

Subordinated debt, uninsured deposits, and market discipline: evidence from U.S. bank holding companies

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Abstract

We investigate market discipline in banking through uninsured depositors and subordinated debt holders, using U.S. bank holding companies data from 1996 to 2005. We test to see both the monitoring and influencing aspects of market discipline. Although our results overall support the presence of monitoring through uninsured deposits, the evidence of influencing is mixed at best. We find some disciplining effect of changes in uninsured deposit levels and prices on bank fundamentals. We find no evidence of any disciplinary influences by subordinated debt holders.

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1. Introduction

To improve and maintain the safety of the global banking system, bank regulators around the globe are working on capital adequacy frameworks where among other factors market discipline is to play a key role.¹ Proposals have been advanced where issuance of subordinated, junior debt is expected to improve market discipline and reduce the costs of safety nets. The rationale underlying these proposals is the conventional wisdom that uninsured creditors of the bank have strong incentives to discipline the riskier banks either through pricing and/or rationing their credit.

The New Basel II proposals are to stand on three pillars: the first pillar -Minimum Capital Requirements; the second – Supervisory Review Process; and the third Market Discipline. The purpose of Pillar 3 – market discipline is to complement the minimum capital requirements (Pillar 1) and the supervisory review process (Pillar 2). The Basel Committee aims to enhance market discipline by developing a set of disclosure requirements which will allow market participants to assess key pieces of information on capital, risk exposures, risk assessment processes, and hence the capital adequacy of the institution. While the focus on disclosure is meant to allow better monitoring, the historical aim and strength of bank regulation has always been on disciplining errant banks to contain systemic risk. Market discipline is to complement regulatory monitoring *and* disciplining through market participants, specifically at-risk claimholders.

¹ See Basel Committee on Banking Supervision (2001).

All uninsured liabilities and equity are among the sources of funds for banks where such market discipline is expected to be exerted. In a recent working paper², the Bank for International Settlements cites a large number of studies reporting to find some evidence of market discipline. Most of these studies focus on subordinated notes and debentures (SNDs), while some also focus on uninsured deposits, certificates of deposit, and common equity. The expectation of discipline from equity holders has been questioned though, as they may gain from increased risk taking and capture most of the upside potential while being shielded from the downside due to insensitive pricing of the safety net to changes in risk exposure³. There is a considerable body of literature on the effectiveness of SNDs in disciplining banks. Strong empirical evidence also exists that uninsured depositors are effective discipliners of financial institutions (Peria and Schmukler, 2001; Park and Peristiani, 1998; Goldberg and Hudgins, 1996, 2002). Armed with this evidence, there have also been proposals to impose *mandatory* requirements of holding minimum amounts of SND for improved market discipline⁴ (e.g., a minimum amount in the range of 1-4 percent of risk weighted assets). Market discipline though is narrowly defined in these studies to mostly imply monitoring only, a signaling story from SND prices and spreads to regulators, while

² Basel Committee on Banking Supervision, Working Paper No. 12, "Markets for Bank Subordinated Debt and Equity in Basel Committee Member Countries" August 2003.

³ Evanoff and Wall (2001) provide an extensive discussion for the benefits from reliance on SND's for market discipline.

⁴ Benston et al., 1986; Litan and Rauch, 1997; Cooper and Fraser, 1988; Keehn, 1989; Evanoff, 1993; Calomiris, 1997, 1999.

leaving aside the actual disciplining dimension. There appears to be a need for further analysis though, into whether banks react to disciplining from at-risk claimants, i.e. do banks behave differently when creditors charge them higher prices and/or ration their credit?

In this paper we intend to complement the literature by providing the link between firm performance attributes that include capital ratios, liquidity, profitability, asset portfolio make-up, efficiency, with two sources of potential market discipline: subordinated debt, and uninsured deposits. We study the US banking industry in a period of relative tranquility and growth. Extant literature in this area mostly used data from the late 1980s and early 1990's, a period of economic malaise and regulatory distortions. In the process we hope to display a clearer picture of market discipline where along with monitoring we also see if there is actual behavioral reaction from banks to actions of uninsured liabilities holders.

We find some evidence of support for market *monitoring* but mostly from the uninsured depositors. The SNDs, on the other hand, don't seem to react to the banks' risk-taking behavior in terms of quantity of funds supplied, but seem to adjust to it rather with the interest they charge on those funds. For *disciplinary* market influence, we get sporadic evidence of support at best. Again, the bank reactions, if any, mostly come in response to the uninsured depositors, and furthermore, occasionally not even in the expected way. Considering the recent desires to enlist at-risk claimants in disciplining the banks, our results do not provide unequivocal support: not only that the banks may not respond to these disciplining market actions, but they may react in unintended ways. Hence, recent calls for mandatory SND requirements to actually change bank behavior may be misplaced: if monitoring is a more effective tool, then the focus should rather be on transparency and disclosure which would enhance monitoring.

2. Review of the Literature

Flannery (2001), Bliss and Flannery (2001), and Hamalainen (2006) distinguish between monitoring (investors react) and influence (firms react). Hamalainen describes effective implementation of market discipline in two phases: *recognition* and *control*. Recognition phase is where rational at-risk bank investors examine bank risk and signal price and/or quantity effects to the borrower. If market discipline is effective the actions taken in the recognition phase should induce banks to respond in a manner that reduces underlying bank risks, leading to the control phase. Flannery (2001), and Bliss and Flannery (2001) similarly break market discipline down to two distinct components: a) ‘Market Monitoring’ which is expected to generate signals that convey useful information to supervisors; and b) ‘Market Influence’ where outside claimants influence a firm’s actions. The first component involves investors who accurately evaluate changes in a firm’s condition, and incorporate those assessments promptly into the firm’s security prices. These prices then are perceived as signals that may trigger regulatory actions to discipline the bank⁵. Numerous studies have empirically tested whether investors accurately priced securities of firm’s to reflect its risks, and most concluded affirmatively. A number of studies focused on SNDs and found evidence of market discipline as in Flannery’s ‘monitoring’ kind for samples of US and international banks for the late 1980’s and 1990’s (Berger et al., 2000; Covitz et al., 2000; DeYoung et al., 2001; Evanoff and Wall, 2001, 2002; Flannery and Sorescu, 1996; Hancock

⁵ Distinctions have also been made between ‘direct’ and ‘indirect’ market discipline, loosely defined, ‘indirect’ links investor signals to regulatory actions, and ‘direct’ as increased costs reducing funding opportunities of riskier banks.

and Kwast, 2001; Jagtiani et al., 1999, 2000; Morgan and Stiroh, 1999; Gropp and Vesala, 2002; Sironi, 2003). Avery, Belton and Goldberg (1988) looking at subordinated debt of US Bank Holding Companies in the early 1980's, provides a rare dissent by concluding that risk premiums on bank-related long-term debt are virtually unrelated to traditional accounting measures of bank performance. Using the same data Gorton and Santomero (1990) has also confirmed the Avery et al. results finding little support for the presence of market discipline in the subordinated debt market. Bliss and Flannery (2001) takes a rare traveled path and actually investigate to see if US bank holding companies' security price changes reliably influence subsequent managerial actions. This rare test of the 'influence' of market discipline fails to provide strong evidence for equity or especially bond investors regularly influencing managerial actions. Though potential issues with the usage of common equity as tools of market discipline have been raised, Evanoff and Wall (2001), Aharony and Swary (1996), Davies (1993), Gunther et al. (2001), Pettway (1976,1980), and Gropp and Richards (2001) use common stock as the signaling security and conclude that there is evidence of market disciplining/signaling in the prices/returns of common stock. A number of studies provide evidence that uninsured *and* insured depositors and/or holders of certificates of deposit are also potential discipliners of financial institutions (Davenport and McDill, 2006; Peria and Schmukler, 2001; Park and Peristiani, 1998; Goldberg and Hudgins, 1996, 2002; Billett et al., 1998; James, 1988,1990; Jordan, 2000; Keely, 1990). Peria and Schmukler (2001) also discusses that large systemic effects take place during crises, affecting deposits and yields regardless of bank fundamentals.

The focus of the extant literature has been on the reaction of uninsured depositors⁶ or subordinated debt, in terms of both the amounts and the prices, to firm attributes, i.e. if a firm was to become riskier, would uninsured depositors or SND holders ration credit and/or charge a higher premium? It remains an empirical question, though, as how disciplinary responses of these two subsequently affect the bank attributes. In other words, do we see firm's actually being disciplined? Are firms' changing their capital ratio, portfolio risk, etc. if they observe SNDs or uninsured depositors ration or change their prices? Is there really market disciplining, or do bankers just move on to other creditors who will be happy to accept the firm as is?

In this paper, we investigate both the monitoring action of the uninsured depositors/creditors and the financial institutions reactions to these 'disciplinary' actions.

3. Data and Methodology

Our data come from the "*Consolidated Financial Statements for Bank Holding Companies*" (Y-9C Reports) as recorded by Thomson-Sheshunoff-Highline Data, Inc., for all bank holding companies (BHCs) from January 1996 to December 2005. Our sample starts with 57,706 firm- quarter observations. We lose some observations due to missing information or suspicious data. For example, we dropped the observations with negative prices on uninsured deposits or SNDs and the observations with ratios exceeding one. We

⁶ Davenport and McDill (2006) provide interesting evidence that insured depositors are also very sensitive to bank risk.

also winsorized the ratios with large positive and negative outliers.⁷ Further, we dropped the firms with inadequate capital ratios (less than five percent, where prompt corrective actions would be triggered) to mitigate the effects of regulatory capital requirements on our results. By applying this threshold, we try to exclude the banks with such low capital ratios that their response to the regulatory pressures can be misinterpreted as their response to the credit rationing or higher interest rates charged by the uninsured depositors and SND holders.

The final sample includes pooled 54,566 (quarterly) observations over ten years from January 1996 to December 2005.

3.1. Market Monitoring

Our initial purpose is to test the relationship between the uninsured depositors and SNDs and the firm fundamentals to examine market discipline from the monitoring point of view. Following the extant literature (e.g. Peria and Schmukler, 2001), we measure the reaction of uninsured depositors (U) and subordinated debt holders (SND) to bank characteristics by testing the following lagged models:

$$\Delta U_t = \alpha_0 + \sum_{k=1}^6 \sum_l \beta_{k,l} \Delta F_{k,t-l} + \sum_l \alpha_l \Delta U_{t-l} + \sum_m \rho_m OCV + \varepsilon_t \quad (1a)$$

$$\Delta SND_t = \alpha_0 + \sum_{k=1}^6 \sum_l \beta_{k,l} \Delta F_{k,t-l} + \sum_l \alpha_l \Delta SND_{t-l} + \sum_m \rho_m OCV + \varepsilon_t \quad (1b)$$

⁷ We assigned the 1st and 99th percentile values to the observations with values beyond those to control for outlier influence.

where ΔU and ΔSND are the changes in the quantities of⁸ uninsured deposits and subordinated debt issued by a BHC i , from time $t-l$ to time t , and l is the lag length (≤ 3), in quarters. The bank identifier i is omitted for notational simplification. ΔF (changes in Fundamentals) is a vector of changes in firm-specific variables where, drawing on the previous studies of the market discipline literature, we include variables measuring attributes of a bank that are similar to those used in CAMEL ratings: capital adequacy, earnings, asset and management quality and liquidity (e.g. Peria and Schmukler, 2001; McDill and Maechler, 2003; Hall et al., 2003).

Bank's equity level is a good indicator of its health and its ability to weather the future financial distresses. We use the equity over total assets ratio as a capital adequacy measure, and expect to find positive relationship with the levels of uninsured deposits and SNDs. Earnings component is measured by the returns on average assets (ROA) with an expected positive relationship with the uninsured depositors and SND holders. Return on assets can also be considered to be a capital adequacy proxy since retained earnings are a good source of capital for banks mitigating the effects of future adverse economic shocks (Berger, 1995).

We report two different measures of asset quality. They include the ratios of loans 90+ days past due to total loans and leases, and non-accruing loans to total loans and leases. We expect these variables to have negative relationship with uninsured deposits and SNDs. To measure the quality of loan portfolios, we use the ratios of residential real estate loans (1-4 family residential loans) to total assets, and other real estate loans to total assets. Real estate loans in general can be expected to have either positive or negative relationship with the

⁸ Hamalainen (2006) "...further research ... into...the influence of quantity effects in controlling bank risk-taking is necessary" p.110

uninsured depositors and SND holders: on the one hand, real estate loans can be considered safer since they are mostly mortgage loans with collateral. On the other hand, they can be considered risky since high concentration of real estate loans exposes a bank to a “vulnerable” risky sector. We separate the residential real estate loans since they are considered to be safer loans relative to commercial loans, and are expected to have positive relationship with the uninsured deposit and SND levels. We also use the ratios of commercial and industrial loans and individual loans to total assets as additional measures of loan quality: although the effect of individual loans on uninsured depositors and SNDs are ambiguous (Peria and Schmukler, 2001), commercial and industrial loans are considered risky and expected to have a negative effect on the levels of uninsured deposit and SND holders (Hall, et al. 2003).

Management quality is measured as the ratio of non-interest expense to total assets which is a raw efficiency measure. Although this concept is expected to have a negative relationship with the uninsured deposits and SNDs, ours is a crude measure which doesn't take the quality of services into consideration, and may give us mixed results.

Finally, two ratios are included as measures of bank's liquidity: liquid assets over total assets (Peria and Schmuckler, 2001), and total loans and leases over core deposits (Hall, et al., 2003). Generally more liquid banks are considered to be safer: consequently we expect to see positive (negative) relationship between the first measure (second measure) of liquidity, and the uninsured deposits and SNDs.

As control variables, first we include recent changes in the dependent variables (ΔU and ΔSND) (as in Bliss and Flannery, 2001; McDill and Maechler, 2003). *OCV* is a vector of other control variables which include variables for size, time, affiliation, state and a ratio of interest over total liabilities. The size of a bank may affect the decisions of the

uninsured depositors and SND holders on whether to keep their money in a particular institution due to their perception that the bank is large and unlikely to fail, or even if it fails, it is highly likely that it would be bailed out (too big to fail). To control for size, instead of imposing a linear relationship between size and our dependent variables, we create five asset groups based on the BHC's total assets, and include four indicators in the model with small BHCs (with assets <\$100 million) as the omitted group. Time dummies are to control for the changes in the banking sector and the general macroeconomic variations during our testing period (Peria and Schmukler, 2001; Bliss and Flannery, 2001), and the state dummies to control for the regional variations (Hall et al., 2003). Affiliation dummy variable is used to control for access to internal capital markets: if the outside forces try to exert discipline, a bank with multiple affiliated banks (hence access to internal capital markets) may behave differently than the ones without (stand alone BHC). Finally we use the ratio of total interest expense to total liabilities to control for the substitution effect: for example, the banks may respond to uninsured depositors demand for higher interest by turning to insured depositors and pay higher interest to attract their deposits instead, without adjusting their fundamentals to satisfy uninsured depositors.

We estimate equations 1a and 1b to investigate if the uninsured depositors and subordinated debt holders monitor the banks' risk-taking, and respond with a disciplinary mechanism such as withdrawing their funds. However, finding a (or lack of) support for disciplining behavior of the uninsured depositors and SND holders may not be enough evidence since the depositors and SND holders can also discipline a bank by requiring higher interest rates on their funds. As an additional test of market discipline, we also investigate the

changes in interest rate levels to changes in bank fundamentals by replacing the uninsured deposits and SNDs on the left hand side with interest rates charged on those funds:

$$\Delta IU_t = \alpha_0 + \sum_{k=1}^6 \sum_l \beta_{k,l} \Delta F_{k,t-l} + \sum_l \alpha_l \Delta U_{t-l} + \sum_m \rho_m OCV + \varepsilon_t \quad (1c)$$

$$\Delta ISND_t = \alpha_0 + \sum_{k=1}^6 \sum_l \beta_{k,l} \Delta F_{k,t-l} + \sum_l \alpha_l \Delta SND_{t-l} + \sum_m \rho_m OCV + \varepsilon_t \quad (1d)$$

where ΔIU is the change in interest charged on the uninsured deposits from time $t-1$ to t . It is calculated as the interest expense on time deposits >\$100K divided by time deposits >\$100K. Similarly, $\Delta ISND$ in 1d is the change in interest charged on the subordinated debt from time $t-1$ to t , and is calculated as the interest expense on subordinated notes divided by subordinated notes⁹. Since at-risk claimants would charge higher interest to riskier banks, we expect the relationship between interest and bank fundamentals to be the opposite of between quantities of uninsured deposits and SNDs and bank fundamentals. For example, while we expect a decrease in uninsured deposits for banks with lower capital ratio, we expect an increase in interest rates to be offered by these banks: the uninsured depositors and SND holders would expect higher interest rates from these risky institutions to stay. Similarly, although highly profitable firms may be attractive to the uninsured depositors and SND holders for safety reasons, “safety” theoretically should have a dampening effect on the interest rates these firms offer.

⁹ Alternatively as in some studies bond spreads could be used here. There are concerns on such use though as spreads may behave differently with different bonds of the same bank, and credit risk issues may contaminate implications.

All the independent variables in the equations 1a-1d are lagged to account for the delay in the financial information announced to the public. Although the literature is in agreement about the lagged relationship between the market reaction and the firm-characteristics due to the timing of firm financial information to become public, there is no consensus about the appropriate number of lags to test this relationship. For example, the lag structure varies from one month/quarter (Peria and Schmukler, 2001) to three quarters (Bliss and Flannery, 2001) to a year (McDill and Maechler, 2003). Since we use quarterly data, we follow Bliss and Flannery (2001) and adopt three-lag structure for all of our independent variables in all of our models.¹⁰

3.2. Market Disciplining

Our main goal in this paper is to investigate the banks' responsiveness to the disciplinary actions of uninsured depositors/creditors: Do the banks, following the market's reaction to their risk-taking, try and remedy the situation that caused this reaction in the first place? After all, market discipline would not be a useful mechanism if the banks do not respond to the market's negative reaction "punishing" the banks' risky behavior. We test this concept of possible market influence by examining the changes in firm-specific characteristics at time t following the changes in the funds or the prices of these funds separately at time $t-l$, and estimate the following models for each depositor and SND group, one for the quantity of the deposits/debentures and the other for the prices:

$$\Delta F(s)_t = b_0 + \sum_l b_l \Delta F(s)_{t-l} + \sum_l \chi_l \Delta U_{t-l} + \sum_m \rho_m OCV + \varepsilon_{t,l} \quad (2a)$$

$$\Delta F(s)_t = b_0 + \sum_l b_l \Delta F(s)_{t-l} + \sum_l \omega_l \Delta IU_{t-l} + \sum_m \rho_m OCV + \varepsilon_{t,l} \quad (2b)$$

¹⁰ We also considered single and two-lag models, and found almost identical results to the ones reported here.

$$\Delta F(s)_t = b_0 + \sum_l b_l \Delta F(s)_{t-l} + \sum_l \chi_l \Delta SND_{t-l} + \sum_m \rho_m OCV + \varepsilon_t \quad (2c)$$

$$\Delta F(s)_t = b_0 + \sum_l b_l \Delta F(s)_{t-l} + \sum_l \omega_l \Delta ISND_{t-l} + \sum_m \rho_m OCV + \varepsilon_t \quad (2d)$$

where all the variables (as defined below equations 1a-1d) are the changes from time $t-1$ to time t for the dependent variables of bank fundamentals, and from time $t-2$ to $t-1$ (three lags) for the independent variables. If we are to see any disciplinary action taken by the depositors and SNDs affecting the bank's fundamentals in the following period, we should get significant χ 's and ω 's: for example, we should see a significant relationship between the current change in a bank's capital ratio and the lagged changes in the uninsured deposits of the same bank if the management of this bank takes the uninsured depositors' action (e.g. withdrawal of their funds or higher prices) seriously and responds to them by making the institution attractive (e.g. less risky) again.

Equations 2a through 2d capture the reaction of firm fundamentals to changes in the levels of uninsured deposits and SNDs and to the changes in the prices charged. The inherent assumption here is that reactions to changes in either direction are as important and meaningful. Obviously, firms may be more responsive to market's negative reactions but choose to stay the course in the presence of positive reactions (Bliss and Flannery, 2001). In other words, the banks may not respond to an increase in uninsured deposits in prior periods by engaging in a risky behavior (e.g. lowering their capital ratio) immediately, but they may respond more promptly in subsequent periods when the uninsured depositors start withdrawing their funds or start charging the institutions higher prices due to their risky behavior (both negative reactions by the at-risk claimants). Consequently, we reconsider our model(s) by focusing on this relationship for the banks with reductions in the levels of funding (credit rationing) and with increases in funding costs (higher interest rates). As we

discussed earlier, we expect disciplining behavior of the market to be opposite of each other in fund levels and fund prices. We define $D1$ as the dummy indicator which takes the value of 1 when the change in levels of uninsured deposits and SNDs are negative at time $t-1$ and $D2$ as the dummy indicator which takes the value of 1 when the change in the prices charged on uninsured deposits and SNDs are positive at time $t-1$. To test if the negative (positive) changes of funds (prices) have any influence on subsequent bank behavior, we estimate the following:

$$\Delta F(s)_t = c_0 + \sum_l c_l \Delta F(s)_{t-l} + \sum_l \tau_l \Delta U_{t-l} + \sum_l \psi_l \Delta U_{t-l} * D1 + \sum_m \rho_m OCV + \varepsilon_t \quad (3a)$$

$$\Delta F(s)_t = c_0 + \sum_l c_l \Delta F(s)_{t-l} + \sum_l \sigma_l \Delta IU_{t-l} + \sum_l \tau_l \Delta IU_{t-l} * D2 + \sum_m \rho_m OCV + \varepsilon_t \quad (3b)$$

$$\Delta F(s)_t = c_0 + \sum_l c_l \Delta F(s)_{t-l} + \sum_l \tau_l \Delta SND_{t-l} + \sum_l \psi_l \Delta SND_{t-l} * D1 + \sum_m \rho_m OCV + \varepsilon_t \quad (3c)$$

$$\Delta F(s)_t = c_0 + \sum_l c_l \Delta F(s)_{t-l} + \sum_l \sigma_l \Delta ISND_{t-l} + \sum_l \tau_l \Delta ISND_{t-l} * D2 + \sum_m \rho_m OCV + \varepsilon_t \quad (3d)$$

where all the variables are defined as before. The interactive terms with dummy indicators show the additional powers of disciplining variables in explaining the changes in bank fundamentals above all other variables. If the at-risk claimants play any role in disciplining the bank behavior by rationing credit and/or charging higher interests, we should see significant coefficients on these interactive terms, ψ and τ respectively. For example, we expect to see positive relationship between the changes in non-accruing loan ratio and the decrease in uninsured deposits (e.g. if the uninsured depositors left the bank due to its risky loan portfolio in time $t-1$, we expect the bank to respond at time t by decreasing its non-accruing loans to attract them back, hence same directional change in these variables).

4. Results

The uninsured deposits have been constantly increasing over our sample period while the subordinated debt has remained somewhat stable with a spike in the middle of our sample period (2001) then subsequently a slight decrease (See Figures 1a through 1c).

[Figures 1a-1c and 2a-2c about here]

Another observation in our sample period regarding these two groups is that uninsured deposits are about equally prominent in all bank sizes (the mega banks –greater than \$10 billion in assets-holding the least amount) while the subordinated debt is a mega bank issue (See Figures 2a through 2c). When we look at the total sample (Figure 2b), we see that majority of the subordinated debt is concentrated in the largest banks. The more focused sample of just subordinated debt holders shows an interesting picture, however, of very similar subordinated debt ratios in very small and largest banks (Figure 2c). Similarity in the magnitude of subordinated debt holdings by these extremely different sized bank groups, and its possible implications¹¹ are interesting topics but our current sample prevents us from investigating this further: The (untabulated) highlight of our sample is that only about 9% has subordinated debt of which over 65% is large banks (with total assets >\$1 billion) while 0.1% is small banks (with total assets <\$100 million). As a result, we acknowledge that most of our analysis regarding subordinated debt applies almost exclusively to larger banks.

¹¹ One would expect smaller banks with relatively sizable amounts of subordinated debt would be more sensitive to market discipline as their ‘too big to fail’ protections should be smaller. Our sample size restricts further analysis in this direction.

Table 1 defines our variables and summarizes the mean statistics of the variables of interest for our final sample of 54,422 firm-quarters for uninsured deposits and 4,884 for subordinated debt analysis.

[Table 1 about here]

The estimated coefficients reported on all tables for all models are the sum of three lags for each variable with t statistics computed from tests for a linear combination of coefficients of these lags. We obtain heteroskedasticity-robust standard errors by using White estimator. Further, since we use a pooled data, we estimate the models using the robust standard errors derived from the pooled data clustered on bank holding company number to remove the effect of the correlations of multiple observations on one firm.

4.1. *Market Monitoring*

Table 2 reports the results where monitoring is to be picked up as at-risk claimholders respond to firm attributes by either price or quantity adjustments. In general, we find some evidence of monitoring by uninsured deposits. Specifically, we find that the quantity of uninsured deposits respond to certain bank characteristics such as profitability, loan concentration in commercial real estate positively, and as inefficiency, liquidity, and non-accruing ratio (mildly) negatively. It seems that uninsured depositors consider commercial real estate loans safe while inefficiency and non-accruing assets have a negative impact on their behavior as expected. Liquidity's negative impact is somewhat surprising that one expects depositors valuing the safety of liquid assets. But results are perhaps implying

that too much liquidity is considered to be too costly hence undesirable by uninsured depositors.

[Table 2 about here]

Response of these depositors to changes in the bank fundamentals in terms of the interest they charge on their funds is reported in the second column of Table 2. Capital ratio, real estate loan ratios, both residential and commercial, liquidity ratio and loans-to-core-deposits ratio all have the expected effect on the prices. Uninsured depositors seem to value high capital, liquidity ratios as well as real estate loans (safe) by charging lower prices while finding the high concentration of loans over core deposits risky. Overall, uninsured depositors seem to monitor the bank fundamentals and respond expectedly in terms of both their deposits and the price they demand on these deposits.

The last two columns of Table 2 report the results of the same tests for the subordinated debt holders. While we see evidence of monitoring by uninsured depositors, we don't find any meaningful relationship between the changes of subordinated debt levels and the prices charged on these funds, and bank characteristics. We see either very mild effects of certain characteristics on subordinated debt holders (ROA, Non-accruing ratio, Past Due Ratio) or one unexpected effect (negative by Inefficiency ratio) but overall with no particular pattern or story.

4.2. *Market Disciplining*

We report the results of our general equations 2a through 2d in Table 3, testing if banks respond to the changes in quantities of uninsured deposits and SNDs and to the changes

in prices charged by them. Although we don't find strong support across the board, we see some evidence of market influence on certain fundamentals especially by uninsured depositors. Panel A and B report our results related to uninsured depositors and to prices they charge on their funds. We find that the changes in uninsured deposits are followed with the changes of capital ratio in the opposite direction. For example, as the uninsured depositors ration credit in prior periods, the BHCs respond with an increase in their capital ratios in the current period. Similarly, the changes in uninsured depositors are followed by the changes in the profitability ratio (ROA) in the opposite direction. Additionally, there is the evidence of a negative relationship between the change in uninsured deposits and the change in real estate loan ratios, both residential and commercial, suggesting that real estate is an effective loan portfolio item used to make the banks more attractive to uninsured depositors. The relationship between the change in depositors' behavior and the change in liquidity is in the same direction implying that high liquidity levels are not very desirable by the depositors. Loan portfolio risks as captured by Past-due and non-accruing ratios fail to provide a meaningfully significant link though. As expected, responses by BHCs to the changes in interest rates are the opposite of the responses to the quantity changes in terms of all these variables. For example, higher interest charges by uninsured depositors in the last period(s) are followed by higher capital ratios, a possible reaction by banks for lower interest charges in the future.

Panels C and D report the results of the same relationships for SND's. The responses of banks to changes in SND's levels are more subdued than to uninsured depositors: we see the same type of responses in commercial real estate loans and liquidity, and somewhat unexpected one in ROA. But that is the extent of the relationship evidenced here. Especially

changes in the interest charged on these funds seem to have no effect on bank fundamentals. A possible explanation for this may lie in the different nature of these two types of claims. The SND's have longer-term relationships with banks, and their financial agreements are structured in a contract which may provide them some protection from risky behavior of the bank through debt covenants in these contracts. As a result, there may not be a short term response by banks to SND's behavior since they may respond through other means to satisfy SND's demands than improving their financial situation.

[Table 3 about here]

As discussed earlier, it is difficult to make inferences from the results of these models since they assume that both positive and negative market responses are evaluated similarly by the managers. Since the goal is to investigate if there is any market disciplining by the uninsured depositors and SND holders through credit rationing or higher price demand, we are interested specifically how banks react to those directional market responses. The (partial) results of our models 3a through 3d testing the additional powers of these disciplining variables are reported on Table 4.

[Table 4 about here]

These results give us some interesting comparisons to the general influencing results of Table 3. The most striking overall result is that the effect of behavioral change in uninsured depositors and SND's on bank behavior almost completely disappears when we consider only

the directional influence. That is even more pronounced for SND's: in terms of level changes and changes in prices, there is no significant disciplining effect showing up from SND holders. This, again, may imply that SND holders have access to other means to manage increased bank risk due to undesirable bank fundamentals. For UD, we still see some sporadic influence but overall banks' responses to uninsured depositors' specific negative changes (rationing their credit or increasing their prices on their credit) don't seem to result in the expected and desired direction in the following period

In summary, we find some evidence of support for market monitoring with our sample during 1996-2005 period, but all from the uninsured depositors, and mostly in terms of credit rationing rather than charging higher prices. Similar to the recent evidence in existing literature (Bliss and Flannery, 2001; Krishnan et al., 2003), we don't find any impact of banks' risk-taking behavior on SNDs in terms of credit levels or interest they charge on those funds. For market influence, we also get some sporadic evidence of support. Again, some bank reactions come in response to the uninsured depositors and SNDs, but occasionally not even in the expected way. Especially when we consider the expected responses by banks to undesirable movements in levels and prices of these funds, we don't get any meaningful conclusions. Considering the recent proposals of employment of at-risk claimants in disciplining the banks, the results provide limited support to their ultimate benefit: not only the banks may not respond to these disciplining market actions, but they may react in unintended ways.

5. Conclusions

In this paper, we investigate the two potential sources of market discipline, uninsured deposits and subordinated debt, following the conventional wisdom that these at-risk claimants have strong incentives to discipline the banks through rationing and/or pricing their credit using a sample of BHC's from 1996 to 2005. We first test to see if the documented monitoring function holds for the more recent period in banking industry for both uninsured deposits and subordinated debt. We then proceed to investigate the influencing effect of these disciplinary actions by depositors/creditors on bank behavior in the following year, by simply switching the traditional monitoring model. We further test the model by focusing on more specific type of reaction by depositors/creditors, namely a negative reaction such as rationing their credit (decrease in their holdings) or charging higher interest (increase in prices).

The results are not very encouraging: although we find some evidence of monitoring, especially by uninsured depositors, we don't find any evidence of any bank responses to these monitoring activities, especially those by subordinated debt holders. The only bank responses are to the changes in uninsured depositors fund levels or some to the changes in their prices but even those disappear when we focus specifically on the traditionally defined monitoring activities: punishing the risky, non-performing banks by rationing the credit or charging higher interest.

We conclude that high expectations from market discipline for banking system stability may be premature. There appears to be some useful signals coming from the market participants, but not strongly enough to substitute for regulatory vigilance and prompt corrective actions. The results have potentially significant and cautionary implications for the new BASEL regulations that desire a high emphasis on market discipline.

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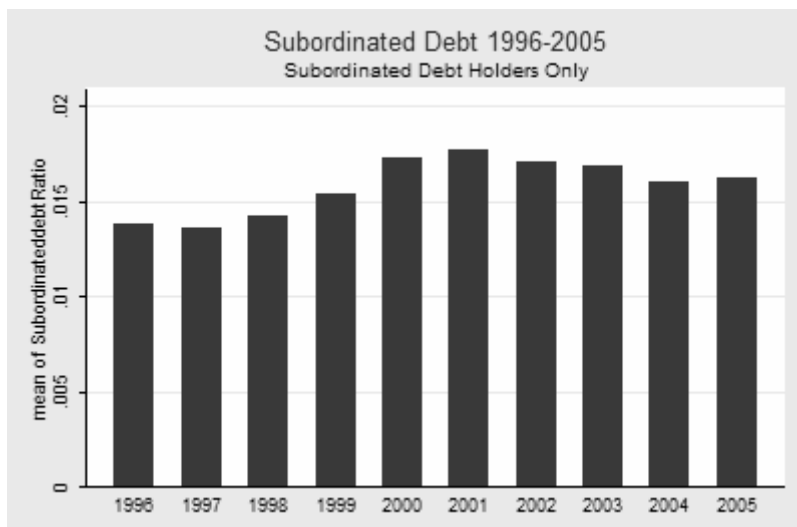
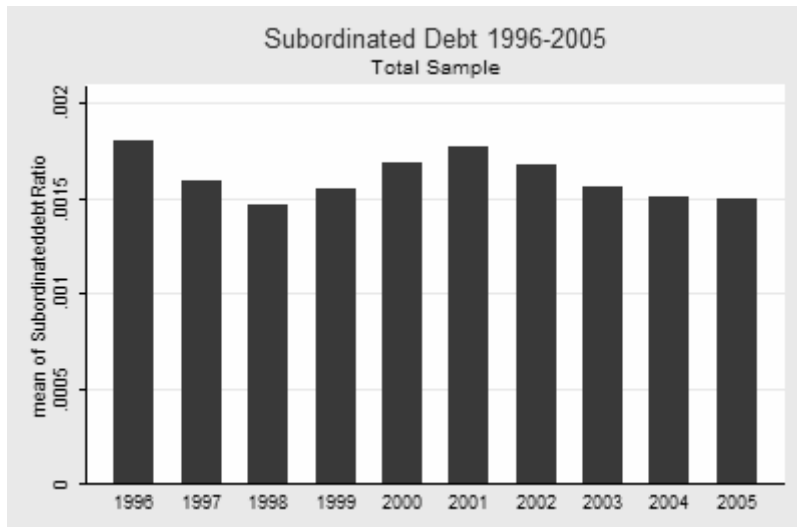
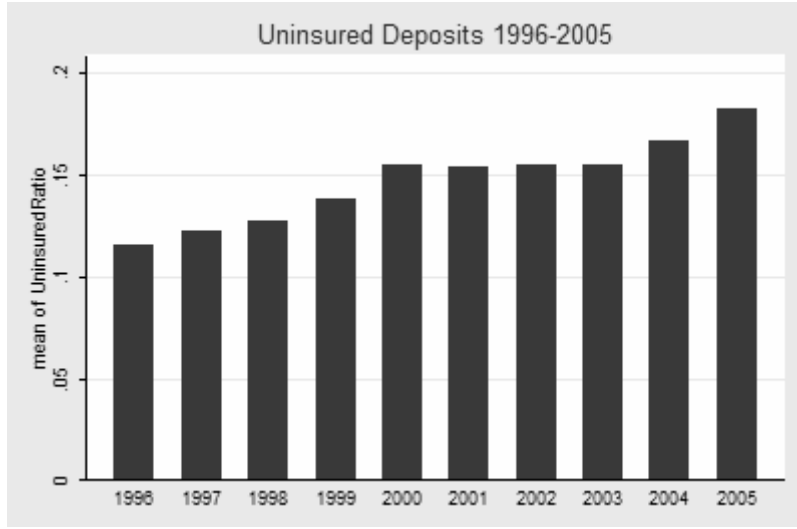
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Figures 1a-1c



Figures 2a-2c

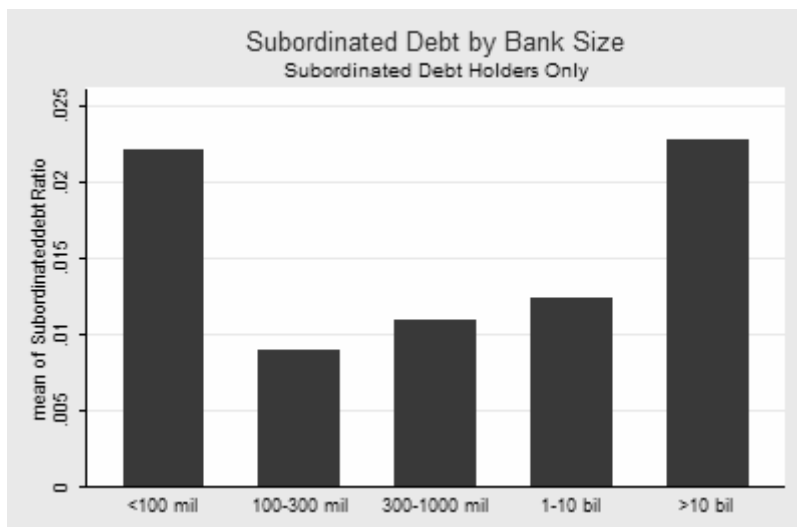
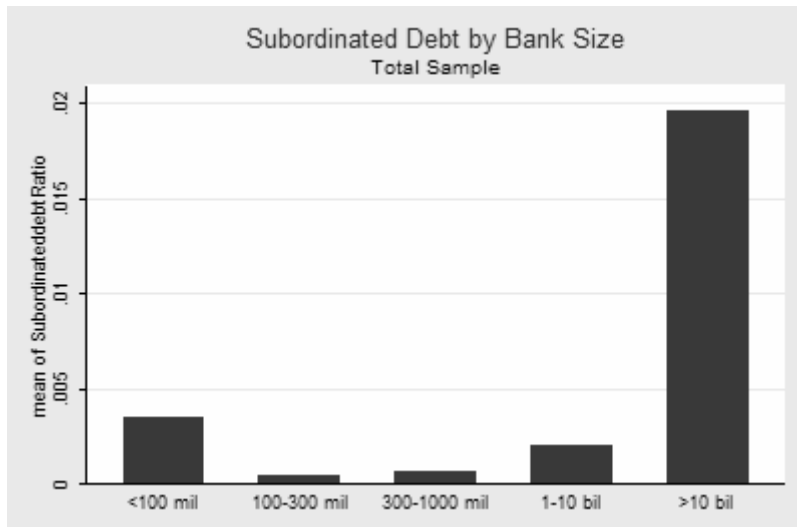
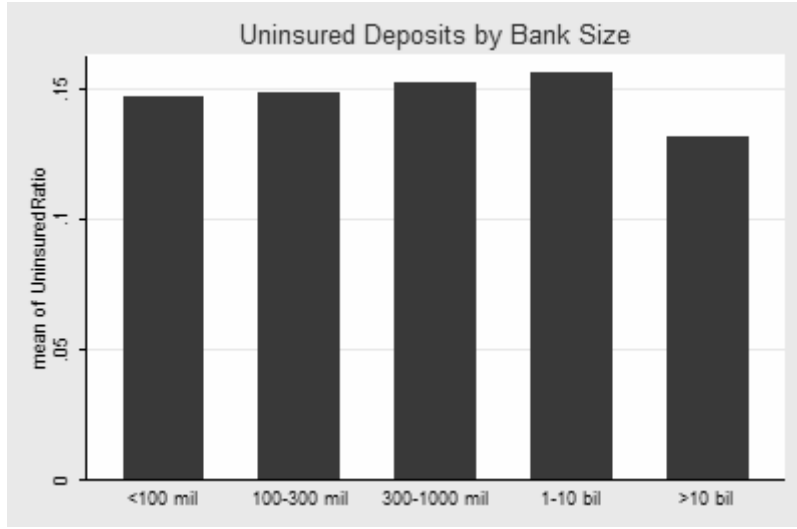


Table 1
Descriptive Statistics

Sample of 54,422 firm-quarters for uninsured deposits and 4,884 for subordinated debt.

Variable _t	Definition	Sample Statistics	
		Mean	Std. Dev.
Capital Adequacy and Earnings:			
Capital Ratio	Equity/Total Assets (TA)	0.093	0.030
Return on Average Assets (ROA)	Net Income/Average Assets	0.011	0.005
Asset Quality:			
Past Due Ratio	Loans 90+ days Past Due/Total Loans and Leases (TLL)	0.002	0.003
Non-Accruing Ratio	Non-accruing loans/TLL	0.006	0.008
Residential Real Estate Loans Ratio	1-4 Family Residential Loans/ TA	0.189	0.108
Other Real Estate Loans Ratio	(Total Real Estate Loans -1-4 Family Residential Loans)/ TA	0.246	0.130
Commercial and Industrial Loan Ratio	Commercial and Industrial Loans/TA	0.108	0.069
Individual Loans Ratio	Loans to Individuals/TA	0.064	0.063
Management:			
Inefficiency Ratio	Net Non-interest Expense/TA	0.005	0.003
Liquidity:			
Liquidity Ratio	Liquid Assets/TA	0.100	0.067
Loans to Core Deposits Ratio	TLL/Core Deposits	0.979	0.279
Other:			
Size	Log of TA	13.192	1.309
Uninsured deposits (UD)	Time deposits >100K/ Total Deposits	0.150	0.084
Price of Uninsured Deposits	Interest on Time deposits >100K / UD	0.010	0.011
*Subordinated Notes and Debentures (SND)	SNDs/Total Liabilities	0.016	0.015
*Price of SND	Interest on SNDs/ SNDs	0.026	0.095

* The subordinated debt statistics only includes the banks with subordinated debt.

Table 2**Monitoring by Uninsured Depositors and SND Holders**

UD and SND are uninsured deposits and subordinated debt. All of the variables reflect the change in that variable from the last period. Variable definitions are as in Table 1. The estimated coefficients reported on all tables for all models are the sum of three lags for each variable with t statistics computed from tests for a linear combination of coefficients of these lags (not reported for cleaner display, though available). Significant levels***, **, * are at the 1, 5 and 10% levels. Coefficients on control variables (Lagged dependent variable and variables for Size, Period, Affiliation, Interest and State) are omitted for brevity in presentation.

Explanatory Variables _{t-1}	UD _t	Price of UD _t	SND _t	Price of SND _t
Capital ratio	-0.003	-0.003**	-0.0009	-0.009
ROA	0.079***	-0.008	-0.038*	-0.386**
Past Due Ratio	-0.011	0.006	0.008	0.331*
Non-Accruing Ratio	-0.031*	-0.00002	-0.015*	0.016
Residential Real Estate Loans Ratio	0.002	-0.001***	-0.0002	0.001
Other Real Estate Loans Ratio	0.004***	-0.0007**	-0.00005	0.00005
Commercial and Industrial Loan Ratio	0.002	-0.002***	-0.0002	0.016
Individual Loans Ratio	0.003	-0.00005	-0.0002	-0.008
Inefficiency Ratio	-0.181**	-0.027	-0.029	-0.470**
Liquidity Ratio	-0.006***	-0.001***	-0.002	-0.002
Loans to Core Deposits Ratio	0.0006	0.0008***	-0.0002	-0.001
<i>R</i> -squared	0.047	0.42	0.05	0.07
Number of observations	54,422	54,422	4,884	4,884

Table 3**Effect of Change in UD and SND or Prices on Change in Fundamentals**

Influence of Uninsured Depositors and Subordinated Debt (SND)-holders on Bank Fundamentals

UD and SND are uninsured deposits and subordinated debt. All of the variables reflect the change in that variable from the last period.

Variable definitions are as in Table 1.

The estimated coefficients reported on all tables for all models are the sum of three lags for each variable with t statistics computed from tests for a linear combination of coefficients of these lags (not reported for cleaner display, though available). Significant levels***, **, * are at the 1, 5 and 10% levels. Coefficients on control variables (Lagged dependent variable and variables for Size, Period, Affiliation, Interest and State) are omitted for brevity in presentation.

Explanatory Variables _{t-1}	Capital Ratio _t	ROA _t	Past Due Ratio _t	Non-Accruing Ratio _t	Residential Real Estate Ratio _t	Other Real Estate Ratio _t	Commercial and Industrial Loan Ratio _t	Individual Loans Ratio _t	Inefficiency Ratio _t	Liquidity Ratio _t	Loan-to-Core Deposits Ratio _t
Panel A:											
UD	-0.016***	-0.012***	0.002*	0.0002	-0.025***	-0.022***	-0.007	0.011**	-0.0008	0.043***	-0.038
<i>R</i> -squared	0.02	0.28	0.16	0.04	0.01	0.01	0.01	0.01	0.57	0.12	0.03
Panel B:											
Price of UD	0.037*	0.031***	-0.001	-0.00002	0.037*	0.028	0.012	0.010	0.035***	-0.106**	0.330**
<i>R</i> -squared	0.02	0.28	0.16	0.04	0.01	0.01	0.01	0.01	0.57	0.12	0.03
Observations	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422
Panel C:											
SND	-0.057	0.070**	0.014	0.028	-0.064	-0.187**	-0.069	-0.092	-0.011	0.433**	-1.00*
<i>R</i> -squared	0.06	0.30	0.21	0.06	0.02	0.04	0.03	0.03	0.55	0.08	0.05
Panel D:											
Price of SND	-0.002	0.002	0.003	-0.0003	-0.010	0.012	-0.001	0.004	0.001	-0.0002	-0.001
<i>R</i> -squared	0.05	0.30	0.21	0.06	0.02	0.04	0.03	0.03	0.55	0.08	0.05
Observations	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884

Table 4
(Partial) Results of Directional Influence of Uninsured Depositors and Subordinated Debt holders

UD and SND are uninsured deposits and subordinated debt. All of the variables reflect the change in that variable from the last period. Variable definitions are as in Table 1.

The estimated coefficients reported on all tables for all models are the sum of three lags for each variable with *t* statistics computed from tests for a linear combination of coefficients of these lags (not reported for cleaner display, though available). Significant levels***, **, * are at the 1, 5 and 10% levels. Coefficients on control variables (Lagged dependent variable and variables for Size, Period, Affiliation, Interest and State) are omitted for brevity in presentation.

Explanatory Variables _{t-1}	Capital Ratio _t	ROA _t	Past Due Ratio _t	Non-Accruing Ratio _t	Residential Real Estate Ratio _t	Other Real Estate Ratio _t	Commercial and Industrial Loan Ratio _t	Individual Loans Ratio _t	Inefficiency Ratio _t	Liquidity Ratio _t	Loan-to-Core Deposits Ratio _t
Panel A:											
Decrease in UD	-0.010	0.00001	0.001	-0.0002	-0.001	-0.029**	0.016	-0.011**	-0.001	0.076***	-0.005
<i>R</i> -squared	0.02	0.28	0.16	0.04	0.01	0.01	0.01	0.01	0.57	0.12	0.03
Panel B:											
Increase in Price of UD	-0.019*	-0.20**	-0.002	0.005	-0.063***	0.026	0.020	0.012	0.004	0.058	0.111
<i>R</i> -squared	0.02	0.28	0.16	0.04	0.01	0.01	0.01	0.01	0.57	0.12	0.03
Observations	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422	54,422
Panel C:											
Decrease in SND	0.049	0.040	0.031	0.021	-0.051	-0.021	0.007	-0.026	0.042	0.098	0.122
<i>R</i> -squared	0.05	0.30	0.21	0.06	0.02	0.04	0.03	0.03	0.55	0.08	0.05
Panel D:											
Increase in Price of SND	-0.001	-0.0009	0.0007	-0.001	-0.002	0.016	0.009	-0.0009	-0.004	-0.008	0.010
<i>R</i> -squared	0.05	0.30	0.21	0.06	0.02	0.04	0.03	0.03	0.55	0.08	0.05
Observations	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884	4,884