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2011

The Fed and the 2007-2009 Financial Crisis: Treating a Virus with Antibiotics? Evidence from the Commercial Paper Market

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Recommended Citation

Griffiths, Mark D.; Kotomin, Vladimir; and Winters, Drew B., "The Fed and the 2007-2009 Financial Crisis: Treating a Virus with Antibiotics? Evidence from the Commercial Paper Market" (2011). *Faculty Publications - Finance, Insurance, and Law*. 11.
<https://ir.library.illinoisstate.edu/fpfil/11>

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The Fed and the 2007-2009 Financial Crisis:
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Abstract

The two main explanations for the 2007-2009 financial crisis in the money markets are credit concerns and liquidity issues. These risks are intimately related, especially in the money markets, and either can lead to somewhat similar behavior by market participants. We study the U.S. commercial paper (CP) market to draw insights about the nature of the crisis which resulted in the amount of outstanding CP shrinking from the peak of \$2.18 trillion in early August 2007 to \$1.27 trillion in early July 2009. However, the CP market is not homogeneous in terms of credit quality, maturities and types of issues and we show that not all CP issuers suffered equally. We find that the crisis in the money markets appears to be related more to increases in perceived credit risk, with liquidity concerns being a secondary issue.

Keywords: Commercial paper, Financial crisis, Credit risk, Liquidity risk

JEL Classification Codes: G01, G12, G18

The Fed and the 2007-2009 Financial Crisis:
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Evidence from the Commercial Paper Market.

“I’m not a financial engineer; I’m a financial pathologist... (t)he reason pathologists study the dead, though, is . . . that from what we learn, we can help the living.”

Stephen A. Ross,
*Forensic Finance:
ENRON and Others,*
Fourth Angelo Costa Lecture.

I. Introduction:

The financial crisis of 2007-2009 provides financial pathologists with many and varied research opportunities including: real estate, mortgages, lending practices, financial institutions, securitization, shadow banking, and money markets. Analyses of financial crises allow researchers to determine what market mechanisms went wrong so appropriate policies can be put in place going forward. This paper contributes to understanding the recent problems in the money markets – the market for short-term debt with original maturities of one year or less that is designed to provide liquidity funding for the global financial system. Specifically, we examine issues in the commercial paper market, arguably the center of the financial crisis.

It is generally accepted (Taylor and Williams, 2009) that the current financial crisis commenced in earnest on August 9, 2007 when BNP Paribas, a large French bank, temporarily halted redemptions from three of its funds holding assets backed by US subprime mortgage debt.¹ As a result, international money market traders found that interest rates on term loans increased dramatically to the point where rates on term lending, such as one- and three-month

¹ Quoting the BNP press release on August 9, 2007, “*The complete evaporation of liquidity in certain market segments of the U.S. securitization market has made it impossible to value certain assets fairly regardless of their quality or credit rating.*” Armantier, Krieger, and McAndrews (2008) commenting on this matter observe: “*This public statement of a condition that many firms had been grappling with – uncertainty about the true value of various financial securities created from residential mortgages – affected the interbank money markets in Europe and the United States like a match in a dry forest.*”

LIBOR, appeared to become disconnected from the overnight rate. Cecchetti (2008, p. 14) provides a succinct description of the situation:

“Normally less than 10 basis points, on Thursday 9 August 2007 the 3-month Libor-OIS² jumped to 40 basis points. And normally stable, with a standard deviation of several basis points, the spread fluctuates between 25 and 106 basis points through the fall. Something is clearly wrong. There should be an arbitrage that allows a bank to borrow overnight, lend for three months, and hedge the risk that the overnight rate will move in the federal funds futures market leaving only a small residual level of credit and liquidity risk that accounts for the small spread we see before the crisis.”

As Taylor and Williams (2009) state, “(i)t was as if banks suddenly demanded more liquidity or had grown reluctant to lend to each other, perhaps because of fears about the location of newly disclosed losses on sub-prime mortgages.”

On August 16, 2007 Countrywide Financial (then, the largest US mortgage lender) announced it had borrowed \$11.5 billion from a group of 40 banks. The loan was necessitated by Countrywide’s inability to borrow in the commercial paper market, as it had done regularly in the past.³ Concerns that numerous sub-prime mortgage loans Countrywide had made were lowering the quality of its assets resulted in Countrywide losing access to the commercial paper market. On March 31, 2007 Countrywide held \$208 billion in total assets with \$32.2 billion in Mortgages Held for Sale and \$16.8 billion in Trading Securities Owned.⁴ These trading accounts were funded in part with \$9.8 billion in asset-backed commercial paper and \$8.7 billion in unsecured commercial paper. Thus, commercial paper provided almost 40% of the funding of Countrywide’s trading assets just prior to the financial crisis and the crisis dramatically reduced

² Overnight Indexed Swap (OIS) rate represents the expected interest rate that would accrue from repeatedly rolling over an investment at the overnight rate for three months.

³ See *Countrywide Squeezed in Commercial Paper Market: CNBC’s Faber*, “The asset-backed commercial paper market is effectively becoming closed for some issuers, including companies that originate mortgages. . . . dealers in the commercial paper market are currently quoting Countrywide Financial’s 30-day commercial paper at a yield of 12.54%. . . this for a company that was borrowing in that same market at 15 basis points over the London interbank rate, currently around 6%.” www.cnbc.com/id/20284085 accessed 2/22/2010.

⁴ The \$32.2 billion in mortgages held for sale includes \$22.5 billion in prime mortgages and \$4.9 billion in non-prime mortgages. The Trading Securities Owned are almost entirely mortgage-backed securities.

their access to this funding. Covitz, Liang, and Suarez (2009) note that about one-third of asset-backed CP programs failed to roll over their issues within a week in the late 2007.

The Countrywide announcement of borrowing difficulties was one of the first of many financial news stories about the inability of borrowers to access the commercial paper market. In addition, there were reports about the inability to borrow in the repurchase agreement (repo) market. Both sets of stories were accompanied by comments of a liquidity crisis.

The Federal Reserve agreed (at least initially) with the consensus opinion and began taking remedial measures to treat such a liquidity crisis.⁵ McAndrews, Sarkar, and Wang (2008) and Wu (2008) implicitly assume, and Anderson and Gascon (2009) suggest that the crisis was mostly related to liquidity. Bernanke (2009) discusses both liquidity and credit issues in his January 13, 2009 speech but seems to focus more on liquidity. However, Taylor (2009) and Taylor and Williams (2009) suggest that the Federal Reserve treated the symptoms but not the cause and argue that the problem in the money market was a credit issue and not one of liquidity. Greenspan (2010), testifying before the Financial Crisis Inquiry Commission in April 2010, lays much of the blame on ‘inaccurately high credit ratings’ (pg. 5), the failure of ‘the private risk management system’ (pg.7) and ‘the collapse of private counterparty credit surveillance’ (pg. 8).

We provide insight into whether the problems in the commercial paper market were liquidity- or credit-based. Understanding the source of the problem is vital for creating policies for properly addressing or preventing similar market crises in the future. The research question is best framed through the differentiation of systemic and firm-specific concerns. Systemic issues relate generally to the orderly functioning of a market, such as access to adequate liquidity. A market-wide problem can be addressed through a market-wide solution, such as the

⁵ A summary of the FOMC discussions from December 2006 – December 2008 related to the financial crisis is available from the authors upon request.

monetary policy of increasing the funds available to a liquidity-constrained market. Firm-specific issues relate to the ability of an individual or small group to continue to function in an orderly manner; here one would be concerned with a borrower's access to credit. Any individual borrower or small group problem can only be addressed through a solution directly related to the specific individual(s), such as tailored loans made to the credit-constrained borrowers. Systemic (liquidity) and firm-specific (credit) problems clearly require different solutions. Our goal is to determine the type of problem that occurred in the commercial paper market during the financial crisis.

These two issues can easily become intertwined, especially when confidence in the underlying value of money market securities becomes uncertain. That is, pervasive firm-specific problems become a systemic issue as is the case when large amounts of firm-issued debt no longer reliably retains their low default risk and high marketability features. If these features cannot be maintained satisfactorily, lenders in the money market generally will decline to make the loan rather than put their funds at risk. In such instances, the market will 'lock up' as was suggested during the recent financial crisis. To emphasize the importance of confidence in the debt issues in relation to financial markets overall, consider the following quote from the executive summary of the Examiner's Report (Valukas (2010) on the underlying causes of the Lehman Brothers failure:

Lehman failed because it was unable to retain the confidence of its lenders and counterparties and because it did not have sufficient liquidity to meet its current obligations.

Our results suggest that an increase in perceived credit (counterparty) risk was the primary force shaping the commercial paper market during the crisis, with liquidity concerns playing a secondary role. Therefore, simple injections of liquidity into the financial system

would not be very effective as they do not address the root cause of a credit crisis.⁶ On the other hand, central banks and other regulators becoming investors and credit risk insurers had a positive impact on the situation in the financial markets.

II. Background and Testable Hypotheses

Kidwell, Blackwell, Whidbee, and Peterson (2006) state “(t)he money markets are where depository institutions and other businesses adjust their liquidity positions by borrowing or investing for short periods of time.” (p. 168). They later state “(t)he most important economic function of the money markets is to provide an efficient means for economic units to adjust their liquidity positions.” (p. 170).

Mishkin and Eakins (2009) highlight the temporary nature of investments in the money markets in the following description of the purpose of the money markets:

“The well-developed secondary market for money markets makes the money market an ideal place . . . to ‘warehouse’ surplus funds until they are needed. Similarly, the money markets provide a low-cost source of funds to firms, the government, and intermediaries that need a short-term infusion of funds.” (p. 214)

The temporary nature of money market investments requires that the securities have two primary characteristics: (1) a high degree of liquidity and (2) a low degree of default risk. High liquidity is achieved through the use of short-term debt contracts and by trading through dealers. Low default risk is generally achieved by lending to only high credit-quality borrowers.

Commercial paper (CP) is a class of short-term debt of private corporations with maturities between one and 270 days and has both credit risk and liquidity risk associated with it.

⁶ The authors recognize that liquidity injections have historically shortened the length of recessions following financial crises (Bruner and Carr, 2009). It may be too early to determine whether this applies equally to the current crisis. Nonetheless, we concentrate on the proximate cause of the crisis.

However, the CP market is not homogeneous in terms of types and credit quality of issuers. We collect rates and amounts outstanding for different classes of commercial paper which vary by type and credit quality of the borrower. We have CP issued by [1] financial institutions (financial CP), [2] non-financial firms (non-financial CP), [3] asset-backed commercial paper (ABCP), [4] highly rated issuers (AA), and [5] lower rated issuers (A2/P2).

These various classes of commercial paper allow for testable hypotheses that can differentiate between liquidity and credit problems. Our testable hypotheses are:

- Liquidity (systemic) problem
 - All commercial paper rates increase by similar amounts in response to the same event.
 - Amounts outstanding and the number of new issues in all commercial paper categories decline in response to the same event.
 - Federal Reserve liquidity injections reduce all commercial paper rates.
- Credit (firm-specific) problem
 - Rates increase in higher risk (lower credit quality) classes relative to lower risk classes of commercial paper in response to the same event.
 - Amounts outstanding and the number of new issues decline in higher risk classes relative to lower risk classes of commercial paper in response to the same event.
 - Federal Reserve lending reduces commercial paper rates and helps increase the number of new issues in the classes of commercial paper in which the Federal Reserve becomes a direct lender.

As we describe above, money markets investors demand high liquidity and low default risk. Accordingly, we need to be clear about the ability to separate liquidity and credit risk in the commercial paper market. Downing and Oliner (2007) examine the term structure of commercial paper rates and find that after controlling for year-end effects that the risk premium

in CP are fairly stable. Griffiths and Winters (2005b) find that the size of the year-end effect in commercial paper rates is related to credit risk. Covitz and Downing (2007) state that the conventional wisdom suggests that liquidity is the key component to CP spreads. However, they conclude that CP is liquid by virtue of its short maturity and that credit risk is the dominant determinant of CP spreads. Longstaff, Mithal and Neis (2005) examine credit default swaps and find that the default component explains the majority of the spread across all ratings with the default component increasing as ratings decline from AAA to BB. They also find that the non-default component of the spread is strongly related to market-wide measures of liquidity and varies little across the different ratings. Thus, the literature suggests that liquidity is market-wide (systematic) component of spreads while credit risk is firm or rating-category specific.

III. Data

The primary data are daily commercial paper rates from the Federal Reserve (Fed). The Fed reports rates for 1-day, 7-day, 15-day, 30-day, 60-day, and 90-day CP. We focus on 30-day and 1-day maturities in this paper. The rates are reported for four categories of CP: AA asset backed, AA financial, AA non-financial, and A2/P2 non-financial, as well as for the CP market total.⁷ These daily data are available starting on January 2, 2001 and our data set continues through July 2, 2009. We provide two alternate (non-CP) measures for the general level of short-term interest rates: the target federal funds rate and the constant maturity one-month T-bill yield.⁸ We also employ daily data on the number and value of dealer CP transactions of newly

⁷ The Federal Reserve data source on commercial paper labels the highest credit quality paper as AA-rated. The rating agencies use the labels of A1 and P1. We use the Fed labels to be consistent with the data source. We note that under the CPFF program the Fed refers to the highest credit quality paper as A1 and P1.

⁸ The target fed funds rate is not a market rate. The effective fed funds rate is a transaction-weighted daily average and is commonly used as the market fed funds rate. We chose to use the target rate as a reference rate to allow comments on the Federal Reserve's liquidity stance during the crisis.

issued CP that the Fed uses to calculate daily CP yields, as well as weekly data on CP outstanding.

IV. Empirical Analysis

We conduct our empirical analysis of the commercial paper market in four parts, beginning with plots of the commercial paper rate and spread series to identify extreme changes and associated events. When we observe such extremes, we examine the rates around the events to determine if all CP rates increase or if the increases are limited to certain maturities or segments in the market. We then extend this analysis to amounts outstanding and the number of new issues. Third, we continue our analysis into a multivariate framework to assess the statistical significance after using appropriate controls. Finally, we conduct robustness analyses related to Federal Reserve market interventions.

IV.A. Rate and Spread Plots

Figures 1 and 2 plot 30-day and one-day CP rate series, respectively, from January 2, 2007 through July 2, 2009. Panel A in each figure contains yields of AA financial and AA non-financial CP (non-collateralized and higher credit quality), while Panel B contains yields of AA asset-backed (collateralized) and A2/P2 non-financial CP (lower credit quality). Both figures also contain the target federal funds rate and yield on the constant maturity one-month T-bills.⁹ The figures also identifies three newsworthy events: (1) the BNP Paribas announcement on August 9, 2007, (2) the failure of Bear Stearns on March 14, 2008 and, (3) the bankruptcy of Lehman Brothers on September 14, 2008 which also led to the Reserve Primary money market fund breaking the buck (i.e., having a negative return on investment, an extremely rare occasion

⁹ To construct the plots and later to run regressions, we set the target federal funds rate equal to 0.25% during the period when it was specified as a range between 0 and 25 basis points.

for money market funds). We do not analyze these events specifically. Instead, we use the three events as reference points and we analyze the commercial paper market's behavior around these three events. While dozens of events may have influenced money markets during the crisis, these three appeared to signal major turning points in the commercial paper market. Accordingly, we focus on these events throughout the paper. Both Afonso, Kovner, and Schoar (2009) and Kaperczyk and Schnabl (2010) use similar events in their analyses of the federal funds market during the crisis.

Panel A of Figure 1 reveals several interesting features. First, around each of the three events the yield on the one-month T-bill declines dramatically consistent with a flight to quality, which can occur for both credit and/or liquidity reasons. Second, the target fed funds rate declines across the crisis period, consistent with the Fed easing access to liquidity. Third, from January 2, 2007 through the failure of Bear Stearns, AA financial and AA non-financial CP rates track each other closely. Following the Bear Stearns event, the spread between the two series becomes positive; it then increases dramatically following the Lehman bankruptcy. The spread between the CP rates in Panel A following Bear Stearns is approximately 50 basis points with the financial CP series having the higher rates. While we do not conduct statistical tests at this point, we note that a 50 basis point spread is an attractive investment opportunity in the money market under normal market conditions. Following the Bear and Lehman events, the market generally had concerns about the viability of many financial institutions. Accordingly, the higher rates on this series are consistent with counterparty risk concerns in the CP market.

Panel B of Figure 1 plots 30-day rates of higher-risk CP categories – AA asset-backed and A2/P2 non-financial paper. It shows that following the BNP announcement the rates on asset-backed and A2/P2 paper increase dramatically. Note that the lower risk CP rates plotted in

Panel A did not increase at this time, suggesting this reaction was related to primarily credit issues and not liquidity issues. Second, 30-day rates in both asset-backed and A2/P2 CP again increase dramatically in December 2007. Panel A shows only a small change before the 2007 year-end in AA financial and AA non-financial rates. Panel B of Figure 1 suggests that even with the Fed increasing liquidity, investors exited the higher risk CP prior to the end of 2007. Third, following the Bear Stearns event, the rates on asset-backed and A2/P2 paper remained near three percent while the target fed funds rate and the rates on the lower-risk CP in Panel A fell between 75 and 100 basis points. Again, the higher risk classes paid substantially higher relative rates indicative of credit quality issues. Following the Lehman bankruptcy, the CP rates in Panel B increase roughly 300 basis points to approximately six percent. The maximum rate in the lower risk classes following Lehman is four percent (Panel A). The most persistent rate increase is in the A2/P2 paper, the highest risk class. The Lehman bankruptcy thus appears to have caused an increase in perceived credit risk.

In liquidity crises, lenders that remain in the market become unwilling to commit their funds for more than a few days. Figure 2 plots AA Financial and AA non-financial *overnight* (one-day) CP rates in Panel A and AA asset-backed and A2/P2 non-financial *overnight* rates in Panel B, with the same reference rates, the target federal funds rate and the one-month T-bill yield. Panel A of Figure 2 indicates that lower-risk CP overnight yields (AA Fin and AA Non-Fin) follow the target fed funds rate closely until after the Lehman bankruptcy, when they experience a couple of short-lived increases. Panel B of Figure 2 shows that overnight yields in higher-risk CP categories (asset-backed and A2/P2 non-financial) diverge from the lower risk CP overnight rates after the BNP announcement and remain higher through the remainder of the analysis period. The combination of rates on the lower risk CP remaining clustered together

around the target rate with higher rates on the higher risk CP continues to suggest a credit risk problem in the CP market.

To complement our rate plots, Figure 3 graphs CP credit and term spreads. Specifically, Panel A presents the credit spreads between A2/P2 non-financial and AA non-financial CP (in 30-day and one-day maturities). The presence of wider spreads is consistent with credit quality issues. Panel B presents term spreads (30-day minus one-day yield) in each CP category used in previous figures. The preponderance of evidence on the term spreads implies a substantial increase in credit risk following each event with some short-lived liquidity effects following Lehman.

In summary, Figures 1, 2, and 3 reflect three important points around significant financial news events. First, the Federal Reserve lowered its policy target rate throughout the financial crisis, consistent with adding liquidity to the financial system. Second, following each of the three events, one-month T-bill yields declined, consistent with both a flight to liquidity and a flight to quality. Finally, following the three reference events, we observed borrower-specific effects instead of market-wide reactions. Specifically, the higher the perceived credit risk of the CP class, the more the rates and the term spreads increase. The behavior of rates and spreads in each instance is consistent with credit quality concerns in the CP market being primary and liquidity concerns being secondary during the financial crisis.

IV.B Amounts Outstanding, Number of Issuers, and Credit Standards

The financial news on the commercial paper market during the crisis suggested that the market had virtually stopped functioning (Milne, 2009), in other words, that the commercial paper market was experiencing a major crisis in which no one could borrow. Even a Treasury

official suggested that the CP markets stopped functioning at some point.¹⁰ To separate the hyperbole from the reality, Figure 4 provides plots of amounts outstanding in the different classes of commercial paper and a survey of credit standards.

The common practice in the commercial paper market when a borrower wishes to continue to borrow is to roll maturing CP into new CP. The new CP is a new loan. Accordingly, if no lending is taking place, the short-term nature of CP would result in the amounts outstanding declining precipitously. Panel A of Figure 4 plots amounts outstanding and provides several noteworthy insights. First, the maximum amount of total commercial paper outstanding (which occurs just prior to the BNP announcement) is approximately of \$2.2 trillion. Second, following the BNP announcement, the total amount of CP outstanding declines by about \$400 billion with almost the entire amount coming from asset-backed CP, the highest risk class with available data on amounts outstanding. Having the decline occur almost entirely in asset-backed CP is consistent with concerns over credit quality issues such as those suggested by Greenspan (2010). Third, the amounts outstanding in CP remained roughly the same after the Bear Stearns failure, lending credence to the argument that lenders did not withdraw en masse from the CP market at this time. Combining this information with the conclusions drawn earlier leads to the contention that lenders did not alter the amount of CP in which they invested following Bear, but did require higher yields for term CP with higher perceived credit risk. Fourth, around the Lehman bankruptcy the total amount of CP outstanding again declined by about \$400 billion. More than \$200 billion of this decline is from a decline in financial CP, with another \$100 billion in asset-

¹⁰Quoting from the Interim Assistant Secretary for Financial Stability Neel Kashkari's speech made on January 13, 2009: "As a result, credit markets froze. The commercial paper market shut down, 3-month Treasuries dipped below zero, and a money market mutual fund "broke the buck" for only the second time in history, precipitating a \$200 billion net outflow of funds from that market. The savings of millions of Americans and the ability of businesses and consumers to access affordable credit were put at serious risk."

backed CP.¹¹ Finally, throughout the period, the amount outstanding in non-financial AA-rated CP remains relatively constant with no substantial declines around any of the three events, leading to the conclusion that the problems in the CP market at this time were likely not market-wide liquidity problems as generally believed and/or reported.

Another approach to the question of whether borrowers could access the commercial paper market is to examine the number of new CP issues. We examine this data (graphs omitted in the interest of brevity) and find that new issues provide the same insights as amounts outstanding, which is that the market continued to function and the constraints are related to credit quality. Specifically, the number of issuers of 30-day AA non-financial CP is relatively consistent, except for a positive spike between the Bear-Stearns and the Lehman events suggesting that this segment had neither liquidity nor credit issues. Thirty-day A2/P2 non-financial CP shows a dramatic decline in the number of new issues following both BNP and Lehman consistent with credit concerns.

Finally, bank credit lines are a substitute for non-financial CP. The Federal Reserve conducts a survey of senior bank loan officers on changes in lending practice in advance of FOMC meetings. Panel B of Figure 4 plots the results from the survey question on whether bank lending standards on credit lines have changed over the previous three months. The plot shows that credit standards began to tighten just prior to BNP (8/9/07) and that the tightening peaked around Lehman (9/15/08) suggesting that bank lenders increased their credit standards at the same time we observe credit quality concerns in the higher risk segments of the CP market.

¹¹ The Total is not the sum of categories due to unclassified (“other”) paper. Also, there are no data on amounts outstanding of A2/P2 non-financial CP available to us. The closest approximation to A2/P2 paper is “tier-2” paper. Its outstanding amount is small relative to the entire CP market (between \$50 billion and \$70 billion throughout the crisis period) and does not change substantially in response to the major events.

IV.C. Multivariate Analysis

To assess the statistical significance of spread changes, we run a system of seemingly unrelated regressions (SUR) model with the following specification:

$$DV_{i,t} = \alpha_0 + \sum_{i=1}^6 \alpha_i * Subperiod_{i,t} + \sum_{j=1}^4 \beta_j * Control_{j,t} + \varepsilon_t \quad (1)$$

The variables are defined as follows:

$DV_{i,t}$ – dependent variables are spread i on day t , in percent; we estimate a SUR system for the spreads of 30-day or one-day CP rates over the base rate and a SUR system for the term spread (30-day rate minus overnight rate) in each CP category,¹²

$Subperiod_1$ – a dummy variable that equals 1 from 1/2/2007 through 8/8/2007 (Year 2007 before the BNP announcement) and 0 otherwise,

$Subperiod_2$ – a dummy variable that equals 1 from 8/9/2007 through 3/14/2008 (between the BNP announcement and Bear Stearns failure) and 0 otherwise,

$Subperiod_3$ – a dummy variable that equals 1 from 3/17/2008 through 9/12/2008 (between the Bear Stearns failure and the Lehman bankruptcy) and 0 otherwise,

$Subperiod_4$ – a dummy variable that equals 1 from 9/15/2008 through 10/31/2008 (between the Lehman bankruptcy and the end of October 2008) and 0 otherwise,

$Subperiod_5$ – a dummy variable that equals 1 from 11/3/2008 through 12/31/2008 (the last two months of the Year 2008) and 0 otherwise (most of the Fed's facilities or other programs were in place by the beginning of this subperiod),

$Subperiod_6$ – a dummy variable that equals 1 from 1/2/2009 through 7/2/2009 (from the beginning of 2009 through the end of the sample period) and 0 otherwise;

ε_t is the error term, assumed to be normally distributed.

The control variables include:¹³

¹² When the base rate for the spread (discussed later) is the non-financial CP yield, there are three equations in the system. When the base rate is the target Fed funds rate, or when the dependent variables are term spreads, there are four equations in the system, one for each CP category. Other functional forms (OLS, GARCH) yield similar results.

¹³ A paper discussant suggested the use of a general credit spread variable as a control variable. Stark changes in the dependent variable from CP market specific events cause the general credit spread variable to behave poorly in the model. Accordingly, we chose not to include the general credit spread in the model estimates reported in the paper. We note that including the general credit spread variable does not qualitatively change any of the regression results reported in the paper.

QEND – a dummy variable equal to 1 starting two days before the maturity of a given commercial paper spans the end of quarters (one through three) through the third-to-last business day of the quarter, other than the end of year,

YEND – a dummy variable equal to 1 starting two days before the maturity of a given commercial paper spans the end of year through the third-to-last business day of the year,

YEND2007 – defined similarly to YEND for the end of the Year 2007 only,

YEND2008 – defined similarly to YEND for the end of the Year 2008 only,¹⁴

The control variables are only applied in the regressions where 30-day CP spreads or term spreads are used. The regressors are the same in all equations in the system.

There are several key points about this model. First, the model is similar to the event study methods of Cornett and Tehranian (1990). We note that the choice of the length of the event dummies does not influence our results. Second, Cornett and Tehranian (1990) include controls for general market movements. We include two types of controls: (1) dummy variables at liquidity constrained times in the money markets¹⁵ and (2) the use of spreads as the dependent variable. Spreads control for general market movements. The base rate in the spread controls for the general level of interest rates and its choice is particularly important during a financial crisis. A common choice for the base rate for short term fixed income analysis would be a Treasury bill yield. However, as shown, one-month T-bill yields were also shocked around each of our reference points, making it a poor proxy for the general level of short-term interest rates. Similarly, the target federal funds rate only proxies for the general level of interest rates when the Fed actively manages its target but still lags the market rates. The best market-based proxy for the general level of short-term interest rates at this time and for this analysis is the rates on

¹⁴ Griffiths and Winters (2005a) show that term commercial paper yields increase two days before its maturity starts to span the end of the calendar year and return to “normal” on the second-to-last trading day of the year. Thus, we control for this effect, e.g., YEND for 30-day CP in 2005 equals to one on November 29 through December 28.

¹⁵ Griffiths and Winters (2005a) find evidence of year-end liquidity squeezes in the 30-day CP market. Kotomin, Smith and Winters (2008) find evidence of quarter-end liquidity effects in one-month LIBOR.

AA non-financial CP. These rates follow the main trends in rates and other than for a very brief period following Lehman appear to be unaffected at the time of the three events. In addition, Figure 4 shows no evidence of a substantial decline in the amount of non-financial CP outstanding across the financial crisis. Accordingly, our regression analysis uses non-financial CP rates of the appropriate term as the base rate in spreads in Table II, Panel A.¹⁶ Table I reports descriptive statistics for AA non-financial CP yields and spreads of other CP categories over AA non-financial CP.

Table II Panel A reports spreads for different classes of CP relative to non-financial CP at terms of one-day and 30-days.¹⁷ We use the Wald test to determine whether a given subperiod's estimated coefficient is different from the previous subperiod's coefficient and from its counterparts in other equations in the same system.

The AA financial 30-day CP spread increases during the financial crisis, consistent with financial firms being perceived as riskier. Specifically, the results suggest: a 6.4 bps spread increase following BNP announcement, a 29.8 bps spread increase following the Bear Stearns event, and a 104.2 bps spread increase following the Lehman bankruptcy (all relative to the pre-crisis period). All of the reference-event spreads are significantly different from zero at better than the 1% level, and each is larger than its predecessor, as indicated by the Wald test. There is not a consistent pattern in the one-day spreads.

The AA asset-backed 30-day CP spread increases during the financial crisis. Specifically, the results suggest: a 46.5 bps spread increase following BNP, a 56.4 bps spread

¹⁶ We also estimated each regression using the target Fed funds rate as the base rate in the spread. All results (available upon request) with the target rate as the base rate are qualitatively similar to the results reported in the Tables 2 and 3 with the non-financial CP rate as the base rate.

¹⁷ For the ease of exposition and in the interest of brevity, we do not report the estimated control variable coefficients (available upon request). The control variables' coefficients are often significant and improve the model's fit. The reference period, not covered by the subperiod dummies, is 2001 through 2006.

increase following Bear Stearns, and a 209.4 bps spread increase following Lehman (all relative to the pre-crisis period). All of the event spreads are significantly different from zero at better than the 1% level, and each is larger than its predecessor and significantly different from the 30-day financial CP spread coefficient. In addition, the one-day (overnight) spreads are significantly larger (at the 1% level) during the financial crisis than during earlier market conditions and from the AA financial results. These increases in both one-day and 30-day spreads are consistent with lenders exiting this class of risky CP and argue that problems in the CP market were related to credit risk.

The A2/P2 30-day CP spread increases during the financial crisis. Specifically, the results suggest: a 34.5 bps spread increase following BNP, a 59.0 bps spread increase following Bear Stearns, and a 356.8 bps spread increase following Lehman (all relative to the pre-crisis period). Again, all of the event spreads are significantly different from zero at better than the 1% level and each is larger than its predecessor and statistically larger than the corresponding coefficients for AA financial paper. Relative to AA asset-backed paper the parameter estimates on A2/P2 paper are smaller following BNP, not different following Bear Stearns and larger following Lehman. In addition, the one-day (overnight) spreads are significantly larger (at the 1% level) during the financial crisis than during earlier market conditions. As the financial crisis progressed, the spread increases for A2/P2 CP exceed the spread increases for both AA financial and asset-backed CP, again consistent with credit risk issues.

Panel B of Table II reports the estimated coefficients from the system of regressions of the term spreads for all classes of CP. If the financial crisis were liquidity related, then within each class of CP, lenders should move from term CP to overnight CP, resulting in term rates increasing relative to overnight rates and thus term spreads increasing. Following BNP, the term

spread change for AA non-financial relative to the base period is significant and negative (at the 1% level), with the other three classes are not different from zero. These results are not consistent with liquidity issues. Following the Bear Stearns event, the term spread for non-financial CP is insignificant, while the others are positive and significant at the 1% level. The lack of a positive spread in the least risky class is *prima facie* evidence that this is not a liquidity-based event. Following Lehman, all the parameter estimates are positive, with the magnitude positively related to risk. Thus, Lehman and Bear results show signs of a general market slowdown with both liquidity and credit features, but clearly credit continues to play a major role as the financial CP spread increase is roughly twice the size of the spread increase for asset-backed and A2/P2 CP, which are about three times the spread increase for AA non-financial CP.

In summary, the regression results confirm the preliminary findings based on the analysis of the plots.¹⁸ Based upon the regression results, the crisis in the CP market appears to be driven primarily by counterparty risk. While the Fed focused on injecting market-wide liquidity into the financial system in the first year of the crisis, our results suggest that liquidity concerns were of secondary importance.

IV.D. Federal Reserve Market Intervention Analysis

While our evidence suggests that the majority of the problems in the CP market are credit risk issues, there is substantial evidence that the Federal Reserve initially approached the problems in the CP market as liquidity-based and took actions to inject liquidity into the CP market. In this section, we examine the effect of Fed liquidity injections on CP spreads. Specifically, we examine Federal Reserve open market operations (OMO) and Federal Reserve

¹⁸The results are not qualitatively sensitive to the model's functional form, base rate, or control variables.

special lending facilities during the financial crisis. If the spread increases during the financial crisis are market-wide liquidity effects, then these Fed actions should reduce their size.

First, we collected the data on daily temporary OMO, including the size of the operations, maturity, and type of collateral (Treasury, agency, or mortgage-backed securities), and used these data as control variables in a variety of specifications in equation (1). The results are not qualitatively different from those reported in Table II, and OMO variables are neither statistically nor economically significant in the majority of categories and subperiods (not reported in the interests of brevity). The results on OMO are consistent with the crisis being driven by increased counterparty risk where injections of liquidity into the financial system would not be very effective as they do not address the root cause of the crisis.

Second, the Federal Reserve has used some unorthodox tools to address the financial crisis. Christensen, Lopez, and Rudebusch (2009) argue that the liquidity facilities helped lower the liquidity premium in term interbank lending rates, although Taylor and Williams (2009) adhere to the opposite view. We study the effect of the following tools on the commercial paper market:¹⁹

- 1) Increased (eased) access to the discount window (August 10, 2007),
- 2) *Term Auction Facility* (TAF, announced December 11, 2007, first auction held December 17, 2007),
- 3) *Term Securities Lending Facility* (TSLF, implemented March 11, 2008),
- 4) *Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility* (AMLF, announced September 19, 2008, started functioning September 22, 2008),
- 5) *Commercial Paper Funding Facility* (CPFF, announced October 7, 2008, started functioning October 27, 2008),

¹⁹ The details of the crisis facilities as well as traditional policy tools are described in detail on the Federal Reserve Board of Governors website at <http://www.federalreserve.gov/monetarypolicy/default.htm>.

- 6) Zero target rate policy (keeping the target rate in the 0-0.25% range and focusing on using the Fed's balance sheet instead, such as purchasing agency MBS, announced December 16, 2008).

To test the effects of the Fed's measures, we estimate the following system of seemingly unrelated regression equations (SUR):

$$DV_t = \alpha_0 + \alpha_1 Subperiod_1 + \sum_{i=1}^6 \delta_i * Facility_{i,t} + \sum_{j=1}^5 \beta_j * Control_{j,t} + \varepsilon_t \quad (2),$$

The dependent variables are the same as in Equation (1), i.e., spreads over the non-financial CP yield of the same maturity or term spreads within each CP category. The facility dummies are defined as follows:

Facility₁ = 1 from August 10, 2007 through December 16, 2007, the period when the Fed had eased access to the discount window and worked on injecting liquidity into the financial system in general, before the implementation of TAF;

Facility₂ = 1 from December 17, 2007 through March 10, 2008 (TAF, before TSLF);

Facility₃ = 1 from March 11, 2008 through September 18, 2008 (TSLF, before AMLF);

Facility₄ = 1 from September 19, 2008 through October 26, 2008 (AMLF, before CPFF);

Facility₅ = 1 from October 27, 2008 through December 15, 2008 (CPFF, before the zero target-rate policy);

Facility₆ = 1 from December 16, 2008 through the end of the sample (zero-rate policy, focusing on the Fed's balance sheet instead of adjusting the target rate).

The control variables are the same as in system (1); again, they are only used in the regressions involving 30-day CP yields.

None of the facilities were closed during our study period. To address the overlapping of the facilities, we define a facility dummy variable to equal 1 from the beginning of a facility until the beginning of the next facility and 0 otherwise. Thus, the coefficient of each facility dummy

should be viewed as a *cumulative effect* of all the measures enacted up to date.²⁰ These facilities dummies, in some cases, cover very similar periods to the subperiod dummies from system (1); e.g., the TSLF dummy covers a period that starts one day before the Bear Stearns failure and ends three days after the Lehman bankruptcy, practically coinciding with the *Subperiod₃* dummy. Accordingly, the subperiod dummies have been dropped, with the exception of *Subperiod₁* (Year 2007 before the BNP announcement). If a facility worked as intended, then the estimated coefficient for a CP spread would be either not different from or smaller than the previous subperiod's coefficient. Table III reports the first eight estimated coefficients from each equation (intercept, *subperiod₁*, and the six facility dummies) from system (2).

The 30-day AA financial CP parameter estimates for all the facilities are positive and significant. TAF, TSLF and AMLF parameters represent increases in spread from the previous period or facility. These increases are inconsistent with the new facilities returning spreads to normal or alleviating liquidity constraints. CPFF is associated with the spreads falling by about 40 bps from the previous facility, consistent with moving market conditions toward normal. We discuss the CPFF in detail below. The zero-rate policy and the Fed focusing on its balance sheet are associated with the spread declining further. There is not a consistent pattern in one-day (overnight) spreads, although overnight spreads increase under AMLF.

The AA asset-backed 30-day CP parameter estimates for each facility are positive and significant at the 1% level. The TAF has a smaller spread (by 11.5 bps) than the previous subperiod, followed by increased spreads after the creations of TSLF and AMLF. Spreads decline under CPFF by roughly 130 bps. The zero-rate policy and the Fed focusing on its

²⁰ In an alternate specification (not presented), we employed an aggregate indicator variable to control for Federal Reserve actions. The interpretation of those results is the same as those presented here.

balance sheet are associated with the spread declining further. The facility coefficients are significantly larger than their 30-day AA financial paper counterparts. One-day (overnight) spreads follow the same pattern as 30-day spreads.

The 30-day A2/P2 non-financial CP parameter estimates for each facility is positive and significant at the 1% level. The TAF is not different from the previous period. TSLF and AMLF show spread increases. Under CPFF the spread declines about 26 basis points which is statistically significant but economically modest at this time. The zero-rate policy and the Fed focusing on its balance sheet are associated with the spread declining. The facility coefficients are significantly larger than their 30-day AA financial and AA asset-backed counterparts for each facility except for TAF. Overnight spreads increase with each facility until a decline under CPFF.

Overall, 30-day spreads increased under TSLF and AMLF, so neither facility moved the spreads toward normal market conditions. TAF shows mixed results for 30-day spreads, with an increased spread in the least risky class. CPFF reduced spreads significantly for all three categories of CP, although the least for A2/P2 CP (40 bps off of 112 bps spread for AA Fin, 130 bps off of a 236 bps spread for AA asset-backed, and 26 bps off of a 369 bps spread for A2/P2). The zero-rate policy and the Fed focusing on its balance sheet are associated with the spread declining further in all categories and maturities of CP. These results raise two questions: why did CPFF have some success while the previous facilities did not and why did CPFF have its smallest effect in A2/P2 CP?

TAF was a lending facility for depository institutions and TSLF was a reserve-neutral facility that allowed primary dealers to exchange less liquid collateral such as MBS for more

liquid securities such as Treasury bills. AMLF was a lending facility for depository institutions, bank holding companies, and US branches of foreign banks that financed purchases of asset-backed commercial paper from money market funds. CPFF was a ‘special purpose vehicle’ using financing from the NY Fed to purchase CP, but not A2/P2 CP. Hence, when the Fed provided liquidity (TAF, TSLF and AMLF), the results were limited, but when the Fed essentially made loans to specific CP issuers through CPFF (thus becoming a major investor), the spreads declined dramatically in the classes of CP where the Fed had operations. That is, instead of addressing market-wide issues, the Fed specifically intervened at the individual borrower level. This is strong evidence that the problems in the CP market are primarily credit issues and not liquidity issues.

CPFF was used by the Federal Reserve Bank of New York to purchase unsecured CP at the overnight index swap (OIS) rate plus 200 bps. Asset-backed CP was purchased at the OIS plus 300 bps. The CPFF became operational on October 27, 2008. Figure 5 re-produces a subset of Figure 1 from July 1, 2008 through January 31, 2009 with the addition of the rates at which the CPFF would purchase the different classes of CP.²¹ We note that the CPFF program did not purchase A2/P2 CP and thus provides a natural experiment related to credit risk.

Panel A of Figure 5 plots 30-day AA financial and AA nonfinancial CP market rates along with rates that the CPFF program charged for these classes of CP. AA non-financial CP shows a spike at the Lehman bankruptcy followed by a steady decline beginning before CPFF is operational. The AA financial CP rates increased following Lehman and remained high until CPFF becomes operational. At this point, AA financial CP market rates drop below the rate

²¹ We note that the CPFF purchased three-month CP and Figure 1 (and therefore Figure 5) are drawn with one-month rates. When we examine plots with three-month rates, these plots are qualitatively similar to the plots in Figure 5.

charged by CPFF, consistent with a market segmentation effect. The CPFF program held about 15% and 25% (see, Kaperczky and Schnabl (2010) Figure 5, p. 44) of the CP market in November and December of 2008, and those paying the CPFF rate would be the higher risk borrowers within a class.

Panel B of Figure 5 plots 30-day AA asset-backed and A2/P2 CP market rates along with the CPFF rates for asset-backed CP. Asset-backed CP market rates started declining before CPFF was operational, but rates still decreased dramatically with the start of CPFF. A2/P2 rates increased with Lehman and remained high for several months after CPFF became operational.²² The continued high rates in the A2/P2 CP, which did not qualify for CPFF purchases, support the argument for credit risk issues in the CP market.

V. Conclusion

We study the U.S. commercial paper (CP) market to draw insights about the nature of the recent crisis in the money markets. The CP market is not homogeneous in terms of credit quality, maturities, and types of issuers, and we show that not all CP issuers suffered equally during the crisis. Commercial paper of the highest perceived credit quality (AA-rated non-financial CP) appears to have been influenced the least by the crisis, as measured by changes in yields relative to other rates, term spreads, the amounts outstanding, and the number of new issues. Other categories (A2/P2 non-financial, AA asset-backed, and AA financial) experience increased yields and/or term spreads for at least some time during the crisis, consistent with credit risk concerns. While term spreads may be indicative of liquidity issues, the fact that term spreads

²² We note that 30-day A2/P2 rates drop promptly just prior to the end of December 2008. This drop is likely related to the abatement of the year-end pressure that causes lenders to exit higher-risk money market instruments first (Griffiths and Winters 2005b). We note that the decline in rates in other terms does not occur on exactly the same day, so this decline in A2/P2 rates is unlikely to be the result of Fed or other regulatory action.

increase more for categories with higher perceived credit risk indicates that the crisis in the money markets is related more to increases in perceived counterparty (credit) risk, with liquidity concerns being a secondary factor.

Our results suggest that the impact of the financial crisis on the commercial paper market was not a market-wide problem, but was instead concentrated in classes of commercial paper with specific credit-quality issues. Accordingly, simple injections of liquidity into the financial system would not be very effective as they do not address the root cause of the crisis. While we cannot and should not rule out that the situation could have been much worse without various liquidity-injecting measures, these measures clearly did not have the intended impact as evidenced by our analysis. On the other hand, central banks and other regulators becoming investors and credit risk insurers has had a positive impact on the situation in the financial markets, as shown through the analysis of the CPFF Federal Reserve lending facility.

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Table I. CP AA non-financial yields, spreads of other categories over AA non-financial CP yields, and term spreads.

	AA Non-Fin		Spreads of other CP over AA Non-Fin, bp						Term Spreads, bp			
	Means											
	1-day yield,%	30-day yield,%	AA Fin 1d	AA Fin 30d	AA AB 1d	AA AB 30d	A2 1d	A2 30d	AA Non- Fin	AA FIN	AA AB	A2/ P2
Entire Sample	2.74	2.71	0	8	14	21	31	49	-3	8	6	17
2007 pre-BNP	5.26	5.23	-2	2	3	6	8	12	-3	0	0	1
BNP-Bear	4.24	4.17	-2	11	45	65	47	69	-8	4	12	14
Bear-Lehman	2.10	2.07	-6	32	40	63	61	84	-2	35	21	21
Lehman - 10/31/08	1.50	1.76	-5	106	173	216	327	382	27	137	69	82
Nov.&Dec. '08	0.23	0.41	3	50	70	89	210	475	18	65	36	283
Yr.2009 thru 7/2	0.19	0.21	0	13	29	33	62	95	2	16	7	36
	Standard Deviations											
Entire Sample	1.71	1.67	5	19	28	37	52	82	16	26	26	46
2007 pre-BNP	0.03	0.02	2	2	1	2	3	3	3	3	3	4
BNP-Bear	0.78	0.86	4	12	15	41	18	27	16	18	39	30
Bear-Lehman	0.15	0.07	6	14	15	14	11	11	13	16	20	17
Lehman - 10/31/08	0.92	0.39	27	49	64	79	49	91	67	76	135	109
Nov.&Dec. '08	0.22	0.25	8	33	21	35	51	67	25	33	32	90
Yr.2009 thru 7/2	0.06	0.06	2	8	10	14	30	59	6	9	13	35

The entire sample period spans the period 1/2/2001 through 7/2/2009. Term spreads are spreads between 30-day and one-day CP yields in each category. Yields are in percent, spreads are in basis points.

Table II. Regression output

PANEL A. Dependent variables are spreads over AA non-financial CP yields

Maturity	1-day			30-day		
Category	AA Fin	AA AB	A2/P2	AA Fin	AA AB	A2/P2
Intercept	0.000 (0.000)	0.039 ^f (0.000)	0.173 ^{f,ab} (0.000)	0.021 (0.000)	0.061 ^f (0.000)	0.268 ^{f,ab} (0.000)
Yr. '07 before BNP	-0.013 (0.000)	-0.010 (0.085)	-0.095 ^{f,ab} (0.000)	0.008 (0.113)	0.003 (0.617)	-0.114 ^{f,ab} (0.000)
BNP-Bear	-0.021 (0.000)	0.413 ^{‡,f} (0.000)	0.300 ^{‡,f,ab} (0.000)	0.064 [‡] (0.000)	0.465 ^{‡,f} (0.000)	0.345 ^{‡,f,ab} (0.000)
Bear-Lehman	-0.061 [‡] (0.000)	0.356 ^{‡,f} (0.000)	0.437 ^{‡,f,ab} (0.000)	0.298 [‡] (0.000)	0.564 ^{‡,f} (0.000)	0.590 ^{‡,f} (0.000)
Lehman-10/31/08	-0.050 (0.000)	1.691 ^{‡,f} (0.000)	3.096 ^{‡,f,ab} (0.000)	1.042 [‡] (0.000)	2.094 ^{‡,f} (0.000)	3.568 ^{‡,f,ab} (0.000)
Nov. & Dec. '08	0.020 [‡] (0.000)	0.661 ^{‡,f} (0.000)	1.924 ^{‡,f,ab} (0.000)	0.588 [‡] (0.000)	0.815 ^{‡,f} (0.000)	4.094 ^{‡,f,ab} (0.000)
Yr. '09 thru 7/2	-0.003 [‡] (0.392)	0.247 ^{‡,f} (0.000)	0.443 ^{‡,f,ab} (0.000)	0.115 [‡] (0.000)	0.265 ^{‡,f} (0.000)	0.701 ^{‡,f,ab} (0.000)

PANEL B. Dependent variables are term spreads (30-day yield minus 1-day yield)

Category	AA non-Fin	AA Fin	AA AB	A2/P2
Intercept	-0.009 (0.060)	0.005 ^{nf} (0.331)	0.015 ^{nf,f} (0.037)	0.077 ^{nf,f,ab} (0.000)
Yr. '07 before BNP	0.005 (0.533)	0.027 ^{nf} (0.003)	0.019 (0.129)	-0.013 ^{f,ab} (0.305)
BNP-Bear	-0.073 [‡] (0.000)	0.016 ^{nf} (0.274)	-0.009 ^{nf} (0.656)	-0.037 ^{nf,f} (0.078)
Bear-Lehman	-0.012 [‡] (0.367)	0.347 ^{‡,nf} (0.000)	0.196 ^{‡,nf,f} (0.000)	0.139 ^{‡,nf,f,ab} (0.000)
Lehman-10/31/08	0.277 [‡] (0.000)	1.371 ^{‡,nf} (0.000)	0.681 ^{‡,nf,f} (0.000)	0.749 ^{‡,nf,f,ab} (0.000)
Nov. & Dec. '08	0.303 (0.000)	0.851 ^{‡,nf} (0.000)	0.404 ^{‡,nf,f} (0.000)	2.139 ^{‡,nf,f,ab} (0.000)
Yr. '09 thru 7/2	0.035 [‡] (0.000)	0.154 ^{‡,nf} (0.000)	0.054 ^{‡,f} (0.008)	0.291 ^{‡,nf,f,ab} (0.000)

The estimation period is January 2, 2001 through July 2, 2009 (inclusive). The table reports the first seven coefficients for each equation in System (1). The coefficients are in percentage points. P-values in parentheses below coefficients are for the null hypothesis of a coefficient being equal to zero.

([‡]) indicates that a given estimated coefficient is different at the 5% level or better from the previous subperiod's coefficient in a given equation (in the case of the first subperiod's coefficient, we do not estimate its difference from the intercept). The Wald test was conducted to detect these differences.

^{nf,f}, and ^{ab} indicate that a given estimated coefficient is different at the 5% level or better from the counterparts in the equations for non-financial, financial, and asset-backed CP, respectively. For example, the estimated intercept in the A2/P2 term spread equation (0.077) is different from the intercepts in the AA non-Financial, AA Financial, and AA Asset-backed term spread equations (estimated at -0.009, 0.005, and 0.015, respectively). The Wald test was conducted to detect these differences.

Table III. Regression output with Fed facilities as independent variables

PANEL A. Dependent variables are spreads over AA non-financial CP yields

Maturity	1-day			30-day		
Category	AA Fin	AA AB	A2/P2	AA Fin	AA AB	A2/P2
Intercept	0.005 (0.000)	0.039 ^f (0.000)	0.173 ^{f,ab} (0.000)	0.021 (0.000)	0.059 ^f (0.000)	0.267 ^{f,ab} (0.000)
Yr. '07 before BNP	-0.013 (0.000)	-0.011 (0.128)	-0.096 ^{f,ab} (0.000)	0.008 (0.100)	0.003 (0.700)	-0.114 ^{f,ab} (0.000)
BNP to TAF	-0.025 [‡] (0.000)	0.426 ^{‡,f} (0.000)	0.326 ^{‡,f,ab} (0.000)	0.039 [‡] (0.000)	0.507 ^{‡,f} (0.000)	0.331 ^{‡,f,ab} (0.000)
TAF to TSLF	-0.015 (0.009)	0.392 ^{‡,f} (0.000)	0.254 ^{‡,f,ab} (0.000)	0.090 [‡] (0.000)	0.392 ^{‡,f} (0.000)	0.349 ^f (0.000)
TSLF to AMLF	-0.070 [‡] (0.000)	0.415 ^{‡,f} (0.000)	0.490 ^{‡,f,ab} (0.000)	0.292 [‡] (0.000)	0.571 ^{‡,f} (0.000)	0.628 ^{‡,f,ab} (0.000)
AMLF to CPFF	0.000 [‡] (0.992)	1.733 ^{‡,f} (0.000)	3.196 ^{‡,f,ab} (0.000)	1.124 [‡] (0.000)	2.356 ^{‡,f} (0.000)	3.685 ^{‡,f,ab} (0.000)
CPFF to zero TFFR	0.020 (0.006)	0.814 ^{‡,f} (0.000)	2.312 ^{‡,f,ab} (0.000)	0.725 [‡] (0.000)	1.055 ^{‡,f} (0.000)	3.426 ^{‡,f,ab} (0.000)
Zero TFFR to end	-0.002 [‡] (0.677)	0.256 ^{‡,f} (0.000)	0.512 ^{‡,f,ab} (0.000)	0.128 [‡] (0.000)	0.273 ^{‡,f} (0.000)	0.871 ^{‡,f,ab} (0.000)

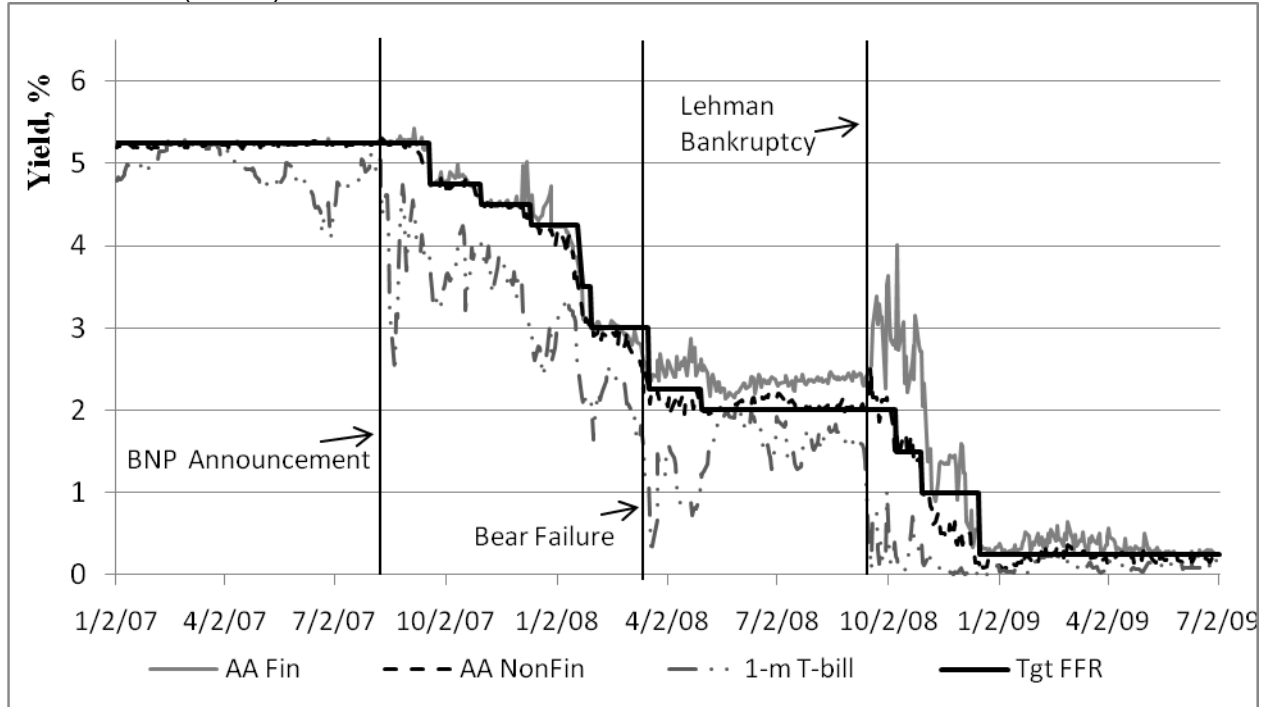
The estimation period is January 2, 2001 through July 2, 2009. The table reports the first eight coefficients for each equation in System (2). The coefficients are in percentage points. P-values in parentheses below coefficients are for the null of a coefficient being equal to zero.

([‡]) indicates that a given estimated coefficient is different at the 5% level or better from the previous subperiod's coefficient in a given equation (in the case of the first subperiod's coefficient, we do not estimate its difference from the intercept). The Wald test was conducted to detect these differences.

^{nf,f, and ab} indicate that a given estimated coefficient is different at the 5% level or better from the counterparts in the equations for non-financial, financial, and asset-backed CP, respectively.

Figure 1. 30-day CP yields

Panel A. AA Financial and AA Non-Financial CP, one-month T-bill, Target Federal Funds Rate (TFFR)



Panel B. AA Asset-backed and A2/P2 Non-Financial CP, one-month T-bill, Target Federal Funds Rate (TFFR)

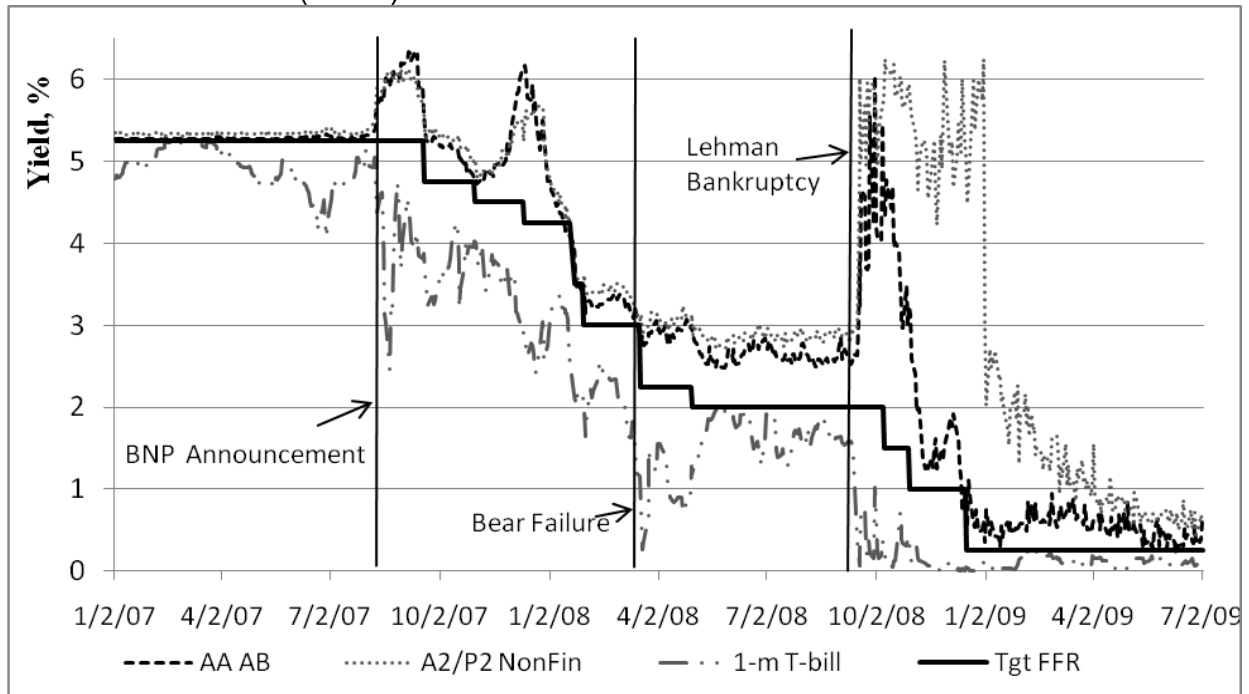
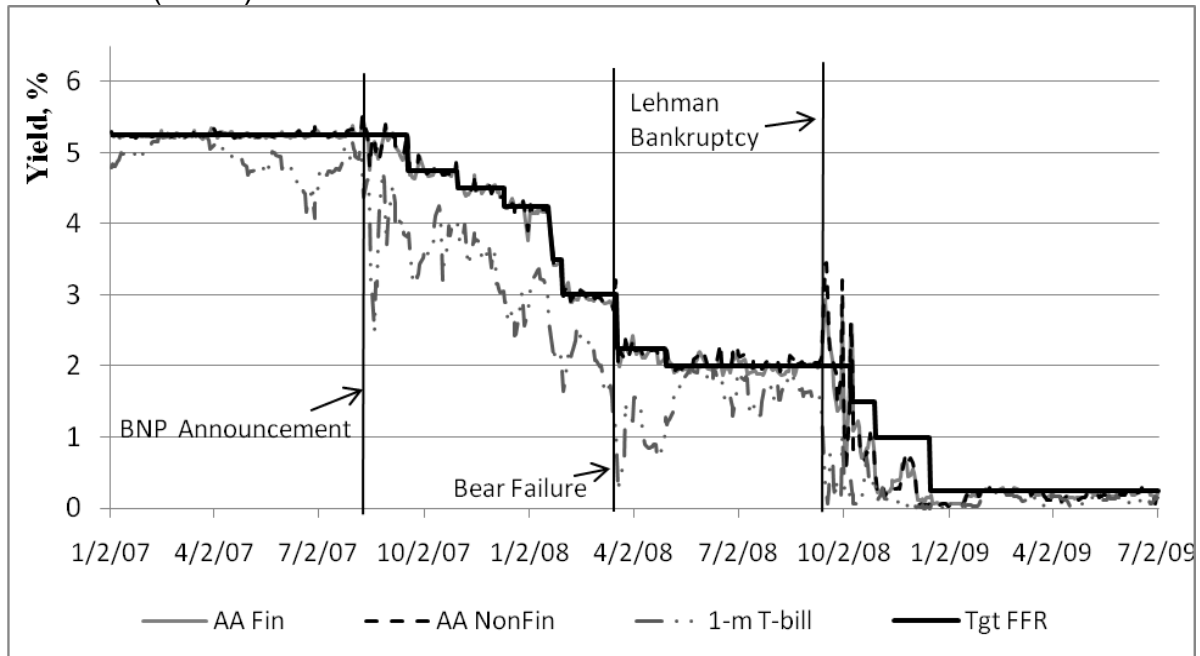


Figure 2. Overnight CP yields

Panel A. AA Financial and AA Non-financial CP, one-month T-bill, Target Federal Funds Rate (TFFR)



Panel B. AA Asset-backed and A2/P2 Non-financial CP, one-month T-bill, Target Federal Funds Rate (TFFR)

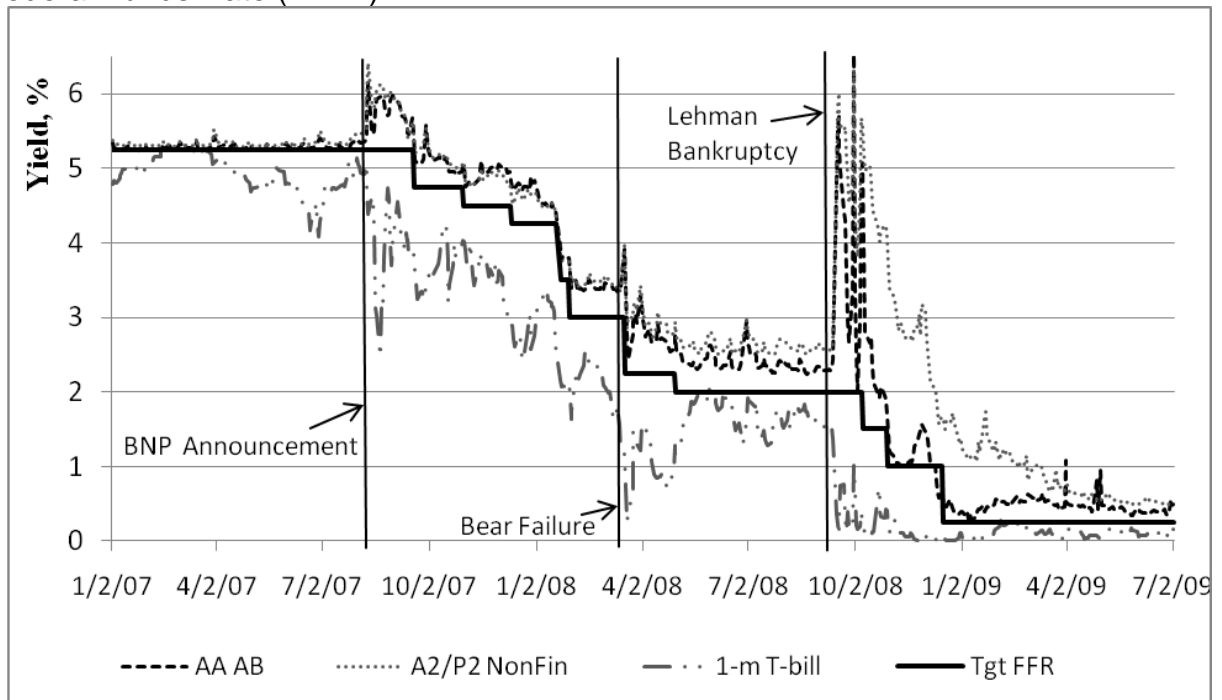
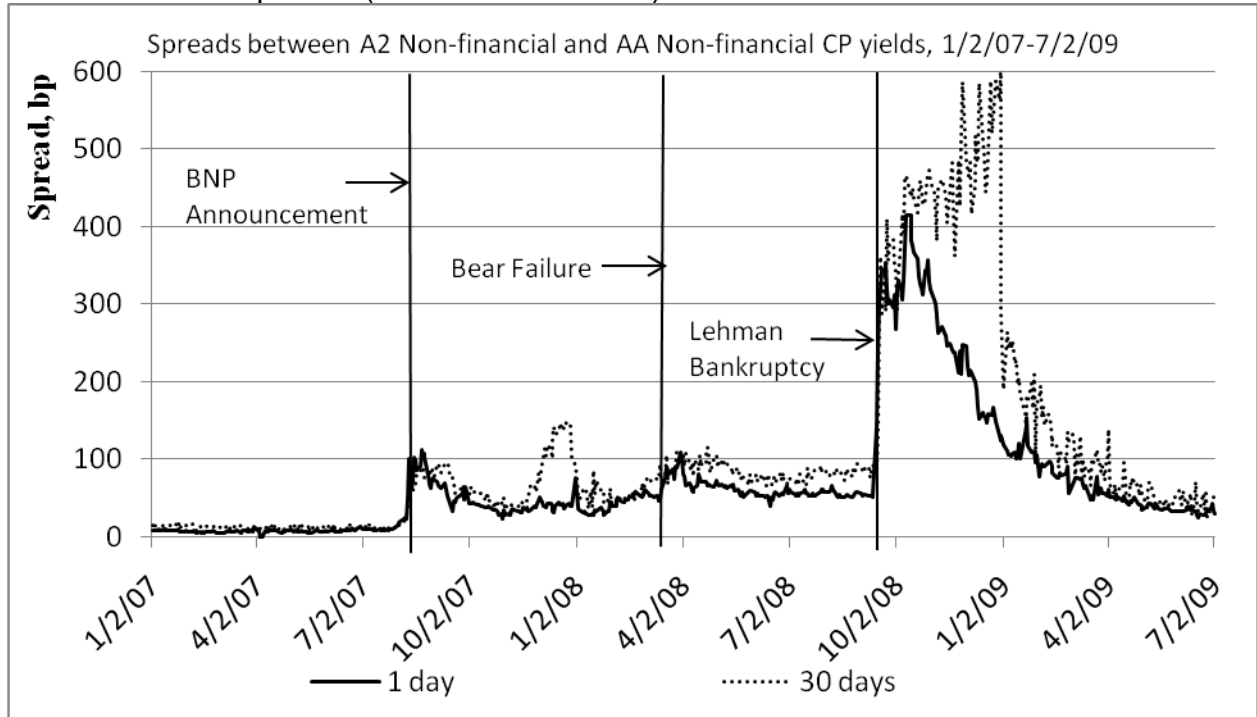


Figure 3. Credit Spreads and Term Spreads

Panel A. Credit Spreads (A2/P2 – AA NonFin)



Panel B. Term spreads (30-day – 1-day) in each CP Category

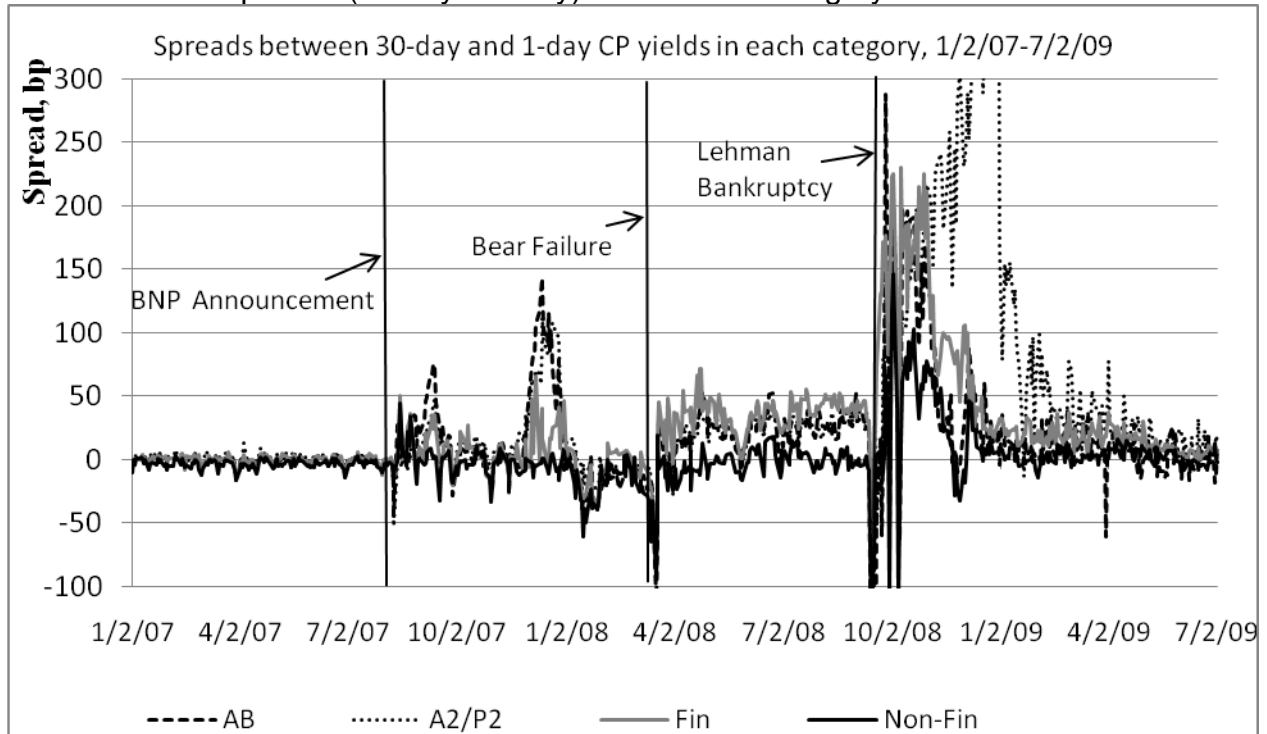
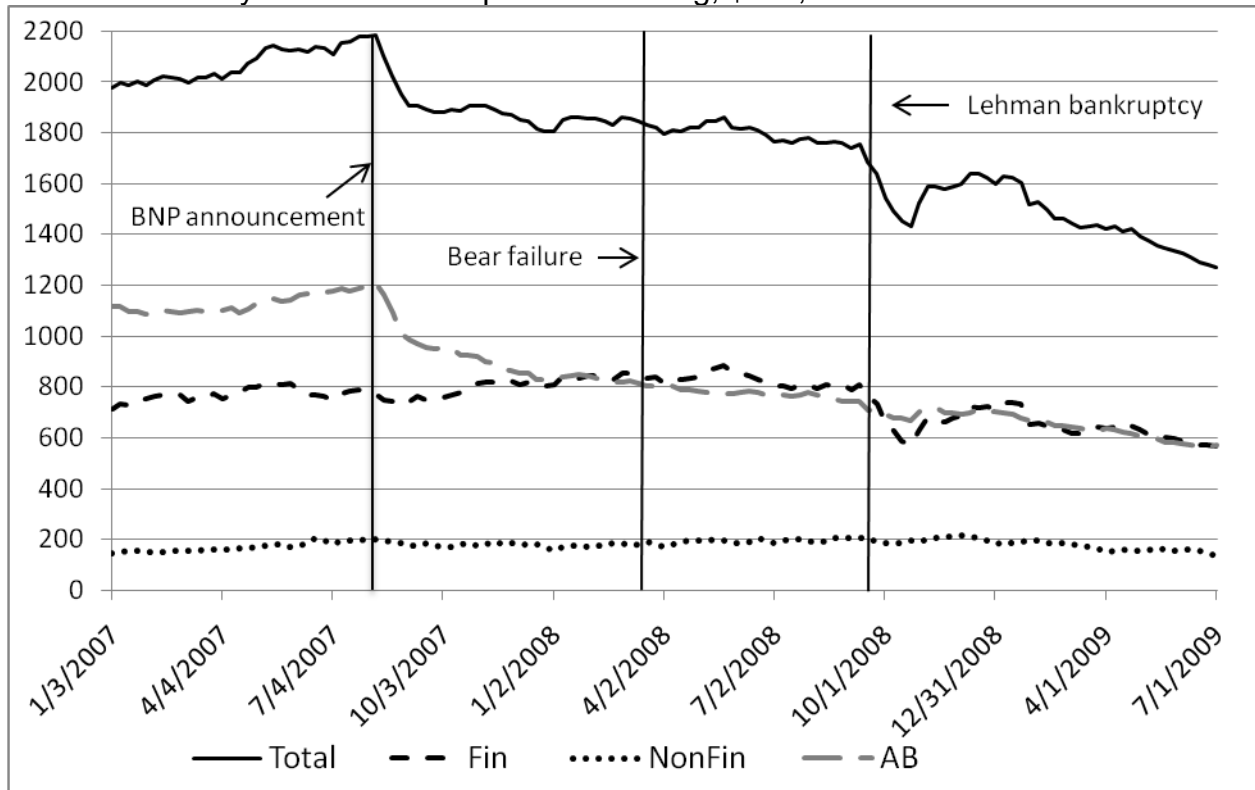


Figure 4

Panel A. Weekly Commercial Paper Outstanding, \$bln., 1/3/07 – 7/1/09



Panel B. Bank Lending Standards on Credit Lines (Based on the Fed's Senior Lender Survey)

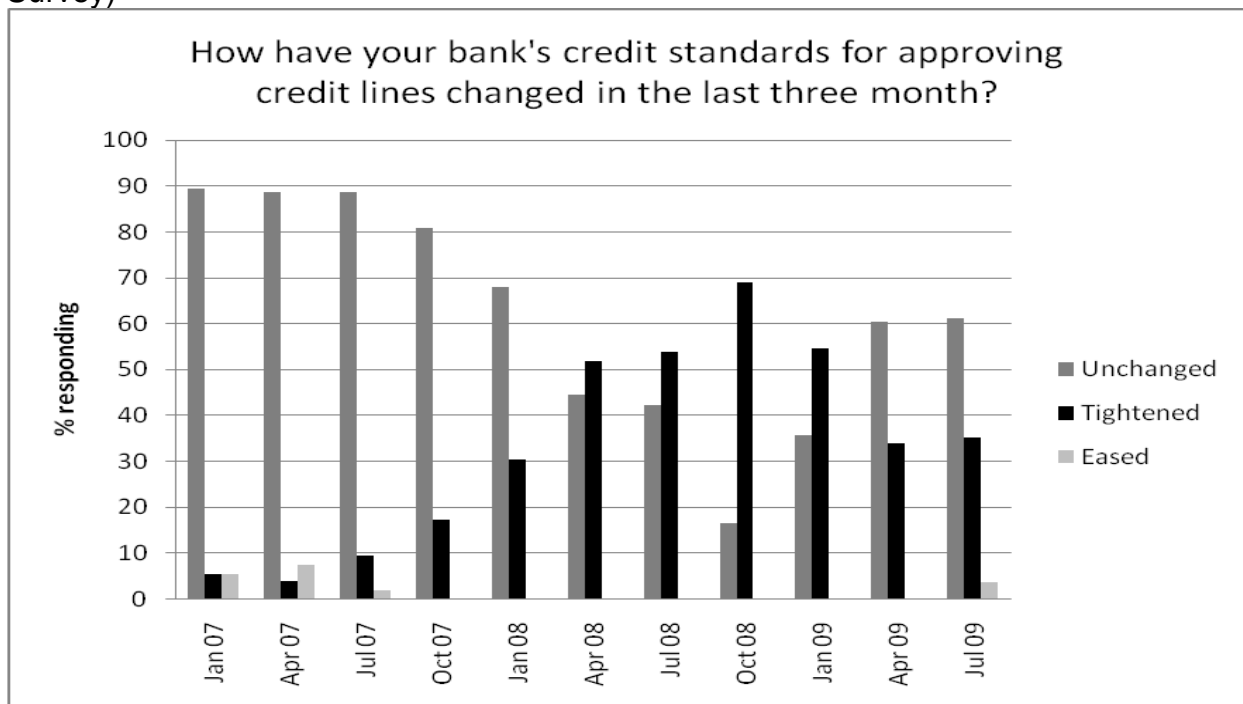
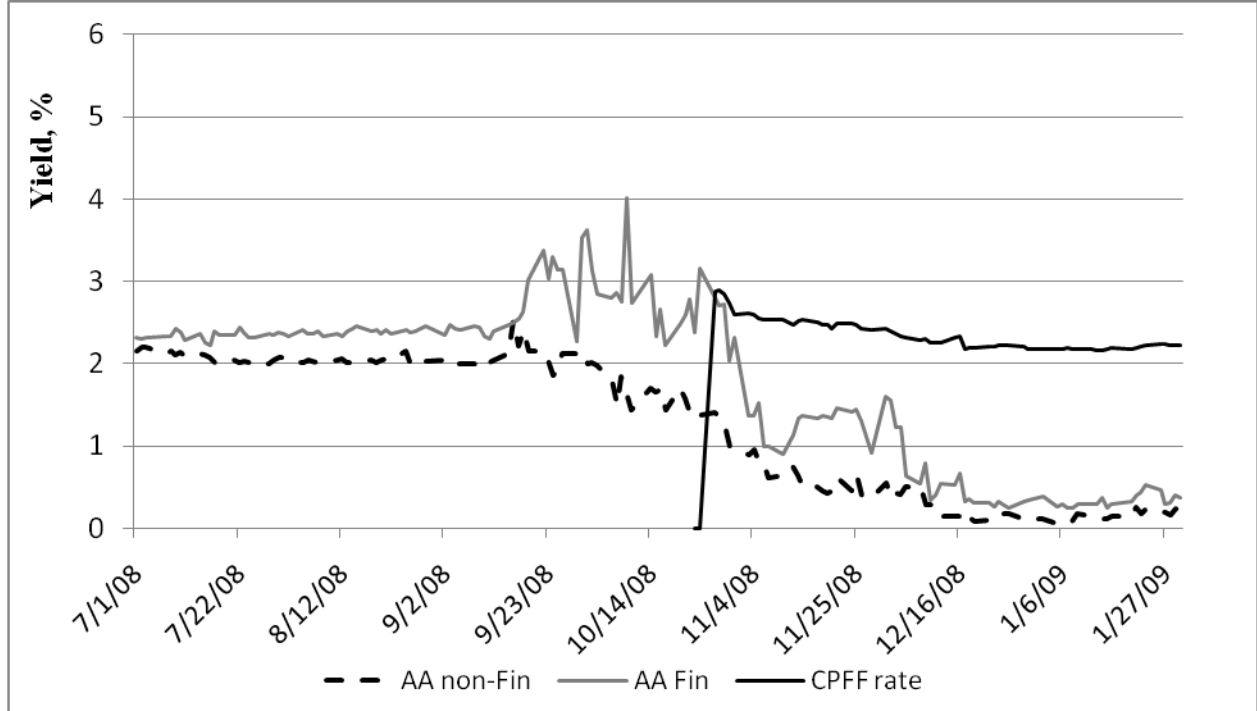


Figure 5. Commercial Paper rates around the beginning of the Commercial Paper Funding Facility (CPFF)

Panel A. 30-day AA Financial and AA Non-financial CP, CPFF Rate



Panel B. 30-day AA Asset-backed and A2/P2 CP, CPFF ABCP rate

