The Effect of Opacity on Market Discipline during the lead up to the Financial Crisis

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This paper examines the role of opacity in the lack of market discipline in the subordinated debt market of banks leading up to the financial crisis in 2008. We investigate reasons why market monitoring and discipline appear to wane after 2001 until the financial crisis of 2008. Our results show that subordinated debt holders were caught off guard by the suddenness and magnitude of the financial crisis and that bank opacity created a vulnerable environment in the banking industry that contributed to this collapse.

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1. Introduction

The Financial Crisis Inquiry Commission (FCIC) concluded in its January 2011 report that the 2008 financial crisis was caused by failures in financial regulation and breakdowns in the corporate governance of financial institutions. Empirical evidence [1] has suggested that market discipline should have at least partially contributed to monitoring and managing bank risk in the absence of effective regulatory controls. However, participants in the unsecured bank debt market apparently failed to recognize the signs of growing risk in the banking system[2]. The recent financial crisis provides clear evidence that monitoring mechanisms have either not materialized, or they were insufficient (Flannery 2008). This paper examines the possible causes of this breakdown of market discipline in the banking industry leading up to the financial crisis.

Benston (2004) identified several features that make banks unique from other entities. Specifically, banks play an important role in providing economic stability, economic growth and links to international trade and investment. While banks are essential to a developed and well-functioning financial marketplace, the valuation of its assets can be difficult since its primary assets are loans which can lack transparent

[1] See Bliss and Flannery (2001), Flannery and Rangan, (2008), Morgan and Stiroh (2001)
[2] These cited causes of the financial crisis are similar to Llewellyn (2002) who cites both ineffective regulatory supervision and a lack of market discipline as causes of various banking crises in Asia from 1990-1997.

information. Market participants do not have access to the private information of the loan recipients that is collected by banks and is needed to accurately assess risk. The similar absence of transparency of the banks' asset backed securities and intangible assets further compound the challenge to determine the correct valuations. In addition, with the introduction of universal banking from the Gramm-Leach-Bliley Act in 1999, banks have evolved into even more complex organizations that are engaged in a wide array of business activities. This complexity can consequently add even more obscurity to the valuation process with the rise of off balance sheet activities like Mortgage Backed Securities (MBS), Collateralized Debt Obligations (CDOs), etc. We define bank opacity as the difficulty of market participants to assess the true value of bank assets and the true degree of risk associated with those assets.

Opacity can create a vulnerable environment for the banking industry. Investor mispricing of assets can lead to price bubbles and financial instability because market participants are not provided with accurate information to make informed decisions (Jones, Lee, and Yeager 2012a). If bank assets are correctly priced, there should be a tradeoff between market discipline and regulation to control risk in the industry. As deregulation occurs, market participants should be more likely to discipline the excessively risky behavior of banks by requiring higher yields on subordinated debt. However, opacity could distort the true risk to both regulators and market participants, which hinders the effectiveness of both methods of controlling risk in the banking industry.

Another possible reason for the breakdown in market discipline in the lead up to the financial crisis is a heightened perception of the Too Big to Fail (TBTF) subsidy. Flannery and Sorescu (1996)[3] argue that the losses to debt claimants during the collapse of First Republic Bank Corporation in 1988 softened the perception of the TBTF subsidy and therefore encouraged market participants to once again monitor and discipline the risk-taking behavior of banks.[4] However, after this resurgence of market discipline, it once again disappeared after 2001.

The main objective of this paper is to determine what impaired the ability of market discipline to control risk in the lead up to the financial crisis. We argue that the increase of bank opacity over time has impaired market discipline. In some ways, the increased opacity of the banking industry is an even greater problem than the existence of TBTF.[5] Since the failure of a TBTF institution could potentially trigger a contagion, it should require even more oversight from a regulator's perspective. In other words, less market discipline should be associated with more

[3] We replicate methodology of Flannery and Sorescu (1996) to analyze the relationship between subordinated debt yield spreads and bank risk.

[4] However, Solidad, Peria and Shmukler (2001) show that safety nets do not diminish market discipline.

[5] Jones et al, (2012b) find opaque assets decrease charter value and thereby decrease yet another avenue of discipline.

regulatory discipline. However, an increase in opacity would diminish the ability of both market participants and regulators to accurately gauge the risk of a bank (Bliss 2001). In examining this topic, we contribute to the literature in three distinct ways. First, we confirm that bank opacity has, in fact, increased from 2002 to 2007. Second, we determine if market discipline has been breaking down during this same time period. Finally, once we've provided evidence to support both of these hypotheses independently, we demonstrate that it was opacity that caused the lack of market discipline leading up to the financial crisis in 2008.

The remainder of the paper will proceed as follows. In section two, we discuss the literature on market discipline in the banking industry and develop our hypotheses. Section three describes the data and methodology. Section four presents and discusses the results. Section five concludes.

2. Literature Review and Background

Market efficiency assumes asset prices reflect all relevant information collected, analyzed, and disseminated by market participants. In the bank subordinated debentures market, an increase in bank risk should be accompanied with a rise in the spread between the yield on these subordinated debt issues and US treasury securities with a comparable maturity. This rise in yield spreads should punish banks for taking excessive risk by raising the cost of debt. In order for this relationship to hold, market participants must have both the ability and the incentive to discipline the risk taking behavior of banks. In other words, market participants must possess the following two conditions:

1) Ability: Market participants monitor banks' behavior, which allows them to collect and update their information set.

2) Incentive: Market participants act rationally in regards to new information, such that the price of the bond accurately reflects this new information.

If these conditions hold, market participants will discipline the risk taking behavior of banks by increasing the cost of debt for a given bank. However, this discipline may not actually change the bank's behavior. Krishnan et al (2005) find that credit spreads do not provide bank supervisors with an accurate estimate of changes in bank risk because the signal to noise ratio is too small. They find little evidence that the issuance of subordinated debt can actually control risk taking and provide an accurate risk signal to the market. This supports our hypothesis that increased opacity in the banking industry has caused these signals to become too "noisy" for market participants and regulators to interpret effectively.

Bliss and Flannery (2001) offer another alternative as to why market participants may not discipline banks for excessive risk taking by demanding higher yields. They argue that even if market participants can monitor banks, a bank may not be disciplined for increased risk if market participants do not anticipate an increase in the likelihood of bankruptcy along with that heightened risk. This could be especially true for banks considered to be TBTF and are likely to be rescued by

regulators during times of financial turmoil. Regardless of whether a TBTF policy actually exists, if just the perception from market participants is that a TBTF policy exists, they may choose not to discipline the banks for excessive risk-taking.

Flannery and Sorescu (1996) found that the implicit TBTF status hindered market discipline from 1983 to 1988. Market participants were less likely to discipline TBTF banks because they were likely to be rescued by regulators during times of financial turmoil. Therefore, there was an insignificant relationship between bank risk measures and subordinated debt yield spreads during this sample period. However, regulators removed the TBTF policy in the late 1980s and early 1990s, making it increasingly clear that bank subordinated debt-holders were not protected. As a result, subordinated debt yield spreads were statistically significant and positively correlated to bank-specific risk measures from 1988 to 1991. Still, market participants' perception of TBTF could change over time and the incentive for market discipline could disappear again in later periods. This paper significantly extends the work of Flannery and Sorescu (1996) by expanding the sample period and utilizing higher frequency data.

Regardless of the TBTF policy, market participants must have the ability to effectively monitor the riskiness of banks for market discipline to exist. Over the last two decades, banks have evolved into more complex organizations that engage in a wider array of business activities. Banks have always been considered to be relatively opaque because loans - their primary asset - are opaque in nature. Market participants do not have access to the private information collected by the banks on their counterparty and are therefore unable to accurately assess the riskiness or fair market value of these loans. However, banks have recently become even more opaque (Gu 2010) due to the growth of off balance sheet activities and trading activities such as high-risk mortgage backed securities (MBS) and other collateralized debt obligations (CDOs).[6]

3. Data and Methodology

3.1 Motivation and Hypotheses

We offer three hypotheses that are hierarchical in nature. That is, the earlier hypotheses must be supported in order to consider subsequent hypotheses. Our first hypothesis is:

H1: Bank opacity has increased over time.

As opacity increases, market participants' ability to monitor bank risk may diminish due to the inability to effectively price, or in some cases even identify, the liabilities and assets of the bank. This hinders market discipline regardless of the market's perception of the TBTF policy.

In the official FCIC report, the commission states that there was a lack of

[6] This is consistent with the view that opacity is a consequence of inherent complexity and nature of the underlying assets (Jones, et al. 2012b).

regulatory enforcement and rating agencies did not fully measure the risks involved. If opacity impaired the ability of both regulators and rating agencies to effectively measure bank risk, it would have been even more difficult for market participants to do so. Based on this discussion, we offer a second hypothesis:

H2: The statistical significance of the relationship between idiosyncratic bank risk and subordinated debt yield spreads weakens over time.

The third hypothesis offers two competing perspectives regarding the lack of market discipline observed in the lead up to the financial crisis in 2008. As we have suggested earlier, opacity can hinder the ability of market participants to monitor bank risk and therefore could be the primary reason why there was little evidence of market discipline in the bank subordinated debt market. Alternatively, banks could be viewed as TBTF as they continued to grow in size and scope. The greater the potential negative impact that a bank failure could have on the wider economy, the higher the market expectation is that regulators will not allow the bank to fail. It is evident that large banks did in fact grow in size and scope during the last decade. The increased use of derivatives and participation of nonbank counterparties increased the sensitivity of financial health in both nonbank institutions and large banks. This would suggest that the negative impact of large bank failures would have grown over time. Therefore, the perceived TBTF guarantee may have strengthened over time. As stated earlier, this perception of TBTF by market participants would lower their incentive to discipline banks.

H3a: Opacity, and not the TBTF policy, is the primary reason for the lack of market discipline leading up to the financial crisis in 2008.

H3b: TBTF policy, and not opacity, is the primary reason for the lack of market discipline leading up to the financial crisis in 2008.

3.2 Sources of Data

Accounting risk measures of banks and all opaque asset measures were constructed from data gathered from FRY-9C quarterly reports from 1994 to 2008. New debt issues were collected from Thomson Reuters SDC Platinum New Issues Database (SDC) to identify Bank Holding Companies (BHCs) and Financial Holding Companies (FHCs). This data was then matched with transaction data from the National Association of Insurance Commissioners (NAIC). The NAIC data provides us with the investment activities of life/accident/health, property/casualty, title, fraternal and health companies, from which subordinated debt yield spreads are calculated. Finally, we pulled yields for the subordinated debt issues from Bloomberg to verify the consistency of our NAIC data[7].

3.3 Variable Definitions

To test our three hypotheses, we identify and categorize specific bank assets as

[7] The NAIC and Bloomberg data were similar in most cases.

opaque.[8] We construct three loan variables, all scaled by total assets. The three variables are labeled *REAL_LOANS*, *TOTAL_LOANS* and *OTHER_LOANS*. *REAL_LOANS* represent the summation of all residential and non-residential real estate loans divided by total assets. *TOTAL_LOANS* are simply the bank's total loans divided by total assets. *OTHER_LOANS* is the difference between *TOTAL_LOANS* and *REAL_LOANS*. The variables *MBS* and *ABS* represent mortgage-backed and asset-backed securities, respectively, that are not guaranteed by any government agency or government sponsored enterprise (GSE). Both of these variables are also scaled by total assets. Mortgage-backed and asset-backed securities issued by GSEs are not classified as opaque assets and therefore are not included in the analysis.

We construct a variable called *HIGH_OPAQUE* which is the sum of the variables *MBS* and *ABS*, as well as other trading assets, intangible assets, and investments in unconsolidated subsidiaries, all divided by total assets. As stated earlier, MBS and ABS are both securitized assets and are characterized as being very opaque. CDOs, which for banks are primarily made up of resecuritized MBSs and ABSs, increasingly become a larger part of trading assets along with other hybrid financial instruments. Intangible assets are by definition opaque because they are non-monetary assets that cannot be physically measured while accounting treatment of investments in unconsolidated subsidiaries makes them opaque[9]. The variable *OTHER_OPAQUE* is the sum of premises and fixed assets, goodwill, other assets and other real estate owned, divided by total assets. We distinguish between *HIGH_OPAQUE* and *OTHER_OPAQUE* because the *HIGH_OPAQUE* assets are more complex and harder to price.

3.4 Methodology

Building on the methodology used by Flannery and Sorescu (1996), we test for the presence of market discipline in the subordinated debt market from 1994 to 2007. We not only extend their sample period, but our data also offers a higher frequency of observations (quarterly instead of annually). As with Flannery and Sorescu, we use fixed effects panel regressions, controlling for both firm and time effects to test our second hypothesis. Specifically, by using the same variables, we replicate the main results in Table 3 of their paper. Below is the model we utilize.

$$SPREAD_{it} = \beta_1 NATA_{it} + \beta_2 PDTA_{it} + \beta_3 OREOTA_{it} + \beta_4 AGAP_{it} + \beta_5 MKTLEV_{it} + \beta_6 ROA_{it} + \beta_7 lnTA_{it} + YearDummy_{it} + \varepsilon_{it} \quad (1)$$

The dependent variable, *SPREAD* is the difference between the yield of subordinated debt and the yield of a treasury bond with the closest maturity. The

[8] See appendix for a full listing of FR Y-9C line items used to construct bank specific variables.

[9] Financial statements of subsidiaries where the BHC has between 20% and 50% common equity voting rights are not included in the consolidated financial statements of the BHC. Instead, this type of subsidiary appears as a line item investment where the initial investment is recorded at book value and adjustments are made based on proportional profits or loss reported by the subsidiary. Therefore the risk profile of the subsidiary is not disclosed.

independent variables are classified as bank specific risk measures. An increase in any of the risk measures should increase the *SPREAD* variable. *NATA* is the ratio of nonaccruing loans to total assets. *PDTA* is the ratio of accruing loans that are at least 90 days past due to total assets. *OREOTA* is the ratio of other real estate owned to total assets. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. The maturity gap is the difference in the amount of assets and liabilities that are maturing, or repricing, within one year. *ROA* is used as a contra-risk measure and it is calculated as net income divided by total assets. It is expected to have a negative relationship with *SPREAD*. Finally we use the log of total assets, *lnTA*, to control for bank size effects, and the year dummy variables capture inter-temporal variations that may affect the spread. Severe multicollinearity prevents us from using opacity measures and risk measures in the same model. Specifically, we see strong multicollinearity between the *HIGH_OPAQUE* measure and *MKTLEV* as well as between *HIGH_OPAQUE* and *lnTA*. This is consistent with the view that larger banks are increasingly engaged in leveraged securitization. As an alternative, we run our analysis on subsamples of BHCs based on size.

To test if opacity is driving our results, we screen out the TBTF[10] banks and rerun the fixed effects panel regression model from Equation 1 above. Because larger banks have more issuances of subordinated debt securities, TBTF banks represent 64.55% of the individual subordinated debt observations and account for 33.48% of the banks in our sample. If we do not observe a positive relationship between our risk measures and *SPREAD*, then there is no evidence of market discipline in the smaller banks and we can conclude that TBTF was not the key factor impeding market discipline during the run up to the financial crisis.

3.5 Summary Statistics

Table 1 shows the summary statistics of all variables used in our analysis as a percentage of total assets. It is divided into two panels with Panel A shows the summary statistics for banks classified as too big to fail and Panel B shows the summary statistics for all other banks in our sample. Table 1 shows that loans, which are considered to be the primary asset of banks, constitute 50.9% of total assets for TBTF banks. This is about 14.5 percentage points less than the non-TBTF banks and this difference is statistically significant at the 1% level. This is an important distinction because loans are considered to be more transparent and easier to value than many other assets held by banks and suggests that TBTF banks may have been shifting from transparent assets to more opaque assets.

[10] We identify the ten largest commercial banks based on the average total assets throughout the sample period and categorize these banks as TBTF. The top five banks are consistently in the top 6 every quarter. Classifying only the top five banks as TBTF yields similar results.

Table 1: Summary Statistics

Panel A: TBTF = 1	N	Mean	Median	Minimum	Maximum	STD
REAL LOANS	2169	22.57	24.34	0.85	49.69	12.25
OTHER LOANS	2169	28.30	25.80	13.35	54.77	8.91
MBS	2169	0.86	0.31	0.00	5.36	1.20
HIGH OPAQUE	2169	17.56	14.77	1.80	54.42	10.32
OTHER OPAQUE	2169	9.09	9.59	3.86	14.30	2.09
SPREAD	2169	2.16	1.89	-2.43	8.56	1.34
NATA	2169	0.53	0.43	0.11	2.59	0.35
PDTA	2169	0.22	0.12	0.00	1.78	0.27
OREOTA	2169	0.14	0.09	0.00	1.59	0.17
MKTLEV	2169	820.60	681.70	281.60	3972.10	420.8
AGAP	2169	168.00	150.50	14.70	752.10	99.60
ROA	2169	0.61	0.58	-4.20	2.18	0.49
lnTA	2169	19.97	19.99	18.09	21.58	0.83
Panel B: TBTF = 0						
REAL LOAN	1191	30.51	29.94	1.28	58.58	12.71
OTHER LOAN	1191	34.75	35.01	10.54	60.42	10.83
MBS	1191	1.17	0.50	0.00	18.68	2.21
HIGH OPAQUE	1191	4.34	3.03	0.09	30.13	4.38
OTHER OPAQUE	1191	8.26	7.52	2.64	26.39	3.47
SPREAD	1191	2.29	1.99	-1.59	12.13	1.32
NATA	1191	0.54	0.43	0.02	2.26	0.39
PDTA	1191	0.20	0.16	0.00	1.70	0.17
OREOTA	1191	0.10	0.06	0.00	0.75	0.13
MKTLEV	1191	602.10	524.70	167.30	3281.70	297.60
AGAP	1191	168.80	156.40	2.50	1693.30	121.50
ROA	1191	0.81	0.73	-2.65	3.08	0.49
lnTA	1191	18.04	18.11	15.37	19.58	0.67

Notes: *REALLOANS* is all real estate loans to total assets. *OTHERLOANS* represents the difference between *TOTAL LOANS* and *REAL LOANS* to total assets. *MBS* represents all mortgage backed securities not guaranteed by a government sponsored entity to total assets. *HIGH OPAQUE* represents the sum of *MBS*, *ABS,* other trading assets, intangible assets, and investments in unconsolidated subsidiaries divided by total assets. *OTHER OPAQUE* represents the sum of premises, goodwill, other assets, and *OREO* divided by total assets. *SPREAD* is the percentage spread between bank subordinated debt yields and the yield of a treasury security with a similar maturity. *NATA* represent non-accruing loans to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity.[11] *ROA* is calculated as net income divided by total assets. *lnTA* is Natural log of total assets.

[11] See Flannery and James (1984) for additional information on the construction of AGAP.

Two other variables that show dramatic differences are *HIGH_OPAQUE* and *MKTLEV*. TBTF banks have substantially higher market leverage and a greater portion of their total assets are highly opaque. *HIGH_OPAQUE* is primarily composed of trading assets which include CDOs. During the 2005 to 2008 period, the issuance and trading of CDOs increased greatly. Although *MBS* accounts for less than 1% of total assets for TBTF, this figure can be misleading. Since *MBS* increasingly became the main underlying asset for CDOs, much of its value is likely captured in the trading assets measure. As banks repackaged securitized assets and created derivatives of derivatives, the line items for *MBS* became underreported. Overall, this pattern indicates that TBTF banks have been shifting from less opaque assets to more opaque assets.

4. Results

4.1 Hypothesis 1

To investigate our first hypothesis, we look at the changing asset composition of all banks in our sample across time. In Figure I, we see evidence that total opaque assets increased relative to total assets from 1994 to 2008. This indicates that banks have shifted their allocation towards opaque assets. This trend supports our first hypothesis that bank opacity has in fact been increasing over time.

Figure I: Total Opaque Assets to Total Assets

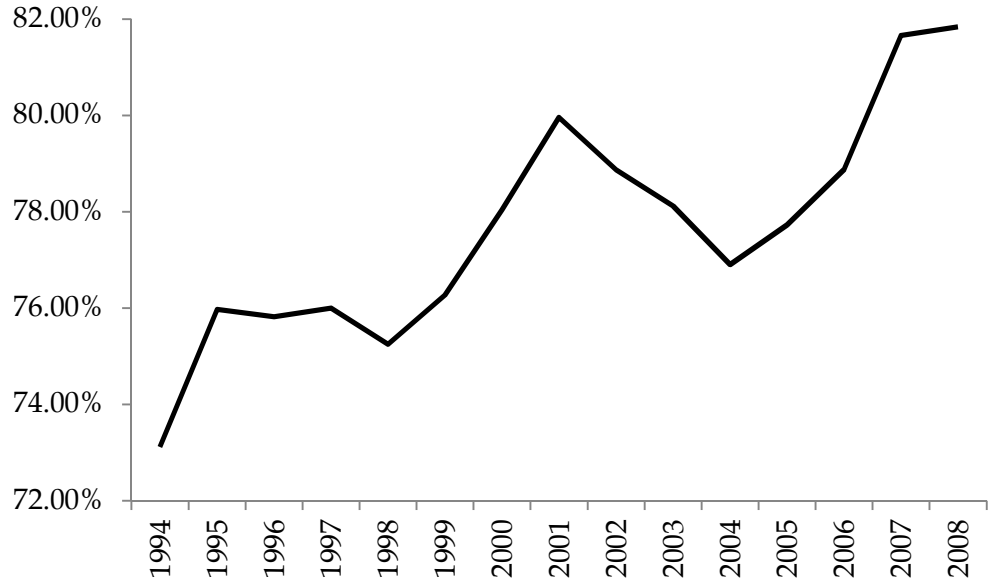

Figure I shows the mean percentage composition of Total Assets accounted for by opaque assets over time from 1994 to 2008. There is presence of a positive trend as opaque assets represents approximately 73% of total assets in 1994 and represents almost 82% of total assets by 2008. The sample consists of 3360 bank-quarter observations.

Table 2: Trend of Opaque Assets

	1994	1996	1998	2000	2002	2004	2006	2008
TOTAL OPAQUE	73.12	75.82	75.25	78.03	78.87	76.9	78.88	81.84
TOTAL LOANS	54.43	58.39	57.69	61.46	54.01	52.65	54.69	54.53
HIGH OPAQUE	12.42	10.94	9.97	7.52	14.54	14.69	13.89	16.78
OTHER OPAQUE	6.27	6.49	7.59	9.05	10.33	9.56	10.29	10.53
REAL LOANS	21.84	22.08	20.81	24.06	24.64	27.95	29.93	29.62
TOTAL OPAQUE (All Banks)	62.51	65.32	66.45	70.48	70.85	72.08	76.97	79.74

Notes: The first row shows the mean percentage composition of Total Assets accounted for by opaque assets over time from 1994 to 2008. This is a tabular representation of Figure I. The second row shows the mean percentage composition of Total Assets accounted for by loans over time from 1994 to 2008. There is presence of a positive trend from 1994 to 2001 but in the latter half of our sample, this trend disappears. Overall, loans represent approximately the same amount of total assets in 1994 and 2008. The third row shows the mean percentage composition of Total Assets accounted for by high opaque assets (MBS + ABS + other trading assets + intangible assets + investments in unconsolidated subsidiaries) over time from 1994 to 2008. There is presence of a negative trend as high opaque assets represents approximately 12.5% of total assets in 1994 and represents less than 8% by 2000. The trend becomes positive in the latter half of our sample as high opaque assets more than double to almost 17% of total assets by 2008. The fourth row shows the mean percentage composition of Total Assets accounted for by other opaque assets (premises + goodwill + other assets + OREO) over time from 1994 to 2008. There is presence of a positive trend as other opaque assets represents approximately 6% of total assets in 1994 and represents approximately 10.5% by 2008. The fifth row shows the mean percentage composition of Total Assets accounted for by real estate loans over time from 1994 to 2008. There is presence of a positive trend as real estate loans represent approximately 22% of total assets in 1994 and almost 30% by 2008. In conjunction with row 2, the composition of total loans shifts towards real estate loans over our sample period. The first five rows are derived from a sample consisting of 3360 bank-quarter observations. The last row shows the mean percentage composition of Total Assets accounted for by opaque assets over time from 1994 to 2008 for all FRY-9C banks. There is presence of a positive trend as opaque assets represents approximately 62.5% of total assets in 1994 and represents almost 80% of total assets by 2008. This pattern is very similar to the pattern shown in the first row, indicating that the positive trend of opaque assets to total assets is not isolated to our sample banks. The sample of the final row consists of 108,867 bank-quarter observations.

Table 3: Yearly Summary Statistics for Spread and Yield

Year	N	Mean	Median	Minimum	Maximum	Standard Deviation
Panel A: Spread ()						
1994	179	3.34	3.33	1.04	6.59	0.69
1995	270	1.63	1.54	-0.37	5.79	0.70
1996	255	1.89	1.85	-1.59	5.18	0.61
1997	264	1.79	1.74	0.29	4.05	0.50
1998	219	1.50	1.31	0.26	3.93	0.64
1999	141	1.94	1.90	0.92	3.25	0.46
2000	92	1.27	1.21	0.22	2.38	0.48
2001	228	2.74	2.62	0.57	5.66	1.11
2002	256	3.70	3.85	0.85	6.05	1.04
2003	263	2.97	3.02	-2.43	6.70	1.31
2004	278	2.94	2.88	0.67	6.32	1.11
2005	244	1.51	1.40	-0.64	5.67	0.69
2006	244	0.55	0.51	-0.88	2.61	0.44
2007	228	1.03	0.95	-0.91	3.89	0.82
2008	199	3.93	3.50	1.22	12.13	1.68
Panel B: Yield ()						
1994	179	7.65	7.74	4.70	10.10	0.86
1995	270	7.33	7.22	5.15	11.31	0.77
1996	255	7.00	7.00	3.37	10.33	0.64
1997	264	7.02	6.95	5.57	9.25	0.47
1998	219	6.51	6.43	5.19	8.46	0.57
1999	141	6.78	6.84	5.55	8.14	0.55
2000	92	7.42	7.43	6.33	8.37	0.35
2001	228	6.13	6.23	3.02	8.36	0.87
2002	256	5.30	5.40	2.18	7.70	1.09
2003	263	4.03	4.09	-1.34	7.65	1.31
2004	278	4.31	4.51	1.63	7.36	1.03
2005	244	4.77	4.83	2.26	8.25	0.60
2006	244	5.42	5.36	3.96	7.70	0.43
2007	228	5.44	5.38	4.25	7.84	0.46
2008	199	5.49	5.24	3.18	13.88	1.35

Notes: Panel A shows summary statistics over time for the spread over treasury of subordinated debt over time from 1994 to 2008. Yield spread rise from 2000 to 2002 and then steadily falls until 2008. Panel B shows the summary statistics for bank subordinated debt yields, which are higher in the earlier half of our sample

Table 2 subcategorizes the opaque assets into more precisely labeled groups. Rows 2, 3, and 4 of Table 2 represent *TOTAL_LOANS*, *HIGH_OPAQUE*, and *OTHER_OPAQUE* assets. Although many assets may be opaque, the degree of opacity varies. As shown in Table 2, *TOTAL_LOANS* decline as a percentage of total assets while both *HIGH_OPAQUE* and *OTHER_OPAQUE* increase. This pattern indicates that banks are not only shifting from transparent assets to opaque assets, but the composition of opaque assets is shifting from less opaque to more opaque.

Row 5 shows that real estate loans grew steadily as a percentage of total assets, while the ratio of total loans to total assets declined. This pattern is consistent with the real estate bubble that occurred during this time period. Row 6 of Table 2 shows the percentage of total opaque assets to total assets for all BHCs that file FRY-9C reports. We do this to verify that the pattern we see is not isolated to just the banks in our sample. The similarity between Row 1 and Row 6 indicates that banks in general have become more opaque during our sample period.

4.2 Hypothesis 2

We investigate the measure of perceived risk in the bank subordinated debt market by comparing the yield spread (as measured by our *SPREAD* variable) and the yield level across each year of our sample. Table 3 panel A shows the summary statistics for the spread between the yield of the subordinated debt and a treasury bond with a similar maturity[12]. Panel B shows the summary statistics for the actual yield of the subordinated debt. Figure II illustrates the data in Table 3. Prior to 2001, the average yield was never below 6.5. From 2002 onwards, the yield never surpasses 5.5. This suggests that market participants may not have accurately assessed the inherent risk that was present in the banking industry from 2002 to 2008 and, in response, conducted appropriate market discipline.

As shown in Figure II, the yield spread is relatively stable between 1995 and 2000. In 2001 and 2002, the yield spread rises in response to the slowing economy and the tragic events of September 11, 2001 as investors retreated to safer treasuries in face of growing uncertainty. After 2002, we see a steady decline in the yield spreads, reaching their lowest point in our sample in 2006 right before the bursting of the real estate bubble. In 2007, we witness a rise in the yield spreads in reaction to the credit crises in the investment banking industry. Finally in 2008, the continued deterioration of the health of the financial sector and declining confidence in the banking industry led to a drastic spike in the subordinated debt yield spreads. This figure is a graphic depiction of the decline in yield spreads during the lead up to the

[12] 10-year treasury notes and 30-year treasury bonds are issued every quarter on the 15th of February, May, August, and November. 2-year to 7-year treasury notes are issued every month either on the 15th or the end of the month. We match subordinated debt by quarter. This means that the most the maturities between a treasury security and subordinated debt will be off is 15 days for maturities less than 7 years and 45 days for longer maturities. We also censor out all observations with subordinated debt maturities of less than one year.

financial crisis. If banks were in fact more risky during this time period, then yield spreads should have risen.

Figure II: Spreads and Yields on bank subordinated debentures

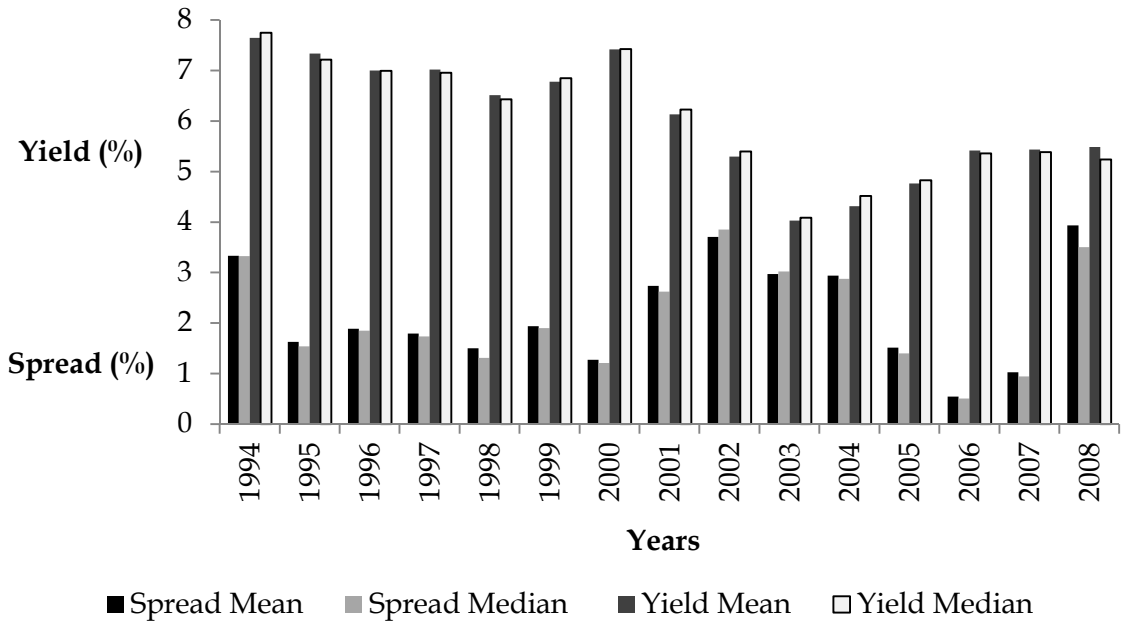

Figure II shows the mean and median yields and spreads over treasury of subordinated bank debt over time from 1994 to 2008. Subordinated debt yields are higher in the earlier half of our sample as it never drops below 6 while it is never above 5.5 in the later half. Yield spread rise from 2000 to 2002 and then steadily falls until 2008. The sample consists of 3360 bank-quarter observations. Figure II corresponds directly with Table 3, Panel A and B.

Motivated by the above observations, we investigate the presence of market discipline in two separate time periods, 1994 to 2001 and 2002 to 2007. Although we show 2008 data in the summary statistics and in previous graphs, we do not include it in our regression analysis. Our primary objective is to see if market participants disciplined banks during the run up to the 2008 financial crisis.

Table 4 reports the results of our fixed effects panel regressions on all sample banks. Column 1 examines the quarterly data from 1994 to 2007. Columns 2 and 3 show the 1994 to 2001 and 2002 to 2007 sub periods, respectively. The results in column 1 show that *NATA* and *MKLEV* are both positive and highly significant as expected. The performance measure of *ROA* is negative and significant, also consistent with expectations. All else equal, better performing banks should be at less risk of default. The other three risk variables (*PDTA*, *OREOTA*, and *AGAP)* show mixed signs but are all insignificant. The control variable for size, *lnTA,* is negative and significant at the 10 level. This indicates that there seems to be a minor perception that larger banks are less likely to default on their subordinated debt obligations.

Overall, these results support the notion of market discipline over the entire sample period from 1994 – 2007.

Table 4: Linear Panel Regression of Spread on Bank Accounting Ratios

	(1)	(2)	(3)
	1994 - 2007	1994 - 2001	2002 - 2007
NATA	0.254***	0.239**	0.084
PDTA	-0.246	0.254	-0.201
OREOTA	0.235	0.081	0.320
AGAP	-0.009	0.053*	-0.209***
MKTLEV	0.039***	0.031**	0.021
ROA	-0.200***	-0.081**	-0.379***
lnTA	-0.145*	0.099	-0.786**
R^2	0.539	0.406	0.521
Nobs	3030	1577	1453

Notes: Dependent variable is the SPREAD measured in percent for each subordinated debt transaction by quarter. Estimation method is fixed effects panel estimation, in which each bank is permitted to have its own intercept term. Fixed effects model and explanatory variables are defined as follows:

$$SPREAD_{it} = \beta_1 NATA_{it} + \beta_2 PDTA_{it} + \beta_3 OREOTA_{it} + \beta_4 AGAP_{it} + \beta_5 MKTLEV_{it} + \beta_6 ROA_{it} + \beta_7 lnTA_{it} + YearDummy_{it} + \varepsilon_{it}$$

NATA represent non-accruing loans to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *ROA* is calculated as net income divided by total assets. Natural log of total assets is represented as *lnTA*. Coefficients for the *YearDummy* variables are omitted to conserve space and are available upon request. ***Significant at the 0.01 level **Significant at the 0.05 level *Significant at the 0.10 level

When we divide our sample, the results become even stronger in the first half of the sample period. In column 2, *NATA* and *MKTLEV* are once again significantly positive. In addition, *AGAP* is significantly positive, indicating that interest rate risk caused by the short term maturity mismatch between liabilities and assets are being priced into the subordinated debt market. The remaining two risk measures, *PDTA* and *OREOTA,* are not significant but unlike the first column, they show consistent positive signs. *ROA* remains negative and significant although the coefficient is much smaller. Also notice that size of the bank no longer influences the yield spread. The results of the sample period from 1994-2001 in column 2 show stronger evidence of market discipline than the entire sample represented in the first column.

Looking at the later period leading up to the 2008 financial crisis, we see that market discipline begins to break down. In fact, *ROA* is the only independent variable that is consistent with expectations. All of the other risk measures are

either insignificant, or the signs are in the wrong direction. *AGAP* stands out as it is negative and highly significant at less than 1. This indicates that market participants actually reward banks that increase their interest rate sensitivity risk. We also notice that *lnTA* is again negatively related to *SPREAD*. This indicates that during the later period, larger banks were viewed as safer. Market participants rewarded good performance but did not punish increased risk. Overall, these results do not show strong evidence of market discipline of banks during the period leading up to the financial crisis.

Table 5: Cross-section, Linear Regressions of SPREAD on Bank Accounting Ratios

Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
NATA	-0.125	0.111	0.421**	0.035	-0.037	0.129	-0.620*
PDTA	1.787*	0.728	0.425	0.891**	0.646	1.44***	0.616
OREOTA	0.213	-0.598	0.496	-0.488	0.400	1.893*	-1.538
AGAP	0.018	0.063*	0.106**	-0.079	-0.006	-0.113	0.217***
MKTLEV	-0.021	-0.041**	0.031**	0.009	0.088***	0.054**	-0.034
ROA	-0.745***	-0.660***	0.061	-0.714***	0.555***	0.007	-0.487***
ln(TA)	0.027	0.048	0.038	-0.040	-0.014	-0.058	-0.060
R^2	0.146	0.069	0.026	0.232	0.129	0.158	0.209
Nobs	172	259	244	253	210	135	88
Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
NATA	0.989***	0.176	-0.025	-1.045***	-1.050***	-0.687***	-0.343
PDTA	1.416**	1.544**	0.480	-1.280***	-0.167	0.029	-0.883***
OREOTA	-2.371	2.099**	3.486***	2.442***	0.646	0.610	-4.183***
AGAP	0.189	0.180	0.098	-0.080	0.079	0.057	-0.149**
MKTLEV	0.198***	0.031	0.089**	-0.010	-0.126*	0.025	0.438***
ROA	1.432***	-0.542***	0.479**	-0.921***	-1.014***	-0.311***	-1.454***
ln(TA)	0.114	-0.222**	-0.154	-0.338***	-0.221***	-0.089*	-0.308**
R^2	0.246	0.138	0.048	0.138	0.370	0.166	0.649
Nobs	219	245	252	266	234	234	219

Notes: Dependent variable is the SPREAD measured in percent for each subordinated debt transaction by quarter. Estimation method is fixed effects panel estimation, in which each bank is permitted to have its own intercept term. Fixed effects model and explanatory variables are defined as follows:

$$SPREAD_i = \beta_1 NATA_i + \beta_2 PDTA_i + \beta_3 OREOTA_i + \beta_4 AGAP_i + \beta_5 MKTLEV_i + \beta_6 ROA_i + \beta_7 lnTA_i + \varepsilon_i$$

NATA represent non-accruing loans to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *ROA* is calculated as net income divided by total assets. Natural log of total assets is represented as *lnTA*. ***Significant at 0.01 level **Significant at 0.05 level *Significant at 0.10 level.

Table 5 shows the results of annual cross-sectional OLS regressions for robustness. While the results are less consistent, we can draw similar inferences to the results in Table 4. Counting the number of risk variable coefficients that are significant and in the expected direction, we see from 1995 to 2001, there are 18 with only 3 that are significant and in the wrong direction. In contrast, from 2002 to 2007, there are 11 risk coefficients that are significant and in the expected direction but there are 9 that are significant and in the wrong direction. In addition, during the earlier period, *lnTA* is never significant while it is significantly negative 5 out of the 6 years from 2002 to 2007, indicating that the perception of the TBTF subsidy may have returned. Examining each year in turn, the coefficients are significantly in the wrong direction more often than not from 2004 to 2007. Overall, these results provide evidence to suggest that while market discipline was effective before 2001, it broke down in the lead up to the financial crisis.

4.3 Hypothesis 3a and 3b

The results up to now indicate that opacity increased during the latter half of our sample and evidence of market discipline seems to disappear. These results may be coincidental, or they may suggest that opacity is a proxy for other factors that could be causing the lack of market discipline. Flannery and Sorescu (1996) suggest the TBTF subsidy is the cause. Our own analysis also shows that there are strong correlations between our variables *HIGH_OPACITY* (a proxy for opacity) and *lnTA* (a proxy for TBTF). To test whether opacity or TBTF is the source of the lack of market discipline from 2002 to 2007, we rerun our analysis looking at two subsamples. In the first subsample, we remove the TBTF banks and look only at the remaining banks. If TBTF is dampening market participants' incentive to discipline banks, this incentive should still be present for banks not deemed as TBTF. Table 6 column 1 shows the results for the banks that are not considered TBTF. The only risk measure that is significant with the expected sign is *MKTLEV* at the 10 level. *AGAP* is negative and significant at the 1 level, which is unexpected. Overall, little evidence of market discipline exists in this subgroup. This supports our argument that it was opacity, and not the TBTF subsidy, that hampered market discipline in the lead up to the financial crisis since the breakdown occurred with non-TBTF banks as well.

A possible explanation for the results in column 1 is that the TBTF subsidy has a spillover or "contagion" effect on other banks that are not TBTF. If the perception of the TBTF subsidy is in place, then the perception of this contagion risk is lowered. Therefore, the non-TBTF banks would at the very least face less contagion risk. To distinguish further between hypothesis 3a and 3b, we introduce a new variable, *LEAST_OPAQUE*, which classifies the banks that are in the bottom quartile based on their average *HIGH_OPACITY* measure. In column 2 we regress only on the subsample of banks classified as *LEAST_OPAQUE*. In column 3 we regress on all other banks in our sample. The results in column 2 indicate that less opaque banks are subject to market discipline while the more opaque banks are not (Column 3). In

column 2, three of the risk measures are positive and significant and *ROA* is negative and significant. Although *PDTA* and *AGAP* are negative, they are not significant. In column 3 we find only one significant risk variable, *AGAP*, and the sign is in the wrong direction. Overall, Table 6 strongly supports H3a and rejects H3b.

Table 6: Subsample of Fixed Effects Regression 2002 – 2007

	(1)	(2)	(3)
	Non-TBTF	Least Opaque	More Opaque
NATA	0.223	0.500**	0.600
PDTA	-0.186	-0.533	0.754
OREOTA	0.089	0.198**	-0.044
AGAP	-0.273***	-0.078	-0.378**
MKTLEV	0.126*	0.137**	0.017
ROA	-0.334***	-0.228***	-0.414***
lnTA	-1.646***	-0.146	-1.190***
R^2	0.310	0.533	0.528
Nobs	419	364	1089

Notes: Dependent variable is the SPREAD measured in percent for each subordinated debt transaction by quarter. Estimation method is fixed effects panel estimation, in which each bank is permitted to have its own intercept term. Fixed effects model and explanatory variables are defined as follows:

$$SPREAD_{it} = \beta_1 NATA_{it} + \beta_2 PDTA_{it} + \beta_3 OREOTA_{it} + \beta_4 AGAP_{it} + \beta_5 MKTLEV_{it} + \beta_6 ROA_{it} + \beta_7 lnTA_{it} + YearDummy_{it} + \varepsilon_{it}$$

Column 1 regresses only on banks not classified as TBTF. Column 2 regresses only on banks in the bottom quartile of banks ranked by *High Opaque*. Column 3 regresses on banks in the top three quartiles of banks ranked by *High Opaque*. *NATA* represent non-accruing loans to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *ROA* is calculated as net income divided by total assets. Natural log of total assets is represented as *lnTA*. Coefficients for the *YearDummy* variables are omitted to conserve space and are available upon request. *** Significant at the 0.01 level ** Significant at the 0.05 level * Significant at the 0.10 level.

4.4 Robustness

For robustness purposes, we verify that our results are consistent when we include other potential explanatory variables (Table 7) as well as when we use alternative measures of loan quality (Table 8 and Table 9). In Table 7, we include subordinated debt issue characteristics. Specifically, we include the coupon rate of the subordinated debt as well at time to maturity. Both *COUPON* and *TTM* are highly significant and positively associated with *SPREAD* in all three models. However, even with the inclusion of these variables, our results are very consistent with Table

4. In the full sample, *NATA*, *MKTLEV*, and *ROA* are all significant and in the expected direction just like the results in Table 4. From 1994 to 2001, *NATA*, *AGAP*, *MKTLEV*, and *ROA* are all significant and in the correct direction just like column 2 of Table 4. In the sub period of 2002 to 2007, ROA is in the expected direction and significant. The only difference is *PDTA* is significant and in the wrong direction instead of *AGAP* as in Table 4. However, these two variables are consistent in direction in both tables. Overall we see evidence of market discipline in our sample from 1994 to 2001 and see little evidence from 2002 to 2007.

Table 7: Linear Panel Regression with the Addition of Subordinated Debt Characteristics

	(1)	(2)	(3)
	1994 - 2007	1994 - 2001	2002 - 2007
NATA	0.092*	0.079**	0.081
PDTA	-0.192	0.029	-0.323***
OREOTA	0.012	0.109	0.065
AGAP	0.012	0.030**	-0.020
MKTLEV	0.012*	0.016*	0.022
ROA	-0.152***	-0.064*	-0.247***
ln(TA)	-0.032**	-0.055	-0.036***
COUPON	0.213***	0.270***	0.148***
TTM	0.077***	0.052***	0.105***
R^2	0.658	0.605	0.759
Nobs	3030	1577	1453

Notes: Dependent variable is the SPREAD measured in percent for each subordinated debt transaction by quarter. Estimation method is fixed effects panel estimation, in which each bank is permitted to have its own intercept term. Fixed effects model and explanatory variables are defined as follows:

$$SPREAD_{it} = \beta_1 NATA_{it} + \beta_2 PDTA_{it} + \beta_3 OREOTA_{it} + \beta_4 AGAP_{it} + \beta_5 MKTLEV_{it} + \beta_6 ROA_{it} + \beta_7 lnTA_{it} + \beta_8 COUPON_{it} + \beta_9 TTM_{it} + YearDummy_{it} + \varepsilon_{it}$$

NATA represent non-accruing loans to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *ROA* is calculated as net income divided by total assets. Natural log of total assets is represented as *lnTA*. *COUPON* is the coupon rate of the bank subordinated debt. *TTM* is the time to maturity of the bank subordinated debt in terms of years where partial years are kept in decimal form. Coefficients for the *YearDummy* variables are omitted to conserve space. ***Significant at the 0.01 level **Significant at the 0.05 level *Significant at the 0.10 level.

In Table 8, we substitute in *ALLTA*, allowance for loan and lease losses minus recoveries to total assets, for *NATA*, *PDTA*, and *OREOTA*. Net allowance is a write down of assets as banks conclude that some value of assets will not be recovered.

Therefore this is an alternative measure of loan and lease quality to *NATA*, *PDTA* and *OREOTA*. The results in Table 8 once again are consistent with the results from Table 4. For the full sample, *MKTLEV* and *ROA* are significant and in the correct direction. For 1994 to 2001 period, *AGAP*, *MKTLEV* and *ROA* are significant and in the correct direction. For the latter part of our sample, only *ROA* is in the expected direction and significant. Both *ALLTA* and *AGAP* are significant and in the wrong direction. Once again, there is little evidence of market discipline from 2002 to 2007.

Table 8: Linear Panel Regression of Spread on Alternative Measure of Loan Quality

	(1)	(2)	(3)
	1994 - 2007	1994 - 2001	2002 - 2007
ALLTA	-0.122	0.164	-0.600***
AGAP	-0.007	0.051*	-0.180***
MKTLEV	0.043***	0.036***	0.020
ROA	-0.200***	-0.131***	-0.252***
lnTA	-0.176**	0.043	-0.661***
R^2	0.541	0.413	0.541
Nobs	3030	1577	1453

Notes: Dependent variable is the SPREAD measured in percent for each subordinated debt transaction by quarter. Estimation method is fixed effects panel estimation, in which each bank is permitted to have its own intercept term. Fixed effects model and explanatory variables are defined as follows:

$$SPREAD_{it} = \beta_1 ALLTA_{it} + \beta_2 AGAP_{it} + \beta_3 MKTLEV_{it} + \beta_4 ROA_{it} + \beta_5 lnTA_{it} + YearDummy_{it} + \varepsilon_{it}$$

ALLTA represent net allowance for loans and lease losses to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *ROA* is calculated as net income divided by total assets. Natural log of total assets is represented as *lnTA*. Coefficients for the *YearDummy* variables are omitted to conserve space and are available upon request. ***Significant at the 0.01 level **Significant at the 0.05 level *Significant at the 0.10 level.

Finally, in Table 9, we report the results using all for measures of loan quality, *ALLTA*, *NATA*, *PDTA*, and *OREOTA*. The results for the full sample are less consistent than in the previous tables. *NATA*, *MKTLEV* and *ROA* are significant and in the expected direction, but *ALLTA* is in the opposite direction and significant at the 10 level. However, looking at the earlier and later sub periods, we find consistent results with previous tables. From 1994 to 2001, *NATA*, *AGAP*, *MKTLEV* and *ROA* are all significant and in the expected direction. *PDTA*, *OREOTA*, and *ALLTA* are also in the expected direction but not statistically significant. From 2002 to 2007, *ALLTA* and *AGAP* are significant and in the opposite direction of expectations. Again we see

evidence of market discipline in our early sample period but little evidence of market discipline in our later period leading up to the financial crisis.

Table 9: Linear Panel Regression of Spread on Four Measures of Loan Quality

	(1)	(2)	(3)
	1994 - 2007	1994 - 2001	2002 - 2007
NATA	0.300***	0.230**	0.269
PDTA	-0.225	0.225	-0.114
OREOTA	0.190	0.105	0.388
ALLTA	-0.212*	0.144	-0.681***
AGAP	-0.008	0.054*	-0.199***
MKTLEV	0.039***	0.030**	0.028
ROA	-0.151**	-0.113**	-0.219***
lnTA	-0.131	0.093	-0.625**
R^2	0.540	0.406	0.552
Nobs	3030	1577	1453

Notes: Dependent variable is the SPREAD measured in percent for each subordinated debt transaction by quarter. Estimation method is fixed effects panel estimation, in which each bank is permitted to have its own intercept term. Fixed effects model and explanatory variables are defined as follows:

$$SPREAD_{it} = \beta_1 NATA_{it} + \beta_2 PDTA_{it} + \beta_3 OREOTA_{it} + \beta_4 ALLTA_{it} + \beta_5 AGAP_{it} + \beta_6 MKTLEV_{it} + \beta_7 ROA_{it} + \beta_8 lnTA_{it} + YearDummy_{it} + \varepsilon_{it}$$

NATA represent non-accruing loans to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *ALLTA* represent net allowance for loans and lease losses to total assets. *PDTA* represents loans that are greater than 90 days past due to total assets. *OREOTA* represents other real estate owned to total assets. *AGAP* is the absolute value of the bank's one-year maturity gap divided by market value of equity. *MKTLEV* is the market leverage and is constructed as the ratio of book value of total liabilities divided by the sum of market value of common stock outstanding and the book value of preferred stock. *ROA* is calculated as net income divided by total assets. Natural log of total assets is represented as *lnTA*. Coefficients for the *YearDummy* variables are omitted to conserve space and are available upon request. ***Significant at the 0.01 level **Significant at the 0.05 level *Significant at the 0.10 level.

5. Conclusion

We find evidence that increased opacity in the banking industry directly contributed to the breakdown in market discipline during the lead up to the 2008 financial crisis. We show that this was a unique factor that was independent of the impact that TBTF can have on the incentive for market participants to discipline banks. Opacity, and not TBTF, caused the breakdown in market discipline in the lead up to the financial crisis.

These results imply that market discipline is not a suitable substitute to regulatory discipline in an opaque banking market. The calls for regulators to incorporate more market information (Berger et al. 2000; Flannery 1998 2001; Krainer

and Lopez 2004) into their analysis of the banks they are charged with may be flawed.[13] The assumption is that regulators can improve their assessment of banks by incorporating market signals. However, there is also an unstated assumption that the banks are transparent enough for the market to gauge their levels of risk accurately. This seems not to be the case. Regulators and policy makers need to limit opacity and promote transparency in the banking industry (Stiroh 2006). Only then will the incorporation of market signals improve regulators' assessment of banks.

These findings have important policy implications because if regulators are looking at market measures to determine the risk level of banks, these market measures may be distorted by opacity. Instead, they should promote more transparency in the industry in order to gain more clear signals.

[13] In fact, some (Hamalainen (2004); Pop (2009)) have argued for mandatory subordinated debt issuances by banks to expose them to market discipline. Basel II also emphasizes the importance of market discipline as a way to make banks more sensitive to risk.

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Appendix A: Opacity Variable Definitions

Total Assets	Total inflation-adjusted assets	BHCK2170
Real Loans	Commercial and residential real estate loans and leases, net	BHCK1410
Total Loans	Total Loans	BHCK2122
Other Loans	All other loans, net	Total Loans - Real Loans
ABS	Asset Backed Securities classified as available-for-sale (AFT) or held-to-maturity (HTM) that are not issued or guaranteed by government agencies or government sponsored enterprises	BHCKB838 + BHCKB842 + BHCKB846 + BHCKB850 + BHCKB854 + BHCKB858 + BHCKB841 + BHCKB845 + BHCKB849 + BHCKB853 + BHCKB587 + BHCKB861 (2001 - 2005)
		BHCKC026 + BHCKC027 (2006 - 2008)
MBS	Mortgage Backed Securities classified as available-for-sale (AFT) or held-to-maturity (HTM) that are not issued or guaranteed by government agencies or government sponsored enterprises	BHCK1709 + BHCK1733 + BHCK1736
Trading	All other trading assets	BHCK3545 - (MBS + ABS)
Goodwill	Goodwill	BHCK3163
IIUS	Investments in unconsolidated subsidiaries	BHCK2130
Intangible	Intangible assets	BHCK3164 + BHCK5506 + BHCK5507 (1994 - 1998)
		BHCK3164 + BHCKB026 + BHCK5507 (1999 - 2000)
		BHCK0426 (2001 - 2008)
OREO	Other real estate owned	BHCK2744 + BHCK2745 (1994 - 2000)
		BHCK2150 (2001 - 2008)
Other Assets	All other assets	BHCK2160
Premises	Total premises and fixed assets	BHCK2145
HIGH OPAQUE	Sub category of opaque assets deemed to have high opacity	MBS + ABS + Trading + Intangible + IIUS
OTHER OPAQUE	Sub category of opaque assets that are nether HIGH OPAQUE or loans	Premises + Goodwill + Other Assets + OREO
TOTAL OPAQUE	All opaque assets	Total loans + High Opaque + Other Opaque

Appendix B: Accounting Risk Variable Definitions

ALLTA	Net allowance for loan and lease losses to total assets	(BHCK4635 - BHCK4605) / BHCK2170
MKTLEV	Market leverage	BHCK2948 / (market value of common shares outstanding + BHCK3283)
NATA	Non-accruing loans to total assets	BHCK5526 / BHCK2170
OREOTA	OREO divided by total assets	OREO / BHCK2170
PDTA	Loans that are greater than 90 days past due to total assets	BHCK5525 / BHCK2170
ROA	Return on assets	BHCK4340 / BHCK2170
SHORT[14]	Net value of assets and liabilities subject to maturity or repricing within one year	(BHCK3365 + BHCK3545 + BHCK1292 + BHCK1296 + BHCK 3197 + BHCK0383) - (BHCK3298 + BHDMA242 + BHFNA245 + BHCK3548 + BHCK2332 + BHCK3408 + BHCK3409)
AGAP	Maturity gap between short term assets and short term liabilities	Abs |SHORT| / (market value of common shares outstanding + BHCK3283)

[14] Our construction of SHORT is slightly different from Flannery and James (1984) because they use line items from the FDIC's Report of Conditions and Income (Call Report) while we use line items from the FR Y-9C. Alternatively we calculated SHORT = BHCK3197 – (BHCK3296 + BHCK3298 + BHCK3408 + BHCK3409) which comes from the interest rate sensitivity table of the FR Y-9C. Results are consistent under both definitions.