announcements may have damaged the reputation of the borrower and also triggered the rating change. To evaluate the information content of ratings, we examine abnormal changes in outstanding CP of BHCs before and after rating changes.[6] We use data for BHCs because they are the only high-frequency microdata on CP available.

B. Reputation and Large Certificates of Deposit

Large CDs issued by banks are similar in several respects to CP issued by BHCs. First, both securities have relatively short maturities. Second, large CDs and CP are "purchased funds" that the issuers use in liability management. Core deposits, in contrast, represent a more stable, passive source of bank funding. Third, many investors view the securities as close substitutes. Accordingly, if ratings convey information about a bank's reputation, then a downgrade may be associated with unexpected declines in the CP, CDs, and, possibly, the total liabilities of the bank.

For two reasons, however, the reaction in the CD market to a downgrade may differ from that in the CP market. First, the quantity of CDs may be slow to adjust because CDs typically have maturities of 30 to 120 days or longer, compared with 20 to 45 days for CP. This difference in maturities may make the response in the CD market more difficult to measure statistically. Second, and more importantly, the existence of the federal safety net might reduce market discipline in the market for CDs. In cases of bank failure, holders of large CDs have nearly always received full payment from the FDIC; in contrast, holders of securities issued at the holding company level may expect to receive less than 50 cents on the dollar.[7] Consequently, if investors believe that large CDs have de facto deposit insurance, the market price and quantity of CDs will reflect the implicit guarantee of the FDIC, instead of the reputation of the issuing bank.

Previous research on CD rates has generally concluded that FDIC insurance has not completely removed market discipline from the CD market. In

[6] In the CP market, the process by which a borrower gradually withdraws from the market as its financial condition worsens is referred to as "orderly exit." In the orderly exit process, investors may avoid losses on CP holdings because deteriorating credit shifts financing away from the CP market. Lucas and Noe (1989) and Fons and Kimball (1991) argue that the orderly exit process accounts for the low incidence of defaults in the CP market. Indeed, between the Penn Central default in 1970 and 1989, only one company defaulted while rated investment grade by Moody's. Although defaults increased in 1989 and 1990, the default rate in the CP market has remained low compared with that of the bank loan and corporate bond markets. Institutional factors also play a role in the orderly exit process. For example, some investor groups, most notably money market mutual funds, are generally prohibited from holding paper rated P-3 and below. Other investor groups often have limitations or outright restrictions on holdings of low-rated paper written into their bylaws or statutes. See Crabbe and Post (1992).

[7] The amount that investors of BHC obligations receive in the event of bankruptcy will depend on the amount of liquid assets of the BHC at the time of insolvency, the seniority of the claim and the relative amounts of senior and subordinated notes outstanding, and the regulatory environment.

an analysis of time series data on CD offering rates of money center banks from 1982 to 1988, Ellis and Flannery (1991) find that the CD market assesses bank risk in setting CD spreads. In cross-sectional studies of the determinants of CD rates, Cargill (1989) and James (1988) likewise find that CD rates reflect the riskiness of the bank. However, Hannan and Hanweck (1988) find a negative relationship between CD rates and bank size, a finding suggesting that FDIC closure policies at large banks may isolate CD holders from market risk.

Our analysis of the response of the quantity of BHC CP and bank CDs to rating changes complements the previous research on the effect of FDIC insurance on CD rates. Finding that the quantities of CP and CDs decrease after downgrades would suggest that both BHCs and banks are subject to market discipline. However, finding that rating downgrades decrease CP but do not affect CDs may indicate that FDIC insurance has removed market discipline from the CD market. In an extreme case, banks could try to shift the increased cost of funding to the FDIC. In this case, the quantity of CDs could increase after a downgrade if banking organizations shift borrowing from the CP market to the CD market.

II. The Data

The data analyzed consist of a sample of weekly (Wednesday) outstanding CP of rated BHCs for the period 1984 to 1991. Data on outstanding CP were obtained from the report form FR 2416, "Weekly Report of Assets and Liabilities for Large Banks." Banks submit this form to their regional Federal Reserve Banks. Outstanding CP, a memo item on the report form, is issued by the parent BHC or affiliated firms of the reporting bank. From the same report form, we also gathered data on large CDs (those over $100,000) issued by the bank and the total liabilities of the bank. In our event study, described in the next section, we model quantities over a two-year, preevent period. Therefore, all rating changes in the sample were announced between 1986 and 1991.

Using the *Moody's Bond Survey* and the *Moody's Global Short-Term Market Record*, we construct a rating history for 66 rated BHCs that had CP outstanding during the sample period. Moody's changed the CP rating of 42 of the 66 of the BHCs in the sample. Five of the 42 BHCs had no CP outstanding on the date when Moody's made a rating change, and three BHCs had less than $10 million outstanding. We eliminate these small programs from the sample, which reduces the sample to 34 BHCs.[8]

Many of the BHCs had more than one rating change in the sample period. In total, Moody's announced 64 downgrades for the 34 BHCs. These multiple downgrades present a methodological problem if quantities are slow to adjust to new information. Specifically, the quantity of CP may not have completed

[8]Outstanding commercial paper reported on FR 2416 is rounded to the millions of dollars. We eliminate small programs to reduce the effect that rounding may have on our inferences.

Table I

Moody's Changes in Ratings of Bank Holding Company Commercial Paper, 1986 to 1991

The sample includes all BHCs that had at least $10 million in outstanding CP on the date of the rating change and a two-year time series of outstanding CP before the rating change. All the rating changes in the sample occurred between 1986 and 1991. If a BHC had two rating changes within a 20-week interval, both rating changes were eliminated from the sample. The sample includes 28 BHCs, 13 of which were downgraded twice, and fifteen of which were downgraded only once. Two BHCs were upgraded twice, and four BHCs were upgraded only once. According to Moody's Investors Service, issuers rated P-1 have a superior ability for repayment of senior short-term debt obligations; issuers rated P-2 have a strong ability for repayment; and issuers rated P-3 have an acceptable ability for repayment. Issuers rated NP do not fall in the Prime rating categories. There tends to be a strong relationship between an issuer's CP rating and its senior bond rating, but the mapping is not perfect. Issuers with P-1 ratings typically have bond ratings that range from Aaa to A3. P-2 issuers have bond ratings that range from A2 to Baa2. P-3 issuers have bond ratings of Baa2 or Baa3. NP issuers have speculative-grade bond ratings. Number of downgrades, 41. Number of upgrades, 8.

Ratings Changed to	Rating Changed from			
	P-1	P-2	P-3	NP
P-1	—	4	—	—
P-2	23	—	2	1
P-3	—	11	—	1
NP	—	2	5	—

Sources: Federal Reserve report form 2416, "Weekly Report of Assets and Liabilities for Large Banks," *Moody's Bond Survey*, and *Moody's Global Short-Term Market Record* (various issues, 1984–1991).

its adjustment to an initial downgrade when Moody's announced a second downgrade. As a result, estimates of the response of quantities to downgrades may be contaminated by the adjustment to information released weeks before the event date. To reduce this potential bias, if a BHC had two rating changes within a 20-week interval, both rating changes are excluded from the sample. This restriction reduces the sample size to 28 BHCs.

Table I gives the distribution of the rating changes for the resulting sample of 41 downgrades and 8 upgrades. Moody's announced 23 downgrades from P-1 to P-2, 11 downgrades to P-3, and 7 downgrades to NP. The 41 downgrades in CP ratings were not evenly distributed across time: 5 occurred in 1986, 3 in 1987, 5 in 1988, 5 in 1989, 17 in 1990, and 6 in 1991. Of the 28 BHCs in the sample, 13 were downgraded twice in 1986 to 1991, but not within a 20-week period, while the other 15 were downgraded only once.

As shown in Panel A of Table II, the amount of CP averaged $1.16 billion in the week before a CP rating downgrade and varied considerably.[9] Most noteworthy, high-rated BHCs had larger amounts of outstanding CP than did

[9]In the sample and estimation, a week refers to the period from Thursday to Wednesday, rather than to a calendar week. Thus, if BHC X was downgraded on Friday and BHC Y was downgraded on the following Monday, both downgrades occurred in the same event week.

Table II

Commercial Paper and Large CDs Outstanding the Week before Commercial Paper Downgrades

The table presents sample statistics for the quantities of CP and large CDs in the week before Moody's downgraded the CP rating of the issuing bank holding company. All of the bank holding companies had at least $10 million in outstanding CP on the date of the downgrade, and all of the downgrades occurred between 1986 and 1991. Moody's short-term ratings (P-1, P-2, P-3, and NP) represent Moody's opinion as to the issuer's capacity to meet its short-term debt obligations, where P-1 is the highest rating and NP is the lowest rating. CP rated P-1, P-2, or P-3 is considered investment grade.

Type of Commercial Paper Rating Change	Number	Amount Outstanding in Millions of Dollars				Memo: Average Ratio to Bank Assets (Percent)
		Mean	Median	Percentiles 25th	Percentiles 75th	
Panel A. Commercial Paper Outstanding						
All downgrades	41	1,157	400	187	1,864	4.69
P-1 to P-2	23	1,521	678	305	1,887	6.46
P-2 to P-3	11	998	425	167	1,976	2.75
P-2, P-3 to NP	7	215	156	137	309	1.90
Panel B. Large CDs Outstanding						
All downgrades	41	3,287	2,663	1,261	4,629	15.37
P-1 to P-2	23	3,068	2,663	1,341	4,384	15.70
P-2 to P-3	11	3,990	3,397	1,320	6,711	14.63
P-2, P-3 to NP	7	2,902	1,114	1,020	6,672	15.42

low-rated BHCs, on average. BHCs downgraded from P-1 to P-2 had an average of $1.52 billion in outstanding CP the week before the downgrading, while those downgraded to P-3 and to NP had averages of $998 million and $215 million, respectively. These differences do not reflect the size of the borrower: The ratio of CP to bank assets was 6.46 percent for downgrades to P-2, 2.75 percent for downgrades to P-3, and 1.9 percent for downgrades to NP. A test of the hypothesis that BHCs downgraded to P-2 and BHCs downgraded to P-3 and NP had the same amount of scaled CP before the downgrade is rejected at the 5 percent level of significance.

As indicated in Panel B, CDs represented a larger and seemingly less-credit-sensitive source of funding. At $3.3 billion, the average amount of outstanding CDs was nearly three times as large as the amount of outstanding CP. Most important, in contrast to outstanding CP, the average amount of outstanding CDs did not vary significantly with the rating of the bank's holding company. Moreover, for each of the three rating categories, CDs funded about 15 percent of bank assets. This finding suggests that having a low CP rating (P-2 or P-3) does not reduce a bank's financing in the CD market.

III. Methodology and Hypothesis Tests

The CP market's reaction to an announcement of a rating change is measured by the unexpected change in outstanding CP. The unexpected changes in quantity in this study are analogous to the excess returns estimated from market models in studies of stock price reactions to new information. (See, for example, Brown and Warner (1985), Asquith and Mullins (1986)).

For each firm that experienced a rating change, a model is estimated over a two-year period, beginning two years and thirteen weeks before the rating change ($t = -117$) and ending thirteen weeks before the rating change ($t = -13$). The coefficient estimates from this model are used to estimate the expected change in outstanding CP for the period surrounding the rating change. In the model, $C_{j,t}$ is the rate of change in outstanding CP of firm j during week t. The unexpected rate of change in outstanding CP of firm j in week t, $U_{j,t}$ is defined as

$$U_{j,t} = C_{j,t} - E\left[\tilde{C}_{j,t}\right],$$

where $E[\tilde{C}_{j,t}]$ is the conditional expected rate of change in outstanding CP of firm j in week t derived as the predicted value

$$E\left[\tilde{C}_{j,t}\right] = \hat{\alpha}_j + \hat{\beta}_{j,1}C_{m,t} + \hat{\beta}_{j,2}(R_t - R_{t-4}) + \sum_{s=1}^{4} \hat{\gamma}_{j,s}C_{j,t-s}.$$

The coefficient estimates are obtained from a OLS regression estimated over the preevent period ($t = -117$ to -13). Definitions and a discussion of the explanatory variables are as follows:

$C_{m,t}$ = The rate of change in outstanding CP of all BHCs during week t. The variable is included to capture changes in an individual firm's CP that are common to all BHCs.

R_t = The interest rate on 30-day prime CP issued by a AA-rated firm. The rates were obtained from the Federal Reserve Bank of New York's daily survey of dealer-placed paper. The four-week change in the CP rate, $(R_t - R_{t-4})$, is included to measure the responsiveness of firm j's borrowing to changes in interest rates.

$C_{j,t-s}$ = The rate of change in outstanding CP of firm j during week $t - s$. Lagged changes in outstanding CP are included to capture the serial correlation of CP for the individual firm.

For the 41 regressions, the adjusted R-squared statistics ranged from 0.03 to 0.51 and averaged 0.17; the Durbin-Watson statistics ranged from 1.87 to 2.38 and averaged 2.02. In preliminary regressions, we included several other variables, such as the slope of the term structure, the level of the CP rate, and the spread between the CP rate and the London Interbank Offered Rate. These additional variables were excluded from the model, however, because they had no explanatory power.

The mean unexpected change in outstanding CP in event week t is

$$\overline{U}_t = \frac{1}{N}\sum_{j=1}^{N} U_{j,t},$$

where N is the number of downgraded CP programs.

The null hypothesis to be tested is that the mean unexpected change in outstanding CP equals zero for each event subperiod. The test statistic is the ratio of the mean unexpected change to its estimated standard deviation, where the standard deviation is estimated from the time series of unexpected changes. For any week t, the t-statistic is

$$t(\overline{U}_t) = \frac{\overline{U}_t}{S(\overline{U}_t)},$$

where

$$S(\overline{U}_t) = \sqrt{\sum_{t=-117}^{-13} (\overline{U}_t - \overline{U})^2 / 104}$$

and

$$\overline{U} = \frac{1}{104}\sum_{t=-117}^{-13} \overline{U}_t.$$

If the $\overline{U}_t$ are independent, identically distributed, and normal, the test statistic is distributed as a Student's t under the null hypothesis.

Test statistics also are calculated over intervals longer than one week. The cumulative unexpected changes in outstanding CP of firm j from week $T1$ to $T2$ are formed by summing mean unexpected changes over event time as follows:

$$CUM_{j,T1,T2} = \sum_{t=T1}^{T2} U_{j,t}.$$

The average cumulative unexpected changes for outstanding CP are calculated by

$$\overline{CUM}_{T1,T2} = \frac{1}{N}\sum_{j=1}^{N} CUM_{j,T1,T2}.$$

The t-statistic for $\overline{CUM}_{T1,T2}$ is

$$t(\overline{CUM}_{T1,T2}) = \frac{\overline{CUM}_{T1,T2}}{(T2 - T1 + 1)^{1/2} S(\overline{U}_t)}.$$

If $T1 = T2$, $t(\overline{CUM}_{T1,T2})$ is equivalent to the t-statistic for $\overline{U}_t$.

The null hypothesis maintains that BHCs did not reduce financing in the CP market in the period around rating downgrades. Under the null hypothe-

sis, the estimates for the unexpected changes, $\overline{U}_t$, and cumulative unexpected changes, $\overline{CUM}_{T1,T2}$, would not be significantly different from zero around the announcement of the downgrades. Negative and statistically significant estimates would suggest that the information associated with a downgrade induced firms to shift their financing away from the CP market. The t-distribution, however, may yield inappropriate inferences if the sample of unexpected changes contains large outliers. Therefore, to evaluate the reliability of our inferences, we also present Wilcoxon signed rank tests on the weekly unexpected changes and cumulative unexpected changes in quantities.

We use the same event study methodology to model large CDs and total bank liabilities in the weeks around CP rating downgrades. In the model for CDs, the rate of change in outstanding CDs of bank j in week t is regressed on the rate of change in large CDs at all banks in week t, the four-week change in the three-month CD composite rate, and four lags of the dependent variable. In the model for bank liabilities, the rate of change in total liabilities of bank j in week t is regressed on the rate of change in aggregated bank liabilities in week t, the four-week change in the three-month CD composite rate, and four lags of the dependent variable. For both models, the coefficients are estimated over the period $t = -117$ to $t = -13$. These estimates are used to construct unexpected changes in large CDs and bank liabilities in the period surrounding the 41 CP downgrades.

IV. Empirical Results

A. The Response of Commercial Paper to Commercial Paper Downgrades

Column 1 in Table III reports the average prediction errors for the sample of 41 CP downgrades. The prediction errors are large and statistically significant in the weeks immediately following the downgrade: In the week of the downgrade announcement and in the following week, unexpected declines in CP averaged 3.5 and 3.2 percent, respectively. From the second week to the thirteenth week after the announcement, quantities ran off another 11.05 percent. These average announcement period effects are not the result of a few outliers. As shown in column 3, 71 percent of the CP programs experienced unexpected declines in the two weeks after the downgrade.

The quantity of CP showed no tendency to run off in the weeks before the rating downgrade. For the 41 downgrades, outstanding CP actually rose an average of 0.19 percent in the thirteen weeks prior to the downgrade, an increase that is not statistically significant. Outstanding CP increased significantly in the fifth and seventh week before the downgrade, and decreased significantly in the eighth week before the downgrade. For each of these weeks, the large average change can be traced to one outlier. In the weeks before the downgrade, none of the signed rank tests are statistically significant. These findings suggest that the news associated with the downgrade had not already been anticipated by market participants.

Table III

Average Prediction Errors ($\overline{U}_t$) and Cumulative Prediction Errors ($\overline{CUM}_{T1,T2}$) for the Rate of Change in Outstanding Commercial Paper from 13 Weeks before to 13 Weeks after Announcements of Commercial Paper and Bond Rating Downgrades

Prediction errors are obtained from a model estimated with two years of weekly data for the period $t = -117$ to $t = -13$. The dependent variable in the model is the percent change in outstanding CP of the BHC. The explanatory variables are the percent change in aggregate outstanding CP of all BHCs, the change in the one-month CP rate over the previous four weeks, and four lags of the dependent variable. The downgrades were announced between 1986 and 1991.

	Downgrades of Commercial Paper Ratings			Downgrades of Bond Ratings That Were Not Accompanied by a Commercial Paper Downgrade		
Week (t)	$\overline{U}_t$ (1)	$t(\overline{U}_t)$ (2)	Percent Negative (3)	$\overline{U}_t$ (4)	$t(\overline{U}_t)$ (5)	Percent Negative (6)
−13	0.42	0.30	56	0.89	0.33	41
−12	−0.34	−0.24	59	0.57	0.21	41
−11	−0.23	−0.17	56	0.12	0.05	41
−10	−2.81	−2.01	59	0.47	0.17	54
−9	−2.49	−1.78	56	−1.34	−0.50	59
−8	−3.49	−2.49[a]	49	−1.13	−0.41	54
−7	4.66	3.33[a]	46	−0.74	−0.27	54
−6	1.38	0.99	63	3.68	1.36	36[b]
−5	3.82	2.73[a]	46	2.11	0.78	46
−4	0.49	0.35	56	−2.33	−0.86	56
−3	−1.53	−1.09	68	1.93	0.71	51
−2	−1.13	−0.81	61	0.03	0.01	56
−1	1.45	1.03	56	−3.04	−1.12	62[b]
AW	−3.50	−2.50[a]	73[b]	−1.28	−0.47	62
1	−3.20	−2.28[a]	71[b]	−1.24	−0.46	56
2	−1.77	−1.26	61	−0.77	−0.29	56
3	−0.49	−0.35	59	−3.80	−1.40	74[b]
4	−1.69	−1.21	54	−1.52	−0.56	62
5	0.28	0.20	59	−1.19	−0.44	54
6	−1.00	−0.71	51	−1.54	−0.57	59
7	−2.19	−1.56	68	−2.81	−1.04	54
8	1.29	0.92	56	5.78	2.13[a]	54
9	1.42	1.02	49	−0.06	−0.02	46
10	−1.00	−0.72	56	−1.36	−0.50	62[b]
11	−2.44	−1.74	56	5.91	2.18[a]	44
12	−2.52	−1.80	66[b]	−1.43	−0.53	56
13	−0.94	−0.67	56	−0.47	−0.17	59
$\overline{CUM}_{-13,-1}$	0.19	0.04	49	1.22	0.12	46
$\overline{CUM}_{0,1}$	−6.69	−3.38[a]	71[b]	−2.53	−0.66	59
$\overline{CUM}_{2,13}$	−11.05	−2.28[a]	59[b]	−3.27	−0.35	51
Number	41			39		

AW, Announcement Week.

[a] Indicates the two-tailed t-statistic is significant at the 5 percent level.

[b] Indicates the two-tailed Wilcoxon signed rank statistic is significant at the 5 percent level.

The event study results indicate that the quantity of CP fell dramatically in the weeks after a downgrade. This finding is consistent with the prediction of Diamond's model that firms reduce financing in the direct markets as they lose their reputation. In the CP market, the adjustment in quantity is spread out over several weeks because the stock of CP cannot decline until existing paper matures. This protracted adjustment in quantities highlights a difference between our event study and event studies that examine stock returns, which typically find that price adjustments occur over one or two days.

B. The Response of Commercial Paper to Bond Downgrades

In its bond-rating system, Moody's uses a finer gradation of rating categories than it uses in its CP system. For example, a borrower with a P-1 CP rating could have as many as seven bond ratings: Aaa, Aa1, Aa2, Aa3, A1, A2, or A3. Consequently, when Moody's changes a borrower's CP rating, it nearly always changes the borrower's bond rating.[10] The converse is not true, however; in many case, Moody's makes changes in bond ratings without changing the issuer's CP rating.

To determine if bond-rating changes alone convey news to investors, we investigate all cases where Moody's downgraded a BHC's bond rating but did not change the BHC's CP rating (e.g., from Aa1 to Aa3). The prediction errors, reported in column 4 of Table III, indicate that CP fell an average of 2.53 percent in the first two weeks after a bond downgrade and 3.27 percent from the second to the thirteenth week after a downgrade, but these declines do not differ significantly from zero. Evidently, investors did not view the news of minor downgrades as providing significant information about the reputation of the BHC.[11]

C. The Response of CDs and Total Liabilities to Commercial Paper Downgrades

Column 1 in Table IV presents prediction errors for the quantity of large CDs around announcements of downgrades of CP ratings. CDs fell a cumulative 2.12 percent in the thirteen weeks before the downgrade announcement, 1.26 percent in the two weeks after the announcement, and 0.58 percent in

[10] There tends to be a strong relationship between an issuer's CP rating and its bond rating, but the mapping is not perfect. Issuers with P-1 ratings typically have senior bond ratings that range from Aaa to A3; P-2 issuers have bond ratings that range from A2 to Baa2; and P-3 issuers have bond ratings of Baa2 or Baa3. NP issuers have speculative-grade bond ratings. For each of the 41 downgrades of CP ratings in our sample, Moody's simultaneously downgraded the issuer's senior debt rating. Therefore, from columns 1 to 3 in Table III, it can be inferred that bond-rating downgrades accompanied by CP downgrades were associated with significant declines in CP outstanding.

[11] We also examine the reaction of outstanding CP to an upgrade. The sample includes only 8 upgrades in CP ratings and only 13 upgrades in bond ratings. The results of the event study indicate that outstanding CP increased an average of 41 percent in the 13 weeks after CP upgrades and 42 percent after bond rating upgrades. These large increases can be traced mainly to a single outlier, however, and the cumulative prediction errors do not differ from zero at the 5 percent level of significance in either the weeks before or after the upgrades.

Table IV

Average Prediction Errors ($\overline{U}_t$) and Cumulative Prediction Errors ($\overline{CUM}_{T1,T2}$) for the Rate of Change in Large CDs and Total Bank Liabilities from 13 Weeks before to 13 Weeks after the Announcement of a Commercial Paper Rating Downgrade

Prediction errors are obtained from a model estimated with two years of weekly data for the period $t = -117$ to $t = -13$, where $t = 0$ is the announcement week for a commercial paper downgrade. In the model for CDs (total liabilities), the dependent variable is the percent change in the bank's large outstanding CDs (total liabilities), and the explanatory variables are the percent change in aggregate large CDs (total liabilities of all commercial banks), the change in the composite CD rate over the previous four weeks, and four lags of the dependent variable.

	CDs Outstanding			Total Bank Liabilities		
Week (t)	$\overline{U}_t$ (1)	$t(\overline{U}_t)$ (2)	Percent Negative (3)	$\overline{U}_t$ (4)	$t(\overline{U}_t)$ (5)	Percent Negative (6)
−13	−0.37	−0.71	54	−0.48	−1.00	59
−12	0.61	1.16	44	−0.13	−0.28	49
−11	0.02	0.04	56	−0.22	−0.46	59
−10	−0.04	−0.08	61	−0.15	−0.31	49
−9	−0.61	−1.17	66	−0.94	−1.94	61[b]
−8	0.31	0.59	44	0.21	0.43	54
−7	−0.74	−1.41	71[b]	−0.07	−0.15	59
−6	−1.42	−2.70[a]	73[b]	0.07	0.15	49
−5	0.46	0.88	46	−0.02	−0.04	54
−4	1.10	2.10[a]	59	0.23	0.47	51
−3	−0.23	−0.43	54	−0.57	−1.19	59
−2	−0.88	−1.67	68[b]	0.86	1.77	37
−1	−0.33	−0.64	49	−0.12	−0.25	56
AW	−0.72	−1.38	68	0.06	0.12	41
1	−0.54	−1.02	54	0.29	0.60	46
2	−0.29	−0.55	49	−0.50	−1.03	59
3	−0.43	−0.82	61	−0.06	−0.13	54
4	−0.41	−0.78	59	−0.20	−0.42	51
5	−1.23	−2.35[a]	68	−0.38	−0.79	51
6	0.74	1.42	46	−0.02	−0.03	46
7	0.01	0.01	46	−0.56	−1.16	66
8	0.49	0.93	59	1.96	4.06[a]	49
9	−0.26	−0.50	59	0.76	1.58	46
10	1.60	3.05[a]	49	0.28	0.58	51
11	−0.29	−0.55	71	−0.09	−0.19	49
12	−0.38	−0.72	54	0.20	0.42	46
13	−0.14	−0.26	59	−0.38	−0.79	59
$\overline{CUM}_{-13,-1}$	−2.12	−1.13	63	−1.34	−0.77	54
$\overline{CUM}_{0,-1}$	−1.26	−1.70	68	0.35	0.51	56
$\overline{CUM}_{2,13}$	−0.58	−0.32	59	1.01	0.61	61
Number	41			41		

AW, Announcement Week.

[a] Indicates the two-tailed t-statistic is significant at the 5 percent level.

[b] Indicates the two-tailed Wilcoxon signed rank statistic is significant at the 5 percent level.

weeks two through thirteen after the announcement. None of these cumulative declines differ from zero at the 5 percent level of significance. The prediction errors are statistically significant in several of the individual weeks. In weeks -6 and $+5$, the average prediction errors are negative and significant, while in weeks -4 and $+10$ the errors are positive and significant. In addition, the signed rank tests are significantly negative in weeks -7, -6, and -2. We have no explanation for these significant changes, other than that the model may not capture all the factors that affect borrowing in the CD market. Overall, these results suggest that downgrades of CP ratings did not significantly deter banks from borrowing in the CD market.

The results for CDs contrast with those for outstanding CP, which fell significantly after downgrades. These divergent findings are consistent with two explanations. First, because CDs have relatively long maturities, the reaction of CDs to a downgrade may be more protracted and more difficult to measure statistically. Second, in evaluating the riskiness of CDs, investors may have relied on the reputation of the FDIC, rather than the reputation of the issuing bank. Consequently, the effect of deposit insurance may have short-circuited market discipline in the market for CDs. To distinguish between these explanations requires microdata on quantities, rates, and maturities of CP and CDs. Unfortunately, such data are unavailable to us at this time.

Column 4 displays the prediction errors for the total liabilities of banks around announcements of downgrades of the CP rating of their holding companies. None of the cumulative prediction errors, and only one of the weekly average prediction errors, differ significantly from zero. Evidently, the downgrades in BHC CP ratings and subsequent runoffs in outstanding CP did not affect the size of the balance sheet of the bank. As a matter of accounting, BHCs that ran off CP must have either decreased assets or increased funding in alternative markets. In the aggregate, the largest decline in CP occurred in 1990 to 1991, when outstanding CP fell from \$53 billion to \$23 billion. Over this period, BHCs nearly matched their \$30 billion reduction in CP by reducing assets by \$29 billion, \$23 billion of which can be traced to securitization and a decrease in investments in nonbank subsidiaries.

D. Cross-sectional Regressions

Table V presents regressions of the cumulative two-week announcement period prediction errors, $\overline{CUM}_{0,1}$, on several variables that represent potential determinants of the unexpected response in quantity. The regressions are estimated for the sample of 41 downgrades of CP ratings, with the residuals corrected for heteroskedasticity. As shown in the first row, outstanding CP fell by more than 10 percent in the two weeks after downgrades to P-3 and to NP, compared with an average decline of 3.80 percent after downgrades to P-2. This difference may indicate that downgrades to P-3 and to NP were associated with more important news about the reputation of the borrower, or

Table V

Regressions of Two-Week, Postdowngrade Cumulative Prediction Errors in Outstanding Commercial Paper on Dummy Variables for Ratings, 1990 and 1991, and the CD Prediction Error

The dependent variable is the cumulative prediction error in outstanding commercial paper in the two weeks after a downgrade. These prediction errors are estimated from a model of outstanding commercial paper in the period $t = -117$ to $t = -13$, where $t = 0$ is the week of the downgrade announcement. Explanatory variables are defined as follows: P-3 is an indicator variable taking on a value of 1 for downgrades to Prime-3 and zero otherwise. NP is an indicator variable for downgrades to Not Prime. CDs $\overline{CUM}_{0,1}$ is the cumulative prediction error in outstanding CDs in the two weeks after the rating downgrade. D90 and D91 are indicator variables for downgrades in 1990 and 1991, respectively. The regression is estimated for the sample of 41 announcements by Moody's of downgrades of commercial paper ratings of bank holding companies from 1986 to 1991. White's (1980) estimate was used to correct the standard errors for heteroskedasticity. t-Statistics in parantheses.

		Independent Variables						
	Constant	P-3	NP	CDs $\overline{CUM}_{0,1}$	D90	D91	F	R^2
1.	−3.80	−6.62	−6.57				1.21	0.06
	(−1.34)	(−1.59)	(−0.92)					
2.	−6.34			0.28			0.41	0.01
	(−2.96)			(0.91)				
3.	−6.81				0.19	0.20	0.00	0.00
	(−1.57)				(0.04)	(0.04)		

it may merely reflect a shorter average maturity of lower-rated CP. In any event, the differences among the rating categories are not statistically significant.

In row 2, the two-week cumulative prediction errors for outstanding CP are regressed on the two-week cumulative prediction errors for outstanding CDs. The coefficient estimate on the CD variable will be positive if firms with declining reputations shift funding away from the direct (CD and CP) markets. However, the estimate will be negative if distortions from FDIC insurance cause banking firms to shift funding from the CP market to the CD market. The coefficient estimate is positive but not statistically significant, a result indicating that borrowing by a bank in the CD market was not related to the deteriorating reputation of its holding company.

In July 1990, the Securities and Exchange Commission may have significantly altered the response in the CP market to rating changes by proposing several amendments to Rule 2a-7, the regulation that governs investments of money market funds. The amendments, which became effective in June 1991, restrict investments in securities with medium-grade credit ratings (e.g., CP rated P-2 by Moody's) to 5 percent of a fund's assets and limit investments in any medium-grade issuer to 1 percent of a fund's assets. Previously, a money fund could hold up to 25 percent of its assets in the securities of any private

issuer, provided that such instruments received at least a medium-grade rating.[12] If a rating downgrade itself caused borrowers to shift financing away from CP, then the amendments to Rule 2a-7 may have intensified the effect. However, as shown in row 3, declines in outstanding CP were not larger in 1990 or 1991 than they were in 1986 to 1989.[13]

V. Summary and Conclusions

When investors receive unfavorable news about the reputation of a borrower, both the yield on new offerings and the quantity of CP may respond over the short run. Quantity may respond because firms with eroding reputations may shift their financing away from the direct, nonintermediated markets, such as the CP market. This quantity response of CP to new information contrasts with that of longer-term assets: in the stock and bond markets, quantities usually are fixed in the short run.

Using event study methodology, this paper examines the quantity response of bank holding company CP to announcements of a Moody's rating change, a proxy for a change in reputation. The results indicate that outstanding CP fell an average of 6.69 percent in the first two weeks after announcements of downgrades in CP ratings. Outstanding CP did not fall significantly in the weeks before the downgrade, a finding which suggests that market participants had not already discounted the news that precipitated the downgrades.

We also examine the effect of bond rating changes on outstanding CP and the effect of rating changes on outstanding CDs. CP rating changes are almost always accompanied by bond rating changes, but not conversely. Outstanding CP did not change significantly after bond rating downgrades that were not accompanied by CP downgrades. We also found that the quantity of large CDs did not change significantly around CP downgrades, a result suggesting that deposit insurance may have removed market discipline in the CD market.

[12] Crabbe and Post (1992) find that the size of the medium-grade CP market shrank relative to the size of the high-grade market and that the rate spread between medium-grade and high-grade CP increased significantly after the SEC proposed the amendments.

[13] In additional cross-sectional tests, we found no significant relationship between the two-week prediction errors and the characteristics of individual BHCs, such as asset size, the level of outstanding CP, and a zero-one indicator variable for money center BHCs.

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