Liquidity Backstop, Corporate Borrowing, and Real Effects*

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Abstract

This research investigates the real effects of public liquidity provision. Using the Commercial Paper Funding Facility's (CPFF) eligibility criteria for non-financial commercial paper issuers as the identification strategy, we show that firms with access to the CPFF were able to mitigate the financing disruptions caused by the Lehman Brothers bankruptcy and the ensuing dysfunctional credit market. CPFF directly reduces risk of eligible firms, which in turn improved their financing and short-term profitability. We find liquidity spillover effects from CPFF-eligible firms to their customers through the increased use of trade credit, which propagates the real effects throughout the economy.

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The failure of financial intermediaries that followed the collapse of Lehman Brothers in September 2008 raised concerns that a weakened financial sector would threaten credit availability for non-financial firms and destabilize the entire economy. In response, the Federal Reserve Board and other U.S. government entities implemented a series of policy interventions to shore up the functioning of financial markets.[1]

Spatt (2012) observes that such government intervention offers us an invaluable opportunity to study the interaction of government and financial markets, and to understand the mechanisms through which economic policy operates. We focus on the effect of the public provision of liquidity on non-financial firms through implementation of the Commercial Paper Funding Facility (CPFF) program.

Understanding the impact of the public provision of liquidity is important for several reasons. Some theories suggest that when capital markets are imperfect or contracts are incomplete, government intervention through an injection of public liquidity can potentially mitigate illiquidity-driven inefficiency (Holmstrom and Tirole, 1998; among others). Conversely, the public provision of liquidity, especially through the lender of last resort, may lead to undesirable consequences due to moral hazard by borrowers or lenders. Whether the public provision of liquidity restores the functioning of lending markets or exacerbates a tendency toward excessive risk taking and default should be subject to careful empirical examination.

Yet studying the impact of the provision of public liquidity is challenging. First, public liquidity provision does not happen often. Second, the decision to adopt a particular policy is often endogenous to firms that are subject to such a policy intervention.

[1] Government policy interventions include the Primary Dealer Credit Facility (PDCF), the Term Securities Lending Facility (TSLF), the Temporary Liquidity Guarantee Program (TLGP), the Money Market Investor Funding Facility (MMIFF), and the Term Asset-Backed Securities Loan Facility (TALF).

The introduction of the CPFF program provides a useful setting for several reasons. First, the collapse of Lehman Brothers led to an unprecedented liquidity shock driven by a substantially weakened financial sector that had been was the main source of private liquidity. With severe contraction in private liquidity, the impact of government-sponsored public liquidity was expected to be substantial, helping us to increase statistical power of testing the impact of public liquidity provision. Second, *borrowed reserves* (the Fed's source of funds for the CPFF program) were intended to be used for deposit-taking institutions, not primarily to rescue non-financial commercial paper (CP) issuers. Various policy choices (including eligibility criteria) are largely exogenous for the non-financial firms that we study.[2] Third, while there are only a few CP issuers in the economy, as they represent a significant fraction of the U.S. economy, they are of significant economic importance.[3] Finally, as we discuss in detail, the CPFF was available only to a subset of CP issuers: only firms with the highest ratings (A-1/P-1/F-1). Hence the eligibility criteria not only guard against issues that may arise because of firms' self-selection for the program, but also allow us to exploit some cross-sectional features embodied in the policy intervention. These cross-sectional variations (CPFF-eligible vs. CPFF-ineligible) and time-series variations (before vs. after the introduction of CPFF) allow us to identify the impact of the public liquidity provision using a difference-in-differences framework.

Calomiris, Himmelberg, and Wachtel (1995) suggest that CP issuers as a whole are homogeneous in credit quality. In our main tests, we actually implement a more stringent set of identification strategies than a simple test based on a dichotomous comparison of CPFF-eligible

[2] While financial CP issuers suffer from fundamental shocks (e.g., losses from subprime mortgage-related transactions), manufacturing firms face difficulties arising mainly from a disruption in financing. Hence, the CPFF for financial CP issuers may be viewed as a bail-out, while the CPFF for non-financial CP issuers can be better viewed as the public provision of liquidity.

[3] As of 2008:Q1, CP issuers in the manufacturing sector accounted for 57% of total assets and over 60% of total market capitalization.

vs. ineligible subsamples within the CP issuers. The identification strategy has two parts. In the first part, we focus on CP issuers near the CPFF eligibility cutoff based on their *long-term* ratings: lowest long-term rating of A-1 vs. highest long-term rating of A-2. Because there is more than one long-term rating in each short-term CP rating category, a long-term rating is more refined than a short-term CP rating.[4] A comparison of CP issuers based on their relative credit qualities under finely tuned *long-term* ratings (*within* each short-term CP rating) further minimizes unintended influence on our inferences on effects during market distress, letting us more precisely quantify the differential impact of the CPFF on firms with access and without access to the program.

Given that CP issuers with slightly different credit qualities may still differ in other characteristics – particularly the flight-to-quality effect during a crisis – in the second part of the identification strategy, we carry out two "placebo" tests that compare firms *within CPFF-eligible* and *within ineligible* groups that *differ only* in long-term ratings. By design, these placebo tests directly tackle whether credit quality and a consequent flight-to-quality effect could generate empirical regularities similar to those generated by introduction of the CPFF program.[5]

Among publicly traded U.S. manufacturing firms from 2008:Q1 through 2009:Q4, we find that the CPFF has a sizable direct economic impact on CPFF-eligible firms. First, it systematically lowers market risk, default risk, total tail risk, and left-tail risk (i.e., downside risk) of CPFF-eligible firms. For example, after introduction of the CPFF, 6-month credit default swap (CDS) spreads of CPFF-eligible firms decreased 100 basis points more than for CPFF-

[4] Specifically, a CP-rating (i.e., short-term rating) of A-1+ includes long-term ratings of AA-, AA, AA+, and AAA; a CP-rating of A-1 includes long-term ratings of A and A+; and a CP-rating of A-2 includes long-term ratings of BBB, BBB+ and A-1. Figure 3 illustrates the mapping between short-term CP ratings and long-term ratings.

[5] Flight-to-quality effect describes the possibility that investors have stronger preferences for higher quality and lower credit risk firms during a crisis (Bernanke, Gertler, and Gilchrist, 1996).

ineligible firms. Similarly, comparing CPFF-eligible vs. ineligible firms, we find that total return volatility decreased by more than 0.0069 (about 28.5% of the pre-crisis sample mean); CAPM beta drops by more than 0.31 (about 36.3% of the pre-crisis sample mean); and left-tail downside risk drops by more than 0.013 (about 333% of the pre-crisis sample mean).[6] All of these effects are statistically significant at 10% or higher.

Second, the collective reduction of risk lowers the financing costs of CPFF-eligible firms. The difference in the interest expenses-to-debt ratio between A (the lowest long-term rating of CPFF-eligible A-1) and A- (the highest long-term rating of CPFF-ineligible A-2) rated firms drops by 0.29% (26.1% of the pre-crisis sample mean). At the same time, CPFF increases CP borrowings of CPFF-eligible firms. Furthermore, the difference in CP-to-assets between these two sets of firms increased by 2.96% (58% of the pre-crisis sample mean). Such a reduction in the cost and increase in the quantity of CP financing led to a substantial improvement in the profitability and short-term earnings forecasts of CPFF-eligible firms. The net income-to-assets ratio of CPFF-eligible firms increased by 1.84% (57.1% of the pre-crisis sample mean) over CPFF-ineligible firms after introduction of the CPFF. On the operational side, revenues and receivables of CPFF-eligible firms increased while inventories declined after introduction of the CPFF.

Our evidence on the direct impact of CPFF on CPFF-eligible firms does not seem to be driven by simple differences due to credit quality and the consequent flight-to-quality effect during market distress. Our placebo tests find no systematic evidence that firms with different credit qualities but without differential access to the CPPF program exhibit discernible

[6] While the amount of downside risk reduction seems to be very large, it is not driven by outliers. Indeed it reflects that after Lehman's bankruptcy filing (i.e., crisis period), *average* downside risk shot up dramatically (about four times). During the pre-crisis period, average downside risk in our sample were 0.0039 (mean) and 0.0032 (median). During the crisis period, average downside risk in our sample were 0.0176 (mean) and 0.0128 (median).

differences in market risk, default risk, and tail risk. They do not experience difference in profitability, or investment, among other real effects. Collectively, our identification strategies suggest that CPFF indeed has real effects on the set of manufacturing firms we study.

Exploration of the broader implications of the government liquidity backstop for firms without direct access to this program suggests that net trade credit extended from CPFF-eligible firms to their customers increased after introduction of the CPFF. Consequently, customers of CPFF-eligible firms were less reliant on cash and could increase investment activities.

Our primary contribution is to provide the first piece of firm-level disaggregated evidence on how the public provision of liquidity affects the financing and operational decisions of non-financial firms, as well as how the market responds to the introduction of such a liquidity backstop. We also shed light on how the public provision of liquidity may be redistributed to the economy through customer-supplier networks, propagating its effect throughout the economy.

The paper is organized as follows. Section I provides background on the recent financial crisis and the institutional features of the Commercial Paper Funding Facility (CPFF) program. Section II describes the data and provides summary statistics. Section III presents evidence of the impact of the CPFF on firms' financing and operational decisions as well as market responses. Section IV examines the spillover effect of the CPFF from CPFF-eligible firms to their clients. Section V concludes.

I. The Financial Crisis of 2008 and the CPFF

I.A. Background

The increase in subprime mortgage defaults in early 2007 triggered the 2008 financial crisis. The most significant event that pushed global financial markets into a full-fledged financial crisis

was the bankruptcy filing of Lehman Brothers on September 15, 2008. Lehman's default raised concerns about the health of the financial sector, which threatened credit for non-financial firms. The deterioration of American International Group's financial health further intensified the crisis. Investors lost confidence in the safety of U.S. money market mutual funds, and the commercial paper market broke down as soon as Lehman Brothers announced its bankruptcy filings (see Mollenkamp, Whitehouse, Hilsenrath, and Dugan, 2008).

Outstanding financial CP issue severely declined in the third week of September 2008. This contraction lasted until the end of October, when the U.S. Federal Reserve Board implemented the Commercial Paper Funding Facility (CPFF). The CPFF uses a special purpose vehicle (SPV) that purchases CP from issuers using emergency funds provided by the Federal Reserve Bank of New York, holds the CP until maturity, and uses the proceeds from maturing CP and other assets of the SPV to repay its loan from the New York Fed. Through this process, the CPFF provided a liquidity backstop to U.S. issuers of CP.

Initially scheduled to terminate on April 30, 2009, the SPV was extended to February 1, 2010. Figure 1 shows the outstanding CP purchased by the CPFF program. While the CPFF was more widely used by financial firms, a substantial amount of non-financial CP was purchased by the CPFF program. At its peak in December 2008, total outstanding non-financial CP purchased by the CPFF reached $100 billion. More important, the role of the CPFF was significant for non-financial firms because the presence of a lender of last resort in the CP market greatly reduced CP investor concerns about downside risk during the financial crisis. Adrian, Kimbrough, and Marchioni (2011) provide aggregate time-series evidence that the CPFF program significantly improved the liquidity of the CP market for both financial and non-financial firms.

A notable feature of the CPFF is the variation in its availability to CP issuers. Since the Federal Reserve acted as the lender of last resort, there was concern that CP issuers might take excessive risk. To mitigate excessive risk taking, the CPFF's SPV purchased only U.S. dollar-denominated CP with an A-1/P-1/F-1 rating from a nationally recognized statistical rating organization (NRSRO). In addition, the maximum amount of CP that could be purchased by the SPV was equal to the highest amount of U.S. dollar-denominated CP outstanding on any day between January 1 and August 31, 2008.

Exploiting these eligibility criteria, we first divide our sample firms in two groups: top-rated CP issuers that had CP outstanding between January 1 and August 31, 2008 (i.e., CPFF-eligible firms) and those that do not satisfy these conditions (i.e., CPFF-ineligible firms). While CP issuers are homogeneous in many observable credit quality characteristics (large asset size, high collateral value, extensive credit market experience, and high earning power), potential credit quality differences could still confound inferences.

We refine the primary test sample by focusing on firms with short-term CP/long-term credit ratings of A-1/A vs. A-2/A-. Note that the sample of firms with short-term CP/long-term ratings of A-1/A were eligible for CPFF but had the lowest long-term credit ratings, while A-2/A- ratings were ineligible but had the highest long-term credit ratings. We further supplement our main test (A-1/A vs. A-2/A-) with two placebo tests that compare firms within CPFF-eligible (firms with short-term CP ratings of A-1+ vs. A-1) and CPFF-ineligible groups (firms with short-term CP/long-term ratings of A-2/A- vs. A-2/BBB and A-2/BBB+) to confirm that our results are not driven by a simple difference in borrower credit qualities.

Around the time the CPFF program was introduced, there were a number of other government policy interventions. We consider them in turn and discuss their likely impact on our

inferences. Some interventions directly targeting financial institutions may have indirectly impacted non-financial firms, including manufacturing CP issuers. These interventions were designed to restore the strength of financial institutions, and encourage them to ease lending to financially constrained (e.g., lower credit quality) non-financial borrowers. Since we examine A-1/A vs. A-2/A- CP issuers after the introduction of CPFF, government interventions in financial institutions that attempted to narrow the lending gap between higher and lower credit quality borrowers, would work against finding any impact of the CPFF program (Bernanke, Gertler, and Gilchrist, 1996). That is, in the presence of additional intervention to financial institutions, findings from our tests could be considered a conservative estimate.[7]

A more serious concern arises when government intervention targets manufacturing CP issuers. Under such a scenario, eligibility criteria are likely to be endogenous with respect to unobserved CP issuer characteristics, and the resulting impact of such interventions on firm outcomes will interfere with evaluation of the CPFF's impact, making it difficult to establish a causal relation between the CPFF and corporate outcomes. There are two government interventions that directly targeted manufacturing firms: the Troubled Asset Relief Program (TARP) and the Cash for Clunkers Program.[8] Of the $700 billion TARP fund, $604.5 billion was disbursed to 926 firms, including two non-financial/non-mortgage/non-insurance firms: General

[7] For example, the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) was designed to restore money market mutual funds (MMMF) including U.S. depository institutions, U.S. bank holdings, or U.S. branches and agencies of foreign banks, which are major investors in the commercial paper market. Adrian, Kimbrough, and Marchioni (2011, p. 29) show that the collapse of MMMF disproportionately impacted A-2 (CPFF-ineligible) CP issuers, because MMMF are required to invest in safe assets. That is, MMMF investors pulled A-2 rated CP first before withdrawing A-1 rated CP. The revival of the MMMF had a more positive impact on A-2 rated issuers, and narrowed the difference between A-1 and A-2 CP issuers. Since our test looks for diverging trends between A-1 and A-2 rated CP issuers after introduction of the CPFF, any significant impact of the MMMF (i.e., convergence of A-1 and A-2) is likely to work against our findings, making our result actually a conservative estimate.

[8] Some non-financial firms use asset-backed securities (ABS), which received government aid through the Term Asset-Backed Securities Loan Facility (TALF). Lemmon, Liu, Mao, and Nini (2013) provide a general discussion of the use of ABS by non-financial firms. In our sample, which excludes all "shadow banks", only three firms report the use of ABS and none of them report using asset-backed commercial paper (ABCP) as of 2008:Q2.

Motors and Chrysler. We exclude these firms from our sample. As Mian and Sufi (2012) point out, the Cash for Clunkers Program lasted for one month from July 24 to August 24, 2009. As we show in our empirical analysis, the impact of the CPFF program took place long before introduction of the Cash for Clunkers program. In the Appendix (Table AI), we further show that our results are similar when we exclude periods after the Cash for Clunkers Program. On balance, it is fair to conclude that focusing on non-financial firms in our sample period minimizes the impact of other government interventions on our study of the CPFF program.

To summarize, interventions that targeted all CP issuers or randomly benefitted only some CP issuers may add noise to our tests, and reduce their precision, but they will not systematically introduce bias.

I.B. Theoretical motivation

Our study is primarily motivated by theories about government intervention in financial markets and public liquidity provision. Prior research suggests that government intervention in the lending market can be beneficial when capital markets are imperfect or contracts are incomplete. Bolton and Rosenthal (2002) show that government-initiated debt relief can be beneficial when contracts are constrained to be state-independent. In this case, majority voting can "certify" economic conditions that merit debt relief. Bolton, Santos, and Scheinkman (2009, 2011) show that banks facing a liquidity shortfall may be compelled to trade their assets prematurely to avoid adverse selection in secondary markets at future dates. Banks that engage in these premature sales give up the opportunity to avoid fire sales entirely when liquidity needs turn out to be temporary. Injections of public liquidity deter the premature sale of assets upon liquidity shock by providing price supports for secondary markets. In the presence of aggregate

uncertainty, the private sector is unable to fully insure liquidity shocks because each firm faces trouble exactly when the others do, and cross-subsidization breaks down. Government intervention can mitigate illiquidity-driven inefficiencies by supplying public liquidity in the financial markets (Holmstrom and Tirole, 1998).

Creation of the CPFF is consistent with these theoretical motivations. Following the bankruptcy of Lehman Brothers, a series of extraordinary policy interventions, including the CPFF, were authorized by the U.S. congress (Mian, Trebbi, and Sufi, 2010). This is consistent with the view of "certification" through majority voting for economic conditions that merit debt relief, as proposed by Bolton and Rosenthal (2002). The collapse of the financial sector in the recent financial crisis fits well with the theory in which pure aggregate uncertainty causes cross-subsidization to break down. As Holmstrom and Tirole (1998, 2011) suggest, a central bank can efficiently coordinate the allocation of excess liquidity in the economy and avoid systemic financial meltdown. This crisis provides a natural context in which to assess the impact of the public liquidity provision on corporate liquidity.[9] Bebchuk and Goldstein (2011) show how provision of government capital or guarantees can encourage privately managed lending. Consistent with their prediction, the CPFF had spillover effects to clients of CP issuers, firms that were not the focus of the policy, through the use of trade credit within business networks. Thus the provision of public liquidity allowed financial markets to maintain their level of lending for creditworthy borrowers during the crisis.[10]

[9] An incomplete list of studies on corporate liquidity (cash and lines of credit) includes Boot, Thakor, and Udell (1987); Fazzari, Hubbard, and Petersen (1988); Blanchard, Lopez-de-Silanez, and Shleifer (1994); Kaplan and Zingales (1997); Martin and Santomero (1997); Kim, Mauer, and Sherman (1998); Opler, Pinkowitz, Stulz, and Williamson (1999); Kashyap, Rajan, and Stein (2002); Almeida, Campello, and Weisbach (2004); Faulkender and Wang (2006); DeMarzo and Fishman (2007); Dittmar and Mahrt-Smith (2007); Harford, Mansi, and Maxwell (2007); Sufi (2009); and Yun (2009).

[10] In contrast, credit card limits were reduced in the consumer credit market after the crisis in the absence of a similar liquidity injection (Andriotis, 2008).

I.C. Relation to the empirical literature

There is a literature on the provision of public liquidity. Sundaresan and Wang (2009) show that the provision of public liquidity in the form of millennium date change (Y2K) options mitigated the liquidity concerns of bond dealers related to Y2K issues (i.e., disruption in the banking system because transaction dates in 2000 might be interpreted by computers to be in 1900). Christensen, Lopez, and Rudebusch (2009) show how central banks' announcements of liquidity facilities led to a lower liquidity premium in term interbank rates. Duygan-Bump et al (2012) evaluate the impact of the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) on flows of money market funds and yields on asset-backed commercial paper.

Our study complements this work by providing firm-level evidence on how the public supply of liquidity affected individual firms' financing and other operational decisions. From an identification point of view, the cross-sectional variation in the public supply of liquidity (i.e., CPFF availability only to current top-tier rated CP issuers) allows us to compare the impact of the CPFF in *ex ante* similar firms with different access to public liquidity.

There is also a growing literature on empirical examination of the financial crisis. Afonso, Kovner, and Schoar (2011) examine the impact of counterparty risk in interbank lending following the Lehman Brothers bankruptcy. Chari, Christiano, and Kehoe (2008) and Ivashina and Scharfstein (2010) show changes in aggregate lending activities by banks during the recent financial crisis. Bebchuk and Goldstein (2011) discuss how government intervention can mitigate self-fulfilling market freezes. Duchin, Ozbas, and Sensoy (2010) and Almeida, Campello, Laranjeira, and Weisbenner (2012) examine the impact of pre-crisis liquidity

positions on post-crisis corporate outcome. Campello, Giambona, Graham, and Harvey (2010) show how firms managed liquidity during the crisis.

Campello, Graham, and Harvey (2010) provide a survey of chief financial officers on companies' ability to access external funds. Wermers (2012) provides high-frequency estimates of the run on money market mutual funds during the Lehman crisis. Kacperczyk and Schnabl (2010) and Covitz, Liang, and Suarez (2013) report contraction in the asset-backed commercial paper market during the recent financial crisis. Kacperczyk and Schnabl (2010) and Adrian, Kimbrough, and Marchioni (2011) consider the impact of the CPFF on money market funds and aggregate market conditions, respectively, while we focus on firm-level evidence on the impact of the CPFF on non-financial firms.

A number of authors investigate prior financial crises. Lemmon and Roberts (2010) examine leverage and the investment decisions of junk bond issuers after the collapse of Drexel Burnham Lambert. Chava and Purnanandam (2011) relate banking relationships to valuations during the financial crisis of 1998. Giannetti and Simonov (2013) study Japan’s bank bailout in the 1990s and its real consequences. These works focus on the impact of a financial crisis on various aspects of firms’ short-term lending and their real effects. We focus rather on the impact of government response to the crisis on firms’ business decisions and subsequent real effects.

Finally, our work contributes to the literature on trade credit, short-term borrowing, and liquidity. Kashyap, Stein, and Wilcox (1993) show that firms switch from bank loans to commercial paper following shifts toward tighter monetary policy. Gatev and Strahan (2006), Adrian, Colla, and Shin (2012), and Becker and Ivashina (2011) show similar switches between bank loans and public bonds. Petersen and Rajan (1997) show that trade credit supplements

capital markets in that financially constrained firms often receive trade credit from their suppliers.

We focus particularly on end-users of short-term credits, to show that the heterogeneous availability of public liquidity led to divergent financing decisions and different real effects among firms. This finding is related to Gertler and Gilchrist (1994), who find that the financial propagation mechanism is asymmetric because of differential access to alternative sources of funds. Kahl, Shivdasani, and Wang (2008) suggest that commercial paper provides financial flexibility and substitutes for cash holdings. Our work complements this by showing how commercial paper issuers respond to a financial crisis and subsequent government rescue efforts in terms of debt borrowings (including commercial paper) and cash holdings.

II. Sample, Data, and Summary Statistics

II.A. Sample construction

The primary data comprise firm-level commercial paper outstanding for manufacturing firms (SIC codes 2000–3999) in the United States at quarterly frequency from the first quarter of 2008 through the fourth quarter of 2009, collected from the Capital IQ database and SEC 10-K/10-Q filings.[11] Commercial paper is a corporate-issued promissory note with maturity of up to 270 days. Corporations use commercial paper as a lower-cost alternative to bank loans to raise cash needed for current transactions. We focus on manufacturing firms because these firms represent a high proportion of non-financial CP issuers and exhibit less seasonality, which can obscure

[11] Data are also available for an extended period from 2007:Q1 through 2010:Q4. The extended sample has 1,649 firm-quarter observations for 110 U.S. CP issuers excluding shadow banks (3,239 firm-quarter observations for 213 domestic and international CP issuers including shadow banks; 2,011 firm-quarter observation for 133 U.S. CP issuers including shadow banks). To focus on the CPFF, we present results from 2008:Q1 to 2009:Q4. Analysis using the extended period gives similar results.

comparison of quarter-to-quarter changes in business activities. Information on unused lines of credit is collected from Capital IQ and SEC 10-K/10-Q filings.

This panel of data on commercial paper is then matched with Compustat quarterly files to obtain borrowers' financial characteristics. For an observation to be included in our sample, we require figures on total assets (ATQ) and total debt (DLCQ+DLTTQ) to be positive and non-missing. To ensure that our findings are not driven by pseudo-financing activities, we exclude firms associated with shadow banks, which we determine using various data sources, including the Mergent database and news articles from Factiva.[12] The resulting final sample includes 788 firm-quarter observations for 104 firms during the 2008:Q1–2009:Q4 period.

We also consider clients (customers and suppliers) of the CPFF-eligible CP issuers. Information on clients is obtained from Capital IQ.[13] Financial information (except number of employees) for clients is from the Compustat quarterly files. Information on the annual number of employees is obtained from Compustat annual files. We exclude firms associated with shadow banking, regulated or financial firms, and CP issuers. To focus mainly on non-CP issuers that are financially constrained, we consider only highly levered firms whose debt/assets as of 2008:Q2 is above the median. The resulting sample includes 4,959 firm–quarter observations from 2007:Q1 through 2010:Q4 for 345 firms.

II.B. Variable Description

The variables we consider are financing, profitability, operations, and market responses of commercial paper issuers and their clients around the introduction of the CPFF.

[12] Bodnaruk, O'Brien, and Simonov (2012) document financial service activities by some U.S. industrial firms through their captive finance subsidiaries.

[13] Capital IQ constructs each firm's customers and suppliers from various sources, including SEC 10-K/10-Q/8-K filings, company announcements, and news articles. SFAS 14 and SFAS 131 guidelines require public firms to disclose customers that account for at least 10% of sales.

For capital structure, we use debt-to-assets, CP-to-assets, and short-term debt-to-total debt ratios. We also consider interest expenses to total debt and liquidity demand. *Debt/assets* is short-term debt (DLCQ) and long-term debt (DLTTQ) divided by non-cash assets (ATQ-CHEQ). *CP/assets* is commercial paper outstanding divided by non-cash assets. *ST debt/debt* is short-term debt (DLCQ) divided by total debt (DLCQ+DLTTQ). *Interest/debt* is interest expenses (XINTQ) divided by total debt.

Following Sufi (2009) and Yun (2009), we measure liquidity demand using the sum of cash and unused lines of credit: *(Cash+LC)/assets* is the sum of cash (CHEQ) and unused lines of credit divided by non-cash assets. We also consider individual components of liquidity: *Cash/assets* and *LC/assets*, which are cash (CHEQ) divided by non-cash assets, and unused lines of credit divided by non-cash assets, respectively.

For profitability, we use operating income-to-assets, and net income-to-assets ratios. *OI/assets* is operating income before depreciation (OIBDPQ) divided by non-cash assets. *NI/assets* is net income (NIQ) divided by non-cash assets.

We also consider the major components of income statements. *COGS/assets* (COGSQ) is cost of goods sold divided by non-cash assets. *SG&A/assets* is selling, general, and administrative expenses (XSGAQ) divided by non-cash assets. *Depreciation/assets* is total depreciation and amortization (DPQ) divided by non-cash assets. *Interest/assets* is interest expense (XINTQ) divided by non-cash assets. *Tax/assets* (TXTQ) is total income tax divided by non-cash assets.

To measure earnings management, we consider discretionary accruals. *Accruals/assets* is discretionary accruals divided by non-cash assets; discretionary accruals are computed following Hribar and Collins (2002) as the sum of accounts receivable (RECCH), inventory (INVCH),

accounts payable and accrued liabilities (APALCH), accrued income taxes (TXACH), other assets and liabilities (AOLOCH), and depreciation and depletion (DEPC), all divided by non-cash assets.

For firm operations, we consider revenue, net trade credit, receivables, accounts payable, and inventory. *Revenue/assets* is total revenue (REVTQ) divided by non-cash assets. *NetTC/assets* is receivables net of account payables (RECTQ-APQ) divided by non-cash assets. *Receivables/assets* is receivables (RECTQ) divided by non-cash assets. *Accounts payable/assets* is accounts payable (APQ) divided by non-cash assets. *Inventory/assets* is total inventory (INVTQ) divided by non-cash assets.

To measure the market expectation on earnings, we consider analysts' quarterly earnings per share forecasts from the Thomson Reuters I/B/E/S database. *EPS/price* is analysts' forecasts of earnings per share divided by stock price last available in June 2008. A useful feature of analysts' forecasts is that are for different quarterly horizons (i.e., one-quarter, …, four-quarters ahead), which allows us to infer market expectations of a policy intervention's impact on earnings at various future horizons.

We measure market expectations on risk on several dimensions. First, to gauge a firm's market risk, we consider the CAPM *Beta*, the sensitivity of stock return to market return; and *Sigma*, the volatility of stock return.

Second, we are particularly interested in tail risk, infrequent but large price movements. Building on the literature of model-free implied volatility estimation based on option prices (Britten-Jones and Neuberger, 2000; Carr and Wu, 2009; and Du and Kapadia, 2012), we derive two forward-looking *tail risk* measures: total tail risk, and left-tail risk. The total tail risk measure considers the market price of insuring against extreme upside and downside price

movements, while left-tail risk measure considers the market price of insuring against extreme downside stock price movement.

Third, to illustrate the economy wide default risk around the financial crisis, we consider the asset value-weighted *expected default frequency* (EDF) of non-financial firms, obtained directly from Moody's KMV. Building on the insights of the Black-Scholes-Merton contingent claim framework, Moody's KMV develops the concept of EDF (see Crosbie and Bohn, 2003; Bharath and Shumway, 2008).[14] Compared to the traditional low-frequency measures of default risk, such as credit rating, leverage, and Z-score, EDF is a market-based, timely, and forward-looking predictor of corporate default. As an alternative, we also consider the six-month *credit default swap (CDS) spreads* provided by Markit as a model-free estimate of firm-level default risk.

For clients of CPFF eligible CP issuers, we examine borrowings through *NetTC/assets, Receivables/assets, AP/assets, EDF, (Cash+LC)/assets, LC/assets, Cash/assets, CapEx/assets, Acq./assets, Employees*, and *Dividends/assets*. *NetTC/assets* is net trade credit (RECTQ-APQ) divided by non-cash assets. *Receivables/assets* is receivables (RECTQ) divided by non-cash assets. *Accounts payable/assets* is accounts payable (APQ) divided by non-cash assets. (*Cash+LC)/assets* is the sum of cash and short-term investments (CHEQ) and unused lines of credit divided by non-cash assets. *LC/assets* is unused lines of credit divided by total assets. *Cash/assets* is cash and short-term investments (CHEQ) divided by total assets. *CapEx/assets* is capital expenditure (CAPXY – one period lag of CAPXY). *Acquisition/assets* is acquisition (AQCY – one period lag of AQCY). *Employees* is the annual number of employees. *Dividends/assets* is total dividends divided by total assets.

[14] Correia, Richardson, and Tuna (2012) compare different predictors of default, and find that the EDF provided by Moody's KMV outperforms other default predictors.

To account for the heterogeneity of borrowers' financial characteristics, we control for firm size, *Net debt/assets* (non-CP book leverage), and market-to-book ratio. Firm size is measured by the natural logarithm of total assets (ATQ). *Net debt/assets*, non-CP book leverage, is measured by book debt (DLTTQ + DLCQ) minus CP outstanding divided by non-cash assets. Market-to-book ratio (*M-B ratio*) is the book value of assets plus the market value of common equity minus the book value of common equity and deferred taxes divided by total assets. Market value of equity is the price (at close) times the number of common shares outstanding.

In Figure 2, we compare cross-sectional average EDF (Figure 2a) and CDS spreads (Figure 2b) associated with firms from different CP rating categories, and examine how the market perceives credit risk associated with each category over the period of January 2008 through July 2009. Several observations are notable. First, the differences in average EDF and CDS spreads among CP issuers (i.e., all A-1 and A-2 rated firms) are very small prior to 2008:Q3 (i.e., before the collapse of Lehman Brothers). This observation confirms the view that as a population all CP rated firms are top-quality firms with very low default risk (Calomiris, Himmelberg, and Wachtel, 1995). Second, the EDF and CDS spreads between CPFF-eligible and ineligible firms diverge right after 2008:Q4 when the CPFF was created. Then, the divergence almost completely disappears around the CPFF program's initial termination date, April 2009. Third, throughout the sample period, A-3 and non-CP rated firms have much higher credit risk than CP issuers, measured by EDF and CDS spreads.

II.C. Summary statistics

Table I shows variable means, standard deviations, and medians. In Panel A, we show the firm-level financial characteristics of all commercial paper issuers from 2008:Q1 through

2009:Q4 (first four columns), and top-rated (A-1 and A-1+) CP issuers from 2008:Q1 through 2009:Q4 (last four columns).

The mean (median) of total assets of all CP issuers is $22.3 billion ($10.3 billion); it is $31.4 billion ($12.9 billion) for top-rated CP issuers, which suggests that top-rated CP issuers are larger firms. The top-rated CP issuer sample has similar capital structure to the full CP issuer sample. That is, the means of debt-to-assets (0.29 vs. 0.27), short-term-debt-to-total-debt ratios (0.18 vs. 0.19), and interest expenses (0.013 vs. 0.011) of the top-rated CP issuers are very similar to those of all CP issuers. Yet the mean of liquidity demand (cash and unused lines of credit divided by non-cash assets) for top-rated CP issuers is higher (0.16) than that of the complete CP issuer sample (0.13). Profitability measures of the top-rated CP issuer sample are similar to those of the full CP issuer sample except for net income, which is slightly higher for the top-rated CP issuer sample (2.9% vs. 2.0%). All major components of the income statement are similar in the top-rated and the full CP issuer samples. Net trade credit (receivables minus accounts payable), and inventories are similar in the top-rated and the full CP issuer samples.

In Panel B, we show pre-crisis (2008:Q1–Q2) summary statistics for top-rated (A-1 and A-1+) CP issuers with CP outstanding prior to the crisis (during 2008:Q1 to 2008:Q2), as well as difference in means for several subsamples that we use in difference-in-differences tests in the later sections. In the first subsample, we compare A-1 rated CP issuers with long-term ratings of A (CPFF-eligible), and A-2 rated CP issuers with long-term ratings of A- (CPFF-ineligible). The most noticeable observation is that CP issuers with long-term ratings of A- pay slightly higher interests than those with long-term ratings of A. The interest-to-debt ratio difference between A and A- firms is 0.34%. CP issuers with long-term ratings of A- have slightly higher CAPM betas, 6-month CDS spreads, and EDFs than those with long-term ratings of A, but the difference is

small and statistically insignificant. In the second subsample, we compare CP issuers with short-term CP ratings of A-1+ vs. A-1 (both are CPFF-eligible). In the third subsample, we compare CP issuers with short-term CP/long-term ratings of A-2/A- vs. A-2/BBB and A-2/BBB+ (both are CPFF-ineligible). Overall, as expected, higher rated firms have lower risks, measured by CAPM betas, return volatility, tail risks, CDS spreads, and EDFs in the second and third subsamples. However, the difference is small, especially in the third subsample.

Panel C shows summary statistics for the clients of CPFF-eligible CP issuers. The mean (median) of net trade credit per non-cash assets is -0.14 (0.07), which suggests that there are more accounts payable (receivables) than receivables (accounts payable). The mean (median) EDF of clients of CPFF-eligible firms is 4.64 (0.87), which is much higher than that of the CPFF-eligible firms themselves.

III. Direct Impact of CPFF on Eligible Firms

In this section, we examine the direct impact of the provision of public liquidity through the introduction of a liquidity backstop (the Commercial Paper Funding Facility program) on CPFF-eligible firms. We first lay out our empirical identification strategy and empirical models in detail, and then discuss the estimation results.

III.A. Empirical specification

One of the main challenges of establishing a causal link between the CPFF and its real effects is the endogenous nature of unobserved firm characteristics and performance. To account for this endogeneity, we exploit the heterogeneous access to the CPFF for commercial paper issuers. While all CP issuers had similar credit risk profiles prior to the policy intervention, the Fed

allowed only A-1 rated CP issuers with CP outstanding between January and August of 2008 to access the CPFF. These eligibility criteria were driven mainly by concerns about *financial* CP issuers, and hence can be viewed as exogenous to non-financial CP issuers.[15]

One possibility is to compare firms with CP outstanding from January through August of 2008 that differ in their CP rating, such as A-1 vs. A-2. During a financial crisis, firms with low default risks and good investment opportunities may benefit disproportionately from a flight-to-quality in access to financing (Bernanke, Gertler, and Gilchrist, 1996). In this case, it is difficult to distinguish the incremental impact of public liquidity provision (to high credit quality/A-1 rated firms) from that of other channels, including flight-to-quality.

To overcome these challenges, we take advantage of the differences in S&P long-term ratings *within* A-1 and A-2 short-term CP ratings as of August 2008. S&P designates firms with long-term ratings of AAA to AA- as A-1+ in their short-term CP ratings. Meanwhile, firms with long-term ratings of A+ and A are assigned an A-1 short-term CP rating, and firms with long-term ratings of A- to BBB are given an A-2 short-term CP rating.

Using the S&P long-term ratings of CP issuers with CP outstanding between 2008:Q1 and 2008:Q2, we make three sets of comparisons of the real effects, as illustrated by Figure 3:

(i) *Boundary difference-in-differences test (Boundary DD test)*: We compare A-1 rated CP issuers with the lowest long-term ratings (i.e., a sample of firms with S&P long-term ratings of A as of August 2008) and A-2 rated CP issuers with the highest long-term rating (i.e., a sample of firms with S&P long-term ratings of A- as of August 2008).

[15] One of the reasons for limiting access to the CPFF to the top-rated CP issuers with active CP usage before the Lehman crisis was to limit the credit risk exposure of financial CP issuers (Adrian, Kimbrough, and Marchioni, 2011). The non-top-tier-rated financial CP issuers, Countrywide Financial Corporation and Washington Mutual Inc., would have imposed huge credit risk, had the CPFF been accessible to them. Non-financial CP issuers were included in the CPFF program because the Fed was concerned about a "contagion effect" from financial CP to non-financial issuers, had the Fed excluded non-financial CP. We are grateful to Tobias Adrian for helpful discussions on the CPFF program's policy considerations.

(ii) *Placebo test I*: We compare CP issuers with short-term CP ratings of A-1+ vs. A-1. All these issuers have access to the CPFF.

(iii) *Placebo test II*: We compare CP issuers with short-term CP/long-term ratings of A-2/A- vs. A-2/BBB and A-2/BBB+. None of these issuers have access to the CPFF.

While the first comparison (*Boundary DD*) may be confounded by the impact of the CPFF's introduction or the flight-to-quality effect, the remaining two tests (*Placebo test I and Placebo test II*) are designed to capture only a potential flight-to-quality effect, because there are no differences in the two groups' accessibility to the CPFF.

After Lehman's bankruptcy, if a flight-to-quality did indeed occur among CP issuers, investors would prefer A to A- (*Boundary DD*), A-1+ to A-1 (*Placebo I*), and A- to BBB and BBB+ (*Placebo II*), and we would observe a significant impact on real effects in all three tests. If there are no detectable changes from *Placebo test I and Placebo test II*, and only the *Boundary DD tests* reveal significant changes, then we can infer that the CPFF had a significant impact. This is because there is no flight-to-quality between A-1+ and A-1 (*Placebo I*), and A- and BBB/BBB+ (*Placebo II*), and it is unlikely to be present only between A and A- (*Boundary DD*). Basically, these placebo tests allow us to establish a benchmark case to evaluate the impact of a possible flight-to-quality on corporate decisions and outcomes.

For the *Boundary DD test*, to test the differential impact of the CPFF on CP issuers, we use a standard difference-in-differences specification:

$$y_{it} = \alpha_i + \gamma_t + \beta_1 \times Post_{it} \times CPFF_i + \beta_2 \times Post_{it} + \beta_3 \times CPFF_i + \delta \times X_{it} + \varepsilon_{it.} \quad (1)$$

The key dependent variables include risk, uncertainty, financing, investment, and other important corporate outcomes. $CPFF_i$ is an indicator variable that is one if a firm is CPFF eligible and zero otherwise. Specifically, a CP issuer is eligible for the CPFF only if it is A-1 rated as of August

2008 and has CP outstanding between January and August of 2008.[16] $Post_{it}$ is an indicator variable that is one if an observation is taken from the post-CPFF (2008:Q4) period and zero otherwise. Note that A rated firms are CPFF-eligible ($CPFF_i = 1$), and A- rated firms are CPFF-ineligible ($CPFF_i = 0$). We control (X_{it}) for firm size (log of total assets), net debt-to-total assets ratio, and market-to-book ratio. We also include firm fixed-effects (α_i) and time fixed-effects (γ_t). ε_{it} is the error term. Standard errors are clustered at the firm level.

The key variable of interest is the parameter of the interaction between $CPFF_i$ and $Post_{it}$ (β_1), which captures the difference-in-differences effect of the CPFF program between eligible and ineligible A-1 rated CP issuers after the introduction of this program.

Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), following Wooldridge (2002, Equation 10.73), Equation (1) is estimated using a first-difference specification:

$$\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}. \quad (2)$$

The first difference of fixed effects (α_i) and $CPFF_i$ is zero, and that of $Post_{it}$ is absorbed in time fixed effects. Interpretation of β_1 in Equation (2) is identical to that of Equation (1): the change in difference between CPFF-eligible and ineligible firms before and after the introduction of the CPFF. That is, β_1 captures the net impact of CPFF program on CPFF-eligible firms compared to ineligible firms.

In *Placebo test I*, the CPFF indicator in regression (2) is replaced by an A-1+ rating indicator, which is one if a firm is A-1+ rated as of August 2008 and zero otherwise. The interaction term ($Post_{it} \times A\text{-}1+$) measures the changes in the gap between A-1+ and A-1 rated firms after introduction of the CPFF. Similarly, in *Placebo test II*, the CPFF indicator in regression (2) is

[16] To avoid endogeneity concerns, the CPFF indicator is kept constant based on pre-crisis (August 2008) values.

replaced by an A rating indicator, which is one if a firm is A rated as of August 2008 and zero otherwise. The interaction term ($Post_{it} \times A_i$) measures the changes in the gap between A and A- rated firms after introduction of the CPFF.

III.B. Market responses: Risk and uncertainty

We use a large number of risk and uncertainty measures to investigate how the market responds around introduction of the CPFF, particularly whether the market responds differently for CPFF-eligible and CPFF-ineligible commercial paper issuers. Since only CPFF-eligible firms had guarantees on their CP borrowings, we expect these firms to have less market risk, and lower return volatilities, tail risk, and default risk than CPFF-ineligible CP issuers.

Because the CPFF program was most relevant for firms that rely on CP, we focus on firms that showed a high CP demand in 2008 prior to the crisis and drop firms in the bottom quintile of the CP/asset ratio as of 2008:Q2.[17] In addition, although time fixed-effects, and controls are included in all regressions, we report only parameter estimates of the interaction variables (i.e., Post × CPFF, Post × A-1+ indicator, Post × A indicator), which measure the changes in difference between the two comparison groups after introduction of the CPFF, to focus on the impact of the CPFF on these financing activities.

Table II shows changes in the market responses to risk and uncertainty around introduction of the CPFF. As shown by the boundary difference-in-difference tests in Panel A, the decline in risk is mostly concentrated near the CPFF eligibility boundary. Column I shows that exposure to market risk (CAPM *Beta*) of A rated CPFF-eligible firms dropped 30.72% relative to A- rated CPFF-ineligible firms after introduction of the CPFF. Similarly, Column II shows that return

[17] Excluding the bottom quintile of CP/debt (as of 2008:Q2) leads to an evenly distributed reduction of firms.

uncertainty measured by the volatility of daily stock return (*Sigma*) of A rated firms dropped by 0.69% relative to A- rated firms after introduction of the CPFF.

Columns III and IV focus on changes in tail risk derived from option prices. Column III shows that total tail risk, the market price for insuring against extreme upward or downward deviation of stock returns, substantially declined for A rated CPFF-eligible firms compared to A-rated CPFF-ineligible firms after introduction of the CPFF (difference-in-differences effect is -0.0074 – about 370% of the pre-crisis sample mean). Column VI reveals that the drop is driven mainly by the reduction of left-tail downside risk (difference-in-differences effect is -0.013 – about 333% of the pre-crisis sample mean).

We measure default risk using expected default frequency (Column V) and credit default swap spreads (Columns VI and VII). Both measures show that the default risk of CPFF-eligible firms substantially declined compared to that of CPFF-ineligible firms after introduction of the CPFF. For example, the difference-in-differences estimate of the six-month CDS spread over 2008:Q1–2009:Q4 is -1.0447 (about 616% of the pre-crisis sample mean).[18] Moreover, as shown in Column VII, the reduction in the CDS spread is clustered near the introduction of the CPFF; the difference-in-differences effect of the CDS spread during 2008:Q3–2009:Q1 is -1.247 (about 736% of the pre-crisis sample mean).[19]

Panels B and C present results of the placebo tests to compare issuers within CPFF-eligible (A-1+ vs. A-1) and ineligible (A- vs. BBB and BBB+) groups. For these comparisons, the

[18] Again, while these changes are large they are not driven by outliers. CDS spreads increased dramatically during the crisis period, especially after the collapse of Lehman Brothers. During the pre-crisis period, average 6-month CDS spreads in our sample were 0.1695 (mean) and 0.1427 (median). During the crisis period, average CDS spreads in our sample were 1.0317 (mean) and 0.9013 (median) between 2008:Q3-2009:Q2, and 0.4774 (mean) and 0.3700 (median) between 2008:Q3-2009:Q4.

[19] Another notable real consequence of the CPFF not reported in Table II is changes in the differences of long-term ratings among CP issuers. The probability of downgrades of S&P long-term ratings from the pre-crisis (2008:Q2) to the post-crisis (2009:Q4) period is significantly lower for A rated (CPFF-eligible) firms than A- (CPFF-ineligible) firms.

availability of the CPFF is the same and only credit quality differs between the two groups. Hence, any significant changes after introduction of the CPFF can be attributed to differences in credit quality between the treatment sample (A-1+ in Panel B or A- in Panel C) and the control sample (A-1 in Panel B, or BBB and BBB+ in Panel C), and may possibly be caused by a flight-to-quality. If flight-to-quality is not significant among CP issuers, however, we would expect to find insignificant difference-in-differences estimates in these placebo tests. Consistent with this latter possibility, the difference-in-differences estimates in Panels B and C are mostly insignificant, and there are not many significant changes after introduction of the CPFF for these comparisons. Hence, the findings from Panel A are most plausibly driven by introduction of the Commercial Paper Funding Facility program.

The results in Table II suggest that the CPFF produced a consistent and sizable reduction in the overall risk profiles of CPFF-eligible firms across different segments of the financial markets.

III.C. Financing

The main objective of the CPFF program was to stabilize short-term financing after Lehman's collapse. We examine its impact on the financing activities of CP issuers over the 2008:Q1–2009:Q4 period.

Table III shows the impact of the CPFF on firms' financing activities. In Panel A, we examine changes near the CPFF eligibility cutoff, where we would expect the CPFF effect to be the strongest, by comparing A rated CPFF-eligible and A- rated CPFF-ineligible CP issuers with CP outstanding during 2008:Q1–Q2. We do not find noticeable changes in the differences between A rated and A- rated CP issuers in terms of their use of debt (Column I), measured by

debt-to-assets ratio. We do find that A rated CPFF-eligible CP issuers increased their use of CP more than A- rated CPFF-ineligible CP issuers (Column II). The difference-in-differences estimate of CP-to-assets ratio is 2.96% which corresponds to 58% of the pre-crisis sample mean of CPFF-eligible firms.

In Column III, the maturities of CPFF-eligible firms shifted toward short-term debt compared to CPFF-ineligible CP issuer maturities; the difference-in-differences estimate of short-term debt-to-total debt is 3.72%, statistically insignificant. In Column IV, we find a significant reduction in interest expenses for A rated CPFF-eligible firms relative to A- rated CPFF-ineligible firms after introduction of the CPFF; the difference-in-differences estimate of *Interest/debt* is -0.0029, which is 26% of the pre-crisis sample mean of CPFF-eligible firms.[20]

Results in Columns I to IV thus suggest that the main impact of the CPFF program is a reduction in financing costs (Column IV) for eligible CP issuers, rather than quantity rationing (Column I). This is consistent with a study by Adrian, Colla, and Shin (2012), who find that the recent financial crisis affected firms more through higher risk premiums than through credit rationing.[21] In other words, we show that the CPFF mainly benefited firms by ameliorating an increase in risk premiums.

In Columns V–VII, we show the impact of the CPFF on liquidity demand, measured by cash and unused lines of credit divided by non-cash assets (Column V), cash divided by non-cash assets (Column VI), and unused lines of credit divided by non-cash assets (Column VII). The difference-in-differences estimate is negative for the sum of cash and lines of credit but

[20] Based on pre-crisis sample mean of CPFF eligible firms, this amounts to $16 million of quarterly interest payments (total assets of $23,678 times debt-to-assets ratio of 0.2328 times interest-to-debt of 0.0029) or 2% of quarterly net income (debt-to-assets of 0.2328 times interest-to-debt of 0.0029 divided by net income of 0.0322).

[21] Results in Column IV are also consistent with findings by Adrian, Kimbrough, and Marchioni (2011). Using aggregate data, they report a significant divergence in average CP rates between CPFF-eligible and ineligible CP issuers after introduction of the CPFF.

statistically insignificant. This suggests that total liquidity demand slightly dropped for CPFF-eligible firms compared to CPFF-ineligible firms after introduction of the CPFF. In Columns VI and VII, we take a closer look at each component of total liquidity demand. The difference-in-differences estimate is significantly negative for cash divided/non-cash assets, with an estimate of -3.34% (34% of the pre-crisis sample mean for CPFF-eligible firms). Differences in unused lines of credit divided by non-cash assets between CPFF-eligible and ineligible firms remains unchanged.

Results from Columns V–VII show generally that introduction of the CPFF led to a composition change in liquidity demand; that is, CPFF-eligible firms substituted cash for more unused lines of credit more than CPFF-ineligible firms. These results highlight that the provision of public liquidity mitigated the impact of aggregate financial sector shocks on firms that relied on lines of credit and were thus vulnerable to the aggregate shocks.[22]

In sharp contrast, Panels B (comparing A-1+ vs. A-1) and C (comparing A- vs. BBB and BBB+) find that most of the difference-in-differences estimates are small and insignificant. On balance, it is fair to conclude that we do not find strong evidence that a flight-to-quality drives the improvement in financing of CPFF-eligible firms after introduction of CPFF. Instead, the CPFF mainly affected CP issuers by allowing increased reliance on CP, reducing the cost of debt financing, while leaving debt borrowing amounts and maturities unchanged.

III.D. Profitability

We now examine how introduction of the CPFF affected CP issuers' profitability from 2008:Q1 through 2009:Q4.

[22] While both cash and lines of credit can insure against liquidity shocks, lines of credit may be vulnerable to aggregate financial sector shocks (Acharya, Almeida, and Campello, 2013).

Table IV shows changes in profitability and major components of income statements after introduction of the CPFF. As in Table III, we compare three different groups, shown in Panels A–C. The first three columns show the profitability of commercial paper issuers around introduction of the CPFF. We expect the profits of CPFF-eligible firms to increase over those of CPFF-ineligible firms after the funding facility became available. That is, we expect the parameter estimate of the interaction (difference-in-differences) variable to be positive.

Panel A (comparing A vs. A-) shows that CPFF-eligible firms became more profitable in terms of operating income divided by non-cash assets (Column I), and net income divided by non-cash assets (Column II). Notably, the increase in net income (of CPFF-eligible firms over ineligible firms) is higher than the increase in operating income; the increase in *NI/assets* of A rated (CPFF-eligible) firms is 1.84% relative to A- rated (CPFF-ineligible) firms, while the increase in *OI/assets* is 1.23%.

The two placebo tests that compare firms with higher and lower ratings within CPFF-eligible (Panel B) and CPFF-ineligible (Panel C) groups show by contrast no significant changes in profitability. This suggests that the significant changes we see in Panel A are not likely to be driven by differences in credit rating or other mechanisms such as flight-to-quality, and are mostly due to introduction of the CPFF.

To uncover the sources of the divergence in profitability in more detail, we decompose the profits of CP issuers into several major components of income statements: the cost of goods sold divided by non-cash assets (Column III), selling, general, and administrative expenses divided by non-cash assets (Column IV), depreciation and amortization divided by non-cash assets (Column V), interest expenses divided by non-cash assets (Column VI), and income tax divided by non-cash assets (Column VII). Revenue minus COGS, SG&A, and depreciation and amortization

gives an approximate estimate of operating income. Operating income minus interest expenses and income taxes gives an approximate estimate of net income.

As we expect, Column VI in Panel A shows a significant reduction in interest payments, which contributes to the greater increase in net income beyond the moderate increase in operating income. The difference-in-differences estimate of *interest/assets* between A rated CPFF-eligible and A- rated CPFF-ineligible firms is -0.07%, which is 23% of the pre-crisis sample mean of CPFF eligible firms.

Also in Panel A, the difference-in-differences changes in the cost of goods sold per non-cash assets (Column III) and tax per non-cash assets (Column VII) between CPFF-eligible and ineligible CP issuers is large but statistically insignificant. For example, the difference-in-differences estimate of *COGS/non-cash assets* between A and A- rated firms is 2.29%. It turns out that this reflects an increase in sales activity for CPFF-eligible firms (more on this later).

In contrast to the significant changes between A rated CPFF-eligible and A- rated CPFF-ineligible firms shown in Panel A, changes in profitability within CPFF-eligible (Panel B) or ineligible (Panel C) CP issuers are insignificant or economically small.

Looking at Tables III and IV together, we see that the CPFF affected firms mainly by lowering the cost of debt financing (*Interest/assets*), a reduction that produced a moderate increase in profitability around introduction of the CPFF.

One possible cause for the diverging profitability between CPFF-eligible and ineligible firms after introduction of the CPFF is the difference in aggressiveness of accounting management between CPFF-eligible and ineligible firms. Authors have shown that discretionary accruals measure potential accounting manipulation (Teoh, Welch, and Wong, 1998a, 1998b, among others). The last column of Table IV shows changes in discretionary accruals, estimated using

the method developed in Hribar and Collins (2002), after introduction of the CPFF. Here we do not find any significant changes in the difference of discretionary accruals between CPFF-eligible and ineligible firms.

Accounting errors and irregularities get resolved over time through accounting restatements. As an additional robustness check, we obtain all restatements of accounting items reported during our sample period from the Audit Analytics database and match them with the sample of firms used in this paper. As of July 2013, only one firm subsequently issued an "immaterial" accounting restatement for the fiscal years 2009 and 2010, and it was not directly related to valuation of financial assets.[23] In addition, we rerun all regressions excluding this observation, and our results remain the same.

Changes in the differences of profitability between A rated CPFF-eligible and A- rated CPFF-ineligible firms after introduction of the CPFF are attributable mainly to the stabilization of financing and consequent reduction in cost of debt financing through the CPFF.

III.E. Market expectation: quarterly earnings forecasts and firm value

So far we have shown that the Commercial Paper Funding Facility significantly reduced the costs of debt financing and increased short-term profitability, while had only a modest effect on long-term investments and dividend payouts. Another question relates to firm values and how the market responded to introduction of the CPFF. Because the CPFF was established primarily to mitigate disruption in short-term financing rather than to introduce shifts in long-term real activities, it is difficult to examine stock prices themselves, or the sum of all discounted future

[23] Specifically, the only company that issued restatement as of July 2013 is ITT Corp (Ticker: ITT; CIK: 0000216228) from placebo test II (A- vs. BBB and BBB+). In its 10-K statement dated to 02/29/2012 (see note 23), ITT's management attributed this restatement to "*income taxes, cumulative translation adjustments, and other adjustments*," and concluded the restatement was immaterial.

cash flows. We can examine the impact of the CPFF on expected future cash flows at various horizons by studying analysts' quarterly earnings forecasts.

The first four columns in Panel A of Table V show changes in the differences in analyst first- through fourth-quarter earnings per share forecasts normalized by share price (*EPS/price*). Column V shows the changes in the difference in market-to-book ratios between A rated CPFF-eligible and A- rated CPFF-ineligible firms around the introduction of the program during the sample period 2008:Q1–2009:Q4.

The most notable finding is that the short-term analyst *EPS/price* forecasts of A rated CPFF-eligible CP issuers increase more than those of A- rated CPFF-ineligible CP issuers after the CPFF was introduced. The differences in forecasts over longer horizons are declining and statistically insignificant. Specifically, one-quarter ahead *EPS/price* forecasts for CPFF-eligible firms are 1.13% higher than those of ineligible firms after the CPFF was introduced. This corresponds to 53.5% of the pre-crisis sample mean of CPFF eligible firms. The point estimates the impact of the CPFF on *EPS/price* forecasts are 0.62% for two-quarter, 0.43% for three-quarter, 0.21% for four-quarter forecasts. The CPFF has little impact on market-to-book ratios, which account for all future discounted cash flows.

Columns VI–X shows that a stronger the positive effect of CPFF for a one-quarter forecast when a shorter time period just around introduction of the CPFF. The impact of the CPFF on longer-horizon earnings forecasts or market-to-book ratios, however, is much weaker.

None of the placebo test results comparing CP issuers within CPFF eligible (Panel B) and ineligible (Panel C) groups is insignificant. This again suggests that the observed difference in short horizon earnings forecasts is driven mainly by introduction of the CPFF rather than by differences in credit quality.

Table V shows overall that the differences in the cost of financing and the profitability of CPFF-eligible and ineligible firms led to an increase in short-horizon expected earnings for A rated CPFF-eligible firms. Because the profitability increase is temporary, however, the market does not perceive significant differences in earnings over longer horizon, and puts insignificant weight on the values of CPFF-eligible and ineligible firms.

III.F. Sales activities and inventories

We have shown so far how firm financing and profitability was impacted by introduction of the CPFF. Table VI examines whether the CPFF had any impact on real activities. In Column I, we consider the trade credit of commercial paper issuers. Comparison of CPFF-eligible and ineligible firms shows a significant increase in revenue. For example, Panel A shows that the *Revenue/assets* of A rated CPFF-eligible firms increased 3.71% relative to A- rated CPFF-ineligible firms after the CPFF was introduced. This corresponds to 12% of the pre-crisis sample mean of CPFF-eligible firms.

In the next two tests, we do not find any significant change in revenue within CPFF-eligible (*Placebo test I* in Panel B) or ineligible (*Placebo test II* in Panel C) groups. This suggests that the significant change in revenue between A and A- rated firms is again driven mainly by the difference in access to the CPFF rather than by differences in credit quality.

In Columns II–IV, we examine changes in trade credit after introduction of the CPFF. Column I of Panel A shows that net trade credit (receivables minus account payables, divided by non-cash assets) of A rated CPFF-eligible firms increased 5.71% over that of A- rated CPFF-ineligible firms after the CPFF was introduced. This corresponds to 23% of the pre-crisis mean

of CPFF-eligible firms. That is, CPFF-eligible firms extended more trade credit to other firms (e.g., customers and suppliers) than CPFF-ineligible firms after introduction of the CPFF.

Columns III and IV show changes in each component of net trade credit, which shows that the large increase in differences in net trade credit between A rated CPFF-eligible and A- rated ineligible firms are driven more by receivables (Column III) than by accounts payable (Column IV). *Receivables/noncash* assets of A rated CPFF-eligible CP issuers increased 3.14% relative to A- rated CPFF-ineligible, while changes in accounts payable between these CP issuers are statistically insignificant after the CPFF was introduced.

In Panels B and C, we do not find any significant change or evidence consistent with what would be expected from flight-to-quality in trade credit activities within CPFF-eligible (*Placebo test I* in Panel B) or ineligible (*Placebo test II* in Panel C) groups. Hence, once again the significant change in net trade credit and receivables between A and A- rated firms is driven mainly by the difference in access to the CPFF rather than by differences in credit quality. On possible motivation for CPFF-eligible firms to extend trade credit to their customers is to increase revenue as reported in Column I. That is, in times of tight credit, CPFF-eligible firms can increase sales by allowing financially constrained customers to buy goods on credit.

In Column V, we consider changes in the difference in inventories among commercial paper issuers around introduction of the CPFF. As Panel A shows, we find a significant reduction in inventories for A rated CPFF-eligible firms compared to A- rated CPFF-ineligible firms after introduction of the CPFF; the difference-in-differences estimate of *Inventory/assets* is -0.0076, which is 5.3% of the pre-crisis sample mean of CPFF-eligible firms. This is consistent with earlier results that CPFF-eligible firms extend trade credit to boost their sales, which in turn led

to less accumulation of inventories during the financial crisis (when overall business activities and consumer spending slowed down).

Overall, the findings shown in Table VI suggest that the CPFF had a very strong revenue impact. It is also noteworthy that trade credit increased significantly after the CPFF was introduced.

IV. Public Liquidity Redistribution Through Trade Credit

The increase we have seen in trade credit activities may have had significant impacts on the business partners of the commercial paper issuers. Researchers recognize that trade credit is a key funding source for daily operation. It plays a particularly important role for a firm that faces difficulties in borrowing from traditional financial institutions (Petersen and Rajan, 1997; Fisman and Love, 2003). In a study of the 1997 Asian financial crisis, Love, Preve, and Sarria-Allende (2007) show that trade credit serves as a form of short-term emergency credit, and substitutes for traditional financing. During the crisis triggered by the collapse of Lehman Brothers, the financial sector was substantially weakened, which led in turn to increased difficulty in raising funds for non-financial firms (Ivashina and Scharfstein, 2010).

Faced with a weakened financial sector and substantial uncertainty about firm-level credit risk during a crisis, one of the Fed's policy objectives is to decentralize credit risk management. Essentially, a public liquidity provider delegates credit risk decisions to firms that are better informed about the credit conditions of their business partners, their suppliers and customers.[24]

IV.A. Empirical design and model specification

[24] We are grateful to Zhenyu Wang for discussion on this issue.

To test whether the Commercial Paper Funding Facility is able to redistribute public liquidity from direct beneficiaries to their business partners via trade credit, we collect information on 345 business partners of CPFF-eligible firms (4,959 observations, excluding regulated and financial firms), and test whether trade credit increased after introduction of the CPFF, especially for customer firms of CPFF-eligible CP issuers during the recent financial crisis. To increase the power of our tests, we focus on financially constrained clients by keeping only highly levered non-commercial paper issuers with debt-to-assets ratios above the sample median as of 2008:Q2. Our final sample of A rated CPFF-eligible firms had 188 business partners (2,423 observations).

We adopt a difference-in-differences specification with first-difference estimation similar to regression model (2), except now the CPFF indicator is replaced by an indicator for crisis-period customers (CrisisCustomer_i) that takes a value of one if a firm was a customer during the crisis period, and zero otherwise.[25] The key variable of interest is the parameter of the interaction between $CrisisCustomer_i$ and $Post_{it}$ (β_1), which captures the difference-in-differences effect of the CPFF program between crisis-period, and former customers of CPFF-eligible CP issuers after introduction of the program.

One caveat about these tests. There is no good reason to believe that crisis-period customers and former clients are *ex ante* identical. Therefore, unlike the evidence presented in Tables II–VI, inference from these difference-in-difference tests are not necessarily causal and is exploratory in nature.

IV.B. Estimation results

[25] From Capital IQ, we collect information on the suppliers and customers of CPFF-eligible firms during 1999–2012 using source date, which is the last time a relationship is reported. Among those, we classify firms reported to be customers during 2008–2011 as crisis-period customers.

Table VII compares changes in differences between *customers during the crisis period* of the CPFF-eligible firms and their *former clients* around introduction of the CPFF. To allow ample passage of time for building or terminating a customer-supplier relationship, we report results for both a short horizon around the CPFF from 2008 through 2009 (Panel A) and a long horizon from 2007 through 2010 (Panel B).

Column I in Panel A examines net trade credit issuance (receivables minus accounts payable, scaled by non-cash assets). A positive net trade credit issuance indicates trade credit extended; a negative value indicates trade credit borrowed. We expect that firms facing increased difficulty in borrowing funds from traditional financial intermediaries during the crisis were more likely to rely on trade credit (i.e., register negative net trade credit issuance), particularly when the CPFF allowed CPFF-eligible firms to redistribute public liquidity in the form of trade credit to their customers. The difference-in-differences estimate on net trade credit is significantly negative (minus24.88%). This means an increase in the difference in net trade credit *received* between CPFF-eligible firms' customers during the crisis period and former clients after introduction of the CPFF.

Columns II (receivables-to-non-cash assets ratio) and III (accounts payable-to-non-cash assets ratio) show components of net trade credit. We find that the significant change in net trade credit is driven mainly by changes in accounts payable (i.e., trade credit received); differences in accounts payable between crisis-period customers and former clients increased substantially, while differences in receivables remained unchanged.

Given these difference-in-differences estimates on trade credit, we present a simple back of the envelope calculation of the economic magnitude of public liquidity redistribution. That is, we

ask how much trade credit an A rated CPFF-eligible firm extends to its clients for every dollar of public liquidity created by the CPFF program. What is the CPFF net trade credit multiplier?

The average asset size of clients of CPFF-eligible firms in the sample is $3.532 billion, and the point estimate of the CPFF impact on clients' net trade credit to non-cash asset is -0.2488. Thus the difference-in-differences estimate of the dollar value of total net trade credit received by clients is $0.2488 \times 3.532 \times 188 = \$165.2$ billion. Meanwhile, Figure 1 shows that the average monthly outstanding CPFF available to all non-financial firms is $94.16B, or $282.5B per quarter. Therefore, for every dollar of liquidity created under the CPFF program, A rated CPFF-eligible firms created *additional* net trade credit to their clients in the amount of 165.2/282.5 = $0.56, or CPFF-net trade credit multiplier is 0.56.

According to the Fed's objective of decentralized credit risk management, we expect CPFF-eligible firms to sort out the credit quality of their clients and to extend trade credit accordingly. In such a case, we expect default risk to be low because only the appropriate amount of credit is extended to clients. To test this idea, Column IV examines changes in expected default frequency around introduction of the CPFF. We find strong evidence that the difference in EDF between crisis-period customers and former clients became negative (-2.73%) after introduction of the CPFF.

In Columns V–VII, we consider the impact of the CPFF on clients' liquidity demand. Since crisis-period customers of CPFF-eligible firms received more trade credit than non-crisis-period customers after introduction of the CPFF, we expect crisis-period customers to have less of a demand for liquidity. Column VI in Panel A shows that the difference-in-differences estimate of total liquidity (sum of cash and unused lines of credit, divided by non-cash assets) is -18.56% (31.5% of the sample mean) during the 2008–2009 period. The reduction in total liquidity

demand is driven mainly by a reduction in cash holdings while unused lines of credit remained stable. In fact, Column VII in Panel A shows that the difference-in-differences estimate of cash/non-cash assets is -20.13%, while Column VI shows that the estimate on unused lines of credit/non-cash assets is low and statistically insignificant.

In Columns VIII–X, we examine changes in customers' real activities, including capital expenditures, acquisitions, and employment, around introduction of the CPFF. We find strong evidence that the difference in investments between crisis-period and former clients increased after introduction of the CPFF. The difference-in-differences estimate of capital expenditures divided by non-cash assets is 0.74% (47% of the sample mean; Column VIII) and that of acquisition amount divided by total assets is 1.25%, which is twice the sample mean (Column IX). We also find that difference in employment (measured by the natural logarithm of the number of employees) between crisis-period and former clients increased after introduction of the CPFF (Column X).[26] Column IX indicates no significant changes in payout policy (dividends divided by non-cash assets) between crisis-period and former clients after introduction of the CPFF.

Overall, the findings in Table VII suggest spillover of the injection of public liquidity via the CPFF to clients of CPFF-eligible firms. Moreover, the default risk of crisis-period clients, who are screened by CPFF-eligible CP issuers when receiving trade credit, dropped substantially compared to former clients (who were not screened). The spillover significantly impacted financing and real activities such as liquidity demand and investments.

[26] For employment data, observations with calendar date (*datadate* in Compustat annual file) before September 30, 2008, are considered pre-CPFF.

V. Conclusions

Motivated by a large body of theory on the provision of public liquidity, we provide the first piece of firm-level empirical evidence about the impact of the Commercial Paper Funding Facility program on risk, corporate borrowing, profitability, and the real effects on non-financial firms. In a difference-in-differences framework, we show that the CPFF lowered CPFF-eligible firms' overall risk profiles, and impacted their short-term financing by shifting toward commercial paper borrowing and reducing the cost of debt financing. This, in turn, led to an increase in profitability and revenue in the short run. We also provide suggestive evidence that the benefits to CPFF-eligible firms spilled over to other firms in the manufacturing sector through the extension of trade credit to their customers, who subsequently experienced reduction in liquidity demand and an increase in investment activities.

The evidence shows the importance of the provision of liquidity by the public sector as the lender of last resort. When we focus on relative changes in the business activities of commercial paper issuers with similar financial characteristics but tease out different access to government support in the form of liquidity backstops, we are able to tease out the impact of such programs for firms. The overall welfare implications of the CPFF program may require examination beyond the manufacturing sector, and we leave this for the future.

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Table I. Summary Statistics

This table shows summary statistics for the 2008–2009 sample. Panel A shows summary statistics for all CP issuers in the manufacturing industry (SIC 2000–3999) during the sample period (2008:Q1-2009:Q4); Panel B shows summary statistics for top-rated (A-1/A-1+) CP issuers in the manufacturing industry (SIC 2000–3999) during the pre-CPFF period (2008:Q1–Q2) as well as means and difference in means for boundary DD, placebo I, and placebo II samples; Panel C shows summary statistics for clients of CPFF-eligible CP issuers. In Panel C, only non-CP issuers with debt/assets above median as of 2008:Q2 are included in order to focus on financially constrained clients. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. Information on the clients of CPFF-eligible CP issuers is obtained from Capital IQ. All CP issuer samples include CP issuers with A-1+, A-1, A-2, and A-3 ratings. *Total assets* is total assets (ATQ). *M-B ratio* (market-to-book ratio) is the book value of assets plus the market value of common equity minus the book value of common equity and deferred taxes divided by total assets. Market value of equity is the price (at close) times the number of common shares outstanding. *Debt/assets* is short-term (DLCQ) and long-term debt (DLTTQ) divided by noncash assets (ATQ-CHEQ). *Net debt/assets* is short-term (DLCQ) and long-term debt (DLTTQ) minus CP outstanding all divided by non-cash assets. *CP/assets* is commercial paper outstanding divided by non-cash assets. *ST debt/debt* is short-term debt (DLCQ) divided by total debt (DLCQ+DLTTQ). *Interest/debt* is interest expenses (XINTQ) divided by total debt. *(Cash+LC)/assets* is the sum of cash (CHEQ) and unused lines of credit divided by non-cash assets. *Cash/assets* is cash (CHEQ) divided by non-cash assets. *LC/assets* is unused lines of credit divided by non-cash assets. *Revenue/assets* is total revenue (REVTQ) divided by non-cash assets. *OI/assets* is operating income before depreciation (OIBDPQ) divided by non-cash assets. *NI/assets* is net income (NIQ) divided by non-cash assets. *COGS/assets* (COGSQ) is cost of goods sold divided by non-cash assets. *SG&A/assets* is selling, general, and administrative expenses (XSGAQ) divided by non-cash assets. *Depreciation/assets* is total depreciation and amortization (DPQ) divided by non-cash assets. *Interest/assets* is interest expenses (XINTQ) divided by non-cash assets. *Tax/assets* (TXTQ) is total income tax divided by non-cash assets. *Accruals/assets* is discretionary accruals divided by non-cash assets; discretionary accruals are computed following Hribar and Collins (2002) as the sum of accounts receivable (RECCH), inventory (INVCH), accounts payable and accrued liabilities (APALCH), accrued income taxes (TXACH), other assets and liabilities (AOLOCH), and depreciation and depletion (DEPC), all divided by non-cash assets. *NetTC/assets* is net trade credit (RECTQ-APQ) divided by non-cash assets. *Receivables/assets* is total receivables (RECTQ) divided by non-cash assets. *Accounts payable/assets* is total accounts payable (APQ) divided by non-cash assets. *Inventory/assets* is total inventory (INVTQ) divided by non-cash assets. *EPS/price* is analysts' long-term forecasts of earnings per share (EPS) divided by stock price. *Beta* is the sensitivity of stock return to market return, *Sigma* is the volatility of stock return. *Tail risk* (total, and left-tail) is option risk implied by option prices (for both tails, and left-tail). *CDS spread (6-month)* is the six-month credit default swap spread. EDF (*Expected default frequency)* is the probability that a company will default within a given time horizon, typically one year. *CapEx/assets* is capital expenditures (CAPXY-one period lag of CAPXY) divided by non-cash assets. *Acquisition/assets* is acquisition (AQCY – one period lag of AQCY). *Employees* is annual number of employees. *Dividends/assets* is total dividends divided by non-cash assets. All financial information except CP outstanding, unused lines of credit, number of employees, EPS, and EDF is obtained from the Compustat quarterly database. Information on commercial paper outstanding and unused lines of credit is obtained from SEC 10-K/10-Q filings and Capital IQ. Information on EPS is obtained from Thomson Reuters I/B/E/S. Information on EDF is obtained from Moody's KMV. Employee data are obtained from the Compustat annual file. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Full CP issuer sample.

Sample	***All CP issuers (2008:Q1-2009:Q4)***				***A-1/A-1+ CP issuers (2008:Q1-2009:Q4)***			
	Obs.	***Mean***	***Std.Dev.***	***Median***	***Obs.***	***Mean***	***Std.Dev.***	***Median***
Total assets	788	22329	37572	10342	408	31426	48819	12948
M-B ratio	772	2.0889	0.9417	1.8523	407	2.4396	0.9702	2.3905
Debt/assets	778	0.2868	0.1353	0.2883	404	0.2723	0.1293	0.2736
Net debt/assets	778	0.2746	0.1368	0.2754	404	0.2572	0.1297	0.2675
CP/assets	788	0.0198	0.0390	0.0000	408	0.0226	0.0379	0.0000
ST debt/debt	764	0.1791	0.1811	0.1341	396	0.1868	0.1709	0.1530
Interest/debt	747	0.0128	0.0043	0.0128	387	0.0111	0.0040	0.0111
(Cash+LC)/assets	788	0.1301	0.1128	0.0933	408	0.1584	0.1166	0.1258
Cash/assets	788	0.1060	0.1280	0.0632	408	0.1316	0.1247	0.0880
LC/assets	788	0.0430	0.0700	0.0000	408	0.0511	0.0731	0.0000
Revenue/assets	788	0.2616	0.0935	0.2521	408	0.2719	0.1021	0.2531
OI/assets	748	0.0470	0.0241	0.0437	392	0.0568	0.0237	0.0541
NI/assets	788	0.0201	0.0426	0.0205	408	0.0286	0.0307	0.0271
COGS/assets	786	0.1538	0.0884	0.1449	407	0.1447	0.0996	0.1340
SG&A/assets	772	0.0628	0.0455	0.0551	406	0.0714	0.0517	0.0649
Depreciation/assets	748	0.0108	0.0049	0.0098	392	0.0116	0.0050	0.0107
Interest/assets	767	0.0037	0.0020	0.0035	395	0.0031	0.0017	0.0031
Tax/assets	788	0.0082	0.0119	0.0080	408	0.0115	0.0104	0.0101
Accruals/assets	780	-0.0014	0.0959	0.0003	402	0.0012	0.0723	0.0004
NetTC/assets	788	0.2227	0.0889	0.2167	408	0.2260	0.0853	0.2165
Receivables/assets	788	0.1450	0.0579	0.1412	408	0.1489	0.0541	0.1416
Accounts payable/assets	788	0.0778	0.0452	0.0716	408	0.0771	0.0490	0.0695
Inventory/assets	785	0.1260	0.0719	0.1123	406	0.1301	0.0727	0.1186
EPS/price	2316	0.0173	0.0147	0.0168	1221	0.0178	0.0079	0.0167
Beta	2415	0.8928	0.4353	0.8504	1278	0.7913	0.3127	0.7881
Sigma	2415	0.0260	0.0143	0.0222	1278	0.0233	0.0105	0.0206
Option risk (total)	1795	0.0066	0.0079	0.0033	1002	0.0061	0.0076	0.0029
Option risk (left-tail)	1925	0.0122	0.0146	0.0066	1039	0.0108	0.0128	0.0058
CDS spread (six-month)	1693	0.8096	1.7111	0.3229	879	0.3401	0.2819	0.2487
EDF	2316	0.5747	2.5865	0.0700	1221	0.0916	0.1198	0.0500

Panel B. Pre-CPFF Top-rated (A-1/A-1+) CP issuer sample.

	A-1+/A-1 active			***Boundary DD: A vs. A-***				***Placebo I: A-1+ vs. A-1***				***Placebo II: A- vs. BBB and BBB+***			
	Mean	***Std.Dev.***	***Median***	***A***	***A-***	***Diff.***	***t-stats***	***A-1+***	***A-1***	***Diff.***	***t-stats***	***A-***	***BBB+/BBB***	***Diff.***	***t-stats***
Total assets	23678	41467	10759	19072	19599	-527	-0.02	36946	18371	18574	1.06	19599	11274	8325	1.19
M-B ratio	2.5944	1.1558	2.5602	2.2134	1.5294	0.6840	1.50	3.3545	2.2903	1.0642	2.38 **	1.5294	1.8924	-0.3630	-1.05
Debt/assets	0.2590	0.0888	0.2624	0.2842	0.2544	0.0298	0.69	0.2383	0.2673	-0.0290	-0.77	0.2544	0.3364	-0.0820	-0.86
Net debt/assets	0.2328	0.0851	0.2561	0.2537	0.2237	0.0301	0.72	0.2180	0.2387	-0.0207	-0.57	0.2237	0.2971	-0.0734	-0.72
CP/assets	0.0511	0.0392	0.0474	0.0608	0.0547	0.0060	0.36	0.0401	0.0555	-0.0154	-1.15	0.0547	0.0814	-0.0267	-0.73
ST debt/debt	0.2406	0.1655	0.2099	0.2535	0.2120	0.0415	0.44	0.2454	0.2387	0.0067	0.10	0.2120	0.2238	-0.0118	-0.11
Interest/debt	0.0111	0.0026	0.0112	0.0119	0.0153	-0.0034	-3.29 ***	0.0094	0.0123	-0.0029	-2.49 **	0.0153	0.0147	0.0006	0.47
(Cash+LC)/assets	0.1383	0.1101	0.0922	0.1298	0.0591	0.0707	1.23	0.1201	0.1456	-0.0255	-0.59	0.0591	0.1182	-0.0591	-1.09
Cash/assets	0.0985	0.0935	0.0648	0.0706	0.0319	0.0387	1.40	0.1358	0.0836	0.0522	1.37	0.0319	0.0496	-0.0178	-1.39
LC/assets	0.0542	0.0813	0.0000	0.0654	0.0269	0.0386	0.93	0.0099	0.0720	-0.0621	-2.17 **	0.0269	0.0685	-0.0416	-0.84
Revenue/assets	0.3046	0.1179	0.2771	0.3192	0.2774	0.0418	0.77	0.2350	0.3324	-0.0974	-2.10 **	0.2774	0.2558	0.0215	0.60
OI/assets	0.0575	0.0216	0.0548	0.0509	0.0381	0.0128	1.44	0.0770	0.0531	0.0239	2.72 **	0.0381	0.0446	-0.0064	-0.61
NI/assets	0.0322	0.0174	0.0309	0.0273	0.0164	0.0109	1.52	0.0406	0.0289	0.0118	1.83 *	0.0164	0.0134	0.0030	0.21
COGS/assets	0.1739	0.1176	0.1488	0.1923	0.1868	0.0055	0.10	0.1293	0.2027	-0.0734	-1.39	0.1868	0.1700	0.0168	0.54
SG&A/assets	0.0772	0.0644	0.0667	0.0759	0.0524	0.0235	0.58	0.0789	0.0766	0.0023	0.08	0.0524	0.0435	0.0090	0.66
Depreciation/assets	0.0103	0.0032	0.0097	0.0109	0.0116	-0.0007	-0.30	0.0118	0.0105	0.0013	0.77	0.0116	0.0087	0.0029	1.02
Interest/assets	0.0030	0.0013	0.0029	0.0034	0.0039	-0.0004	-0.66	0.0022	0.0037	-0.0015	-2.05 *	0.0039	0.0053	-0.0014	-1.01
Tax/assets	0.0136	0.0084	0.0135	0.0115	0.0068	0.0047	1.60	0.0174	0.0121	0.0053	1.62	0.0068	0.0080	-0.0012	-0.37
Accruals/assets	0.0346	0.0622	0.0093	0.0528	0.0203	0.0326	0.84	0.0077	0.0453	-0.0377	-1.47	0.0203	0.0334	-0.0131	-0.38
NetTC/assets	0.2542	0.0993	0.2489	0.2665	0.3254	-0.0588	-1.11	0.2049	0.2739	-0.0691	-1.71 *	0.3254	0.2438	0.0816	1.53
Receivables/assets	0.1703	0.0657	0.1616	0.1771	0.2115	-0.0343	-0.98	0.1420	0.1815	-0.0395	-1.46	0.2115	0.1517	0.0598	1.78 *
Accounts payable/assets	0.0839	0.0466	0.0767	0.0894	0.1139	-0.0245	-0.96	0.0628	0.0924	-0.0296	-1.55	0.1139	0.0921	0.0218	0.90
Inventory/assets	0.1423	0.0753	0.1277	0.1556	0.1424	0.0133	0.31	0.1018	0.1586	-0.0567	-1.87 *	0.1424	0.1226	0.0198	0.63
EPS/price	0.0157	0.0053	0.0152	0.0163	0.0187	-0.0024	-0.83	0.0144	0.0163	-0.0019	-1.01	0.0187	0.0169	0.0017	0.64
Beta	0.8539	0.2895	0.8626	0.9188	1.0506	-0.1318	-1.27	0.6076	0.9508	-0.3432	-3.81 ***	1.0506	0.9068	0.1438	0.88
Sigma	0.0242	0.0094	0.0222	0.0256	0.0255	0.0001	0.06	0.0192	0.0262	-0.0070	-3.23 ***	0.0255	0.0255	-0.0001	-0.01
Option risk (total)	0.0020	0.0015	0.0016	0.0031	0.0027	0.0009	0.75	0.0012	0.0031	-0.0025	-2.90 ***	0.0027	0.0036	-0.0015	-0.95
Option risk (left-tail)	0.0039	0.0029	0.0032	0.0047	0.0046	0.0010	0.56	0.0022	0.0049	-0.0037	-2.60 **	0.0046	0.0055	-0.0022	-0.86
CDS spread (six-month)	0.1695	0.0968	0.1427	0.4506	0.5582	-0.1077	-0.43	0.2783	0.4106	-0.1324	-0.79	0.5582	0.4341	0.1242	0.72
EDF	0.0367	0.0351	0.0200	0.0467	0.0592	-0.0125	-0.73	0.0127	0.0461	-0.0334	-2.62 **	0.0592	0.0663	-0.0072	-0.31

Panel C. Clients of CPFF eligible CP-issuers sample.

Sample	*Sample period: 2008-2009*				*Sample period: 2007-2010*			
	Obs.	*Mean*	*Std.Dev.*	*Median*	*Obs.*	*Mean*	*Std.Dev.*	*Median*
Total assets	2511	3532	13280	500	4959	3595	13560	493
NetTC/assets	2502	-0.1358	4.0301	0.0690	4940	-0.1053	4.0849	0.0703
Receivables/assets	2502	0.1973	0.1466	0.1710	4940	0.2008	0.1468	0.1752
Accounts payable/assets	2509	0.3325	4.0346	0.0801	4955	0.3060	4.0798	0.0834
EDF	2286	4.6400	8.5811	0.8733	4530	3.6448	7.6467	0.5967
(Cash+LC)/assets	2509	0.5886	1.5663	0.1332	4955	0.6730	1.8160	0.1596
LC/assets	2509	0.0088	0.0374	0.0000	4955	0.0166	0.0541	0.0000
Cash/assets	2509	0.5799	1.5680	0.1171	4955	0.6564	1.8191	0.1239
CapEx/assets	2457	0.0159	0.0261	0.0083	4854	0.0174	0.0301	0.0088
Acquisition/assets	2397	0.0060	0.0413	0.0000	4724	0.0077	0.0473	0.0000
Employees	413	26.6270	154.7075	1.9560	835	26.2372	150.8895	1.9520
Dividends/assets	2451	0.0146	0.3613	0.0000	4842	0.0157	0.4981	0.0000

Table II. Impact of the CPFF: Risk and Uncertainty

This table shows changes in the market response of firm values around the introduction of the CPFF, from 2008 through 2009 (except Column (VIII) which is from 2008:Q3 through 2009:Q1). Panel A considers A (lowest long-term rating among A-1 rated firms) and A- rated (highest long-term rating among A-2 rated firms) CP issuers. Panel B considers A-1 and A-1+ rated CP issuers. Panel C considers BBB, BBB+, and A- (A-2 rated) CP issuers. All firms considered have CP outstanding during 2008:Q1-Q2. To focus on firms with high CP demand, we exclude the bottom quintile of *CP/asset* firms. Observations are measured at monthly frequency. This table uses a difference-in-differences specification, $y_{it} = \alpha_i + \gamma_t + \beta_1 \times Post_{it} \times CPFF_i + \beta_2 \times Post_{it} + \beta_3 \times CPFF_i + \delta \times X_{it} + \varepsilon_{it}$. The key variable of interest is the interaction term ($Post_{it} \times CPFF_i$ for Panel A, $Post_{it} \times "A-1+" - rated_i$ for Panel B, and $Post_{it} \times A - rated_i$ for Panel C), which measures the changes in the difference between CPFF-eligible and ineligible CP issuers after introduction of the CPFF. The dependent variables (y_{it}) are *Beta*, *Sigma*, *Option risk* (total, and left-tail), *EDF*, and *CDS spreads*, all as defined in Table I. $Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CPFF_i$ is an indicator variable that is one if a firm is CPFF-eligible. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. We control (X_{it}) for *firm size* (log of total assets), *Net debt/assets*, and *M-B ratio*. α_i is firm fixed effects, γ_t is time fixed effects, and ε_{it} is an error term. Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), the difference-in-differences equation, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm fixed effects (α_i) and $CPFF_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown in the table. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Dependent variables	*Beta*	*Sigma*	*Option risk (total)*	*Option risk (left-tail)*	*EDF*	*CDS spread (2008-2009)*	*CDS spread (2008:Q2-2009:Q1)*
	(I)	*(II)*	*(III)*	*(IV)*	*(V)*	*(VI)*	*(VII)*
Panel A. Boundary DD: A-1 and A-2 boundary (A vs. A-)							
*Post*CPFF-eligible*	-0.3072 **	-0.0069 *	-0.0074 **	-0.013 **	-0.2702 **	-1.0447 *	-1.3693 **
	[0.1103]	[0.0038]	[0.0021]	[0.0046]	[0.1047]	[0.5771]	[0.6078]
Observations	381	381	261	304	405	215	115
R-squared	0.844	0.914	0.830	0.812	0.652	0.713	0.769
Panel B. Placebo test I: Within CPFF-eligible CP issuers (A-1 vs. A-1+)							
*Post*A-1+ rated*	-0.0411	0.0029 ***	-0.0027	-0.0051 *	-0.0931 ***	0.1276 *	0.0618
	[0.0631]	[0.0010]	[0.0016]	[0.0026]	[0.0211]	[0.0619]	[0.1336]
Observations	510	510	403	439	534	314	169
R-squared	0.861	0.916	0.754	0.789	0.782	0.717	0.808
Panel C. Placebo test II: Within CPFF-ineligible A-2 rated CP issuers (A- vs. BBB and BBB+)							
*Post*A- rated*	0.0563	0.0011	0.0055 *	0.0073	-0.3764	0.2073	0.2674
	[0.0979]	[0.0033]	[0.0027]	[0.0057]	[0.3487]	[0.6781]	[0.9720]
Observations	357	357	283	314	357	253	130
R-squared	0.888	0.891	0.779	0.763	0.598	0.626	0.64

Table III. Impact of the CPFF: Financing

This table shows changes in financing activities around the introduction of the CPFF, from 2008:Q1 through 2009:Q4. Panel A considers A (lowest long-term rating among A-1 rated firms) and A- rated (highest long-term rating among A-2 rated firms) CP issuers. Panel B considers A-1 and A-1+ rated CP issuers. Panel C considers BBB, BBB+, and A- (A-2 rated) CP issuers. All firms considered have CP outstanding during 2008:Q1-Q2. To focus on firms with high CP demand, we exclude the bottom quintile of *CP/asset* firms. Observations are measured at quarterly frequency. This table uses a difference-in-differences specification as defined in Table II. The dependent variables (y_{it}) are *Debt/assets* (Column I), *CP/debt* (Column II), *ST debt/assets* (Column III), *Interest/debt* (Column IV), *(Cash+LC)/assets* (Column V), *Cash/assets* (Column VI), and *LC/assets* (Column VII), all as defined in Table I. $Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CPFF_i$ is an indicator variable that is one if a firm is CPFF-eligible. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. We control (X_{it}) for *firm size*, *Net debt/assets*, and *M-B ratio*. Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), the difference-in-differences equation, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm fixed effects (α_i) and $CPFF_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown in the table. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Dependent variables	*Debt/assets*	*CP/assets*	*ST debt/assets*	*Interest/debt*	*(Cash+LC)/assets*	*Cash/assets*	*LC/assets*
	(I)	*(II)*	*(III)*	*(IV)*	*(V)*	*(VI)*	*(VII)*
Panel A. Boundary DD: A-1 and A-2 boundary (A vs. A-)							
*Post*CPFF-eligible*	0.0075	0.0296 *	0.0372	-0.0029 **	-0.0216	-0.0334 **	0.0066
	[0.0163]	[0.0150]	[0.0604]	[0.0013]	[0.0184]	[0.0154]	[0.0196]
Observations	118	118	118	115	118	118	118
R-squared	0.409	0.162	0.108	0.270	0.297	0.548	0.164
Panel B. Placebo test I: Within CPFF-eligible CP issuers (A-1 vs. A-1+)							
*Post*A-1+ rated*	-0.0159	-0.0075	0.0047	0.0004	0.0243	-0.0172	0.0299
	[0.0170]	[0.0114]	[0.0428]	[0.0008]	[0.0359]	[0.0102]	[0.0381]
Observations	155	155	155	152	155	155	155
R-squared	0.355	0.172	0.128	0.142	0.254	0.670	0.086
Panel C. Placebo test II: Within CPFF-ineligible A-2 rated CP issuers (A- vs. BBB and BBB+)							
*Post*A- rated*	-0.0136	-0.0163	0.0001	0.0006	0.0456	0.0305 **	0.0174
	[0.0154]	[0.0161]	[0.0747]	[0.0013]	[0.0353]	[0.0117]	[0.0357]
Observations	104	104	104	100	104	104	104
R-squared	0.337	0.077	0.101	0.483	0.156	0.267	0.170

Table IV. Impact of the CPFF: Profitability

This table shows changes in profitability around the introduction of the CPFF, from 2008:Q1 through 2009:Q4. Panel A considers A (lowest long-term rating among A-1 rated firms) and A- rated (highest long-term rating among A-2 rated firms) CP issuers. Panel B considers A-1 and A-1+ rated CP issuers. Panel C considers BBB, BBB+, and A- (A-2 rated) CP issuers. All firms considered have CP outstanding during 2008:Q1-Q2. To focus on firms with high CP demand, we exclude the bottom quintile of *CP/asset* firms. Observations are measured at quarterly frequency. This table uses a difference-in-differences specification as defined in Table II. The dependent variables (y_{it}) are *OI/assets* (Column I), *NI/assets* (Column II), *COGS/assets* (Column III), *SG&A/assets* (Column IV), *Depreciation/assets* (Column V), *Interest/assets* (Column VI), *Tax/assets* (Column VII), and *Accrual/assets* (Column VIII), all as defined in Table I. $Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CPFF_i$ is an indicator variable that is one if a firm is CPFF-eligible. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. We control (X_{it}) for *firm size*, *Net debt/assets*, and *M-B ratio*. Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), the difference-in-differences equation, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm fixed effects (α_i) and $CPFF_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown in the table. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Dependent variables	*OI/assets* (I)	*NI/assets* (II)	*COGS/assets* (III)	*SG&A/assets* (IV)	*Deprec./assets* (V)	*Interest/assets* (VI)	*Tax/assets* (VII)	*Accruals/assets* (VIII)
Panel A. Boundary DD: A-1 and A-2 boundary (A vs. A-)								
*Post*CPFF-eligible*	0.0123 ***	0.0184 *	0.0229	0.0009	-0.0004	-0.0007 **	0.0033	-0.0012
	[0.0039]	[0.0089]	[0.0133]	[0.0024]	[0.0006]	[0.0003]	[0.0021]	[0.0045]
Observations	114	118	118	118	114	115	118	118
R-squared	0.170	0.185	0.233	0.192	0.034	0.477	0.091	0.447
Panel B. Placebo test I: Within CPFF-eligible CP issuers (A-1 vs. A-1+)								
*Post*A-1+ rated*	-0.0067	0.0093	-0.0016	-0.0037	-0.0006	-0.0001	-0.0028	0.0001
	[0.0050]	[0.0121]	[0.0070]	[0.0032]	[0.0008]	[0.0002]	[0.0025]	[0.0025]
Observations	143	155	154	155	143	152	155	155
R-squared	0.157	0.203	0.098	0.143	0.149	0.194	0.102	0.369
Panel C. Placebo test II: Within CPFF-ineligible A-2 rated CP issuers (A- vs. BBB and BBB+)								
*Post*A- rated*	-0.0079 **	0.0057	-0.0289 **	-0.0009	-0.0001	-0.0001	0.0043	0.0053
	[0.0028]	[0.0121]	[0.0117]	[0.0022]	[0.0006]	[0.0003]	[0.0035]	[0.0084]
Observations	102	104	102	104	102	100	104	104
R-squared	0.213	0.394	0.246	0.136	0.296	0.451	0.319	0.365

Table V. Impact of the CPFF: Firm Value (Analyst EPS Forecasts and M-B Ratio)

This table shows changes in market response of firm values around the introduction of the CPFF, from 2008:Q1 through 2009:Q4 (Columns I to V) and from 2008:Q2 through 2009:Q2 (Columns VI to X). Panel A considers A (lowest long-term rating among A-1 rated firms) and A- rated (highest long-term rating among A-2 rated firms) CP issuers. Panel B considers A-1 and A-1+ rated CP issuers. Panel C considers BBB, BBB+, and A- (A-2 rated) CP issuers. All firms considered have CP outstanding during 2008:Q1-Q2. To focus on firms with high CP demand, we exclude the bottom quintile of *CP/asset* firms. Observations are measured at monthly frequency. This table uses a difference-in-differences specification as defined in Table II. The dependent variables (y_{it}) are analysts forecasts of earnings per share divided by price (*EPS/price*) and *M-B ratio*. *EPS/price* is obtained from the IBES and we consider four forecast horizons: 1-quarter, 2-quarters, 3-quarters, and 4-quarters. *M-B ratio* is book value of assets plus market value of common equity minus book value of common equity and deferred taxes divided by total assets. $Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CPFF_i$ is an indicator variable that is one if a firm is CPFF-eligible. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. We control (X_{it}) for *firm size* and *Net debt/assets*. Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), the difference-in-differences equation, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm fixed effects (α_i) and $CPFF_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown in the table. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Sample period	*2008:Q1-2009:Q4*					*2008:Q2-2009:Q1*				
Dependent variables	***1 Quarter (I)***	***2 Quarters (II)***	***3 Quarters (III)***	***4 Quarters (IV)***	***M-B ratio (V)***	***1 Quarter (VI)***	***2 Quarters (VII)***	***3 Quarters (VIII)***	***4 Quarters (IX)***	***M-B ratio (X)***
Panel A. Boundary DD: A-1 and A-2 boundary (A vs. A-)										
*Post*CPFF-eligible*	0.0113 *	0.0062 *	0.0043 *	0.0021	-0.1464	0.0115 **	0.0028	0.0000	-0.0017	-0.0960
	[0.0061]	[0.0035]	[0.0024]	[0.0039]	[0.1066]	[0.0045]	[0.0016]	[0.0033]	[0.0059]	[0.1107]
Observations	381	381	381	381	134	192	192	192	192	68
R-squared	0.504	0.442	0.518	0.521	0.371	0.703	0.616	0.585	0.574	0.186
Panel B. Placebo test I: Within CPFF-eligible CP issuers (A-1 vs. A-1+)										
*Post*A-1+ rated*	0.0017	0.0017	0.0014	0.0018	0.0166	-0.0003	0.0000	-0.0013	-0.0013	0.0045
	[0.0019]	[0.0016]	[0.0017]	[0.0017]	[0.1164]	[0.0021]	[0.0018]	[0.0021]	[0.0013]	[0.1163]
Observations	510	510	510	507	176	258	258	258	255	90
R-squared	0.480	0.471	0.471	0.485	0.372	0.637	0.637	0.552	0.573	0.231
Panel C. Placebo test II: Within CPFF-ineligible A-2 rated CP issuers (A- vs. BBB and BBB+)										
*Post*A- rated*	-0.0055	-0.0019	-0.0006	-0.0005	0.0448	-0.0074	-0.0000	0.0025	0.0034	0.0419
	[0.0056]	[0.0043]	[0.0039]	[0.0038]	[0.0892]	[0.0088]	[0.0057]	[0.0059]	[0.0066]	[0.0862]
Observations	357	357	353	347	118	180	180	177	174	60
R-squared	0.474	0.434	0.483	0.508	0.304	0.475	0.443	0.548	0.652	0.090

Table VI. Impact of the CPFF: Revenue, Trade Credit, and Inventories

This table shows changes in long-term real activities (trade credit, inventory, investments, and payout policy) around the introduction of the CPFF, from 2008:Q1 to 2009:Q4. Panel A considers A (lowest long-term rating among A-1 rated firms) and A- rated (highest long-term rating among A-2 rated firms) CP issuers. Panel B considers A-1 and A-1+ rated CP issuers. Panel C considers BBB, BBB+, and A- (A-2 rated) CP issuers. All firms considered have CP outstanding during 2008:Q1-Q2. To focus on firms with high CP demand, we exclude the bottom quintile of *CP/asset* firms. Observations are measured at quarterly frequency. This table uses a difference-in-differences specification as defined in Table II. The dependent variables (y_{it}) are *Revenue/assets* (Column I), *NetTC/assets* (Column II), *Receivables/assets* (Column III), *AP/assets* (Column IV), *Inventory/assets* (Column V), all as defined in Table I. $Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CPFF_i$ is an indicator variable that is one if a firm is CPFF-eligible. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. We control (X_{it}) for *firm size*, *Net debt/assets*, and *M-B ratio*. Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), the difference-in-differences equation, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm fixed effects (α_i) and $CPFF_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown in the table. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Dependent variables	*Revenue/assets*	*NetTC/assets*	*Receivables/assets*	*AP/assets*	*Inventory/assets*
	(I)	*(II)*	*(III)*	*(IV)*	*(V)*
Panel A. Boundary DD: A-1 and A-2 boundary (A vs. A-)					
*Post*CPFF-eligible*	0.0371 *	0.0571 **	0.0314 ***	0.0257	-0.0076 *
	[0.0179]	[0.0261]	[0.0072]	[0.0263]	[0.0042]
Observations	118	118	118	118	117
R-squared	0.240	0.252	0.235	0.133	0.153
Panel B. Placebo test I: Within CPFF-eligible CP issuers (A-1 vs. A-1+)					
*Post*A-1+ rated*	-0.0123	0.0265	0.0027	0.0238	-0.0011
	[0.0117]	[0.0242]	[0.0040]	[0.0230]	[0.0058]
Observations	155	155	155	155	153
R-squared	0.229	0.103	0.084	0.091	0.148
Panel C. Placebo test II: Within CPFF-ineligible A-2 rated CP issuers (A- vs. BBB and BBB+)					
*Post*A- rated*	-0.0342 ***	-0.0613 **	-0.0342 ***	-0.0271	0.0063
	[0.0087]	[0.0238]	[0.0087]	[0.0264]	[0.0044]
Observations	104	104	104	104	103
R-squared	0.349	0.376	0.349	0.143	0.173

Table VII. Spillover Effects

This table shows changes in financing, investment, and payout policy of the clients of CPFF eligible firms around the introduction of the CPFF from 2008:Q1 through 2009:Q4 (Panel A), and from 2007:Q1 through 2010:Q4 (Panel B). To focus on financially constrained clients, only non-CP issuers with debt/assets above median as of 2008:Q2 are considered. Observations are measured at quarterly frequency except for Column (X). Column (X) is in annual frequency. We use a difference-in-differences specification, $y_{it} = \alpha_i + \gamma_t + \beta_1 \times Post_{it} \times CrisisCustomer_i + \beta_2 \times Post_{it} + \beta_3 \times CrisisCustomer_i + \delta \times X_{it} + \varepsilon_{it}$. The key variable of interest is the interaction term ($Post_{it} \times CrisisCustomer_i$), which measures the changes in the difference between CPFF customers during the crisis period and the non-crisis period after the introduction of the CPFF. $Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CrisisCustomer_i$ is an indicator variable that is one if a firm is a customer around the crisis period (2008–2011).The dependent variables (y_{it}) are *NetTC/assets*, *Receivables/assets*, *AP/assets*, *EDF*, *(Cash+LC)/assets*, *LC/assets*, *Cash/assets*, *CapEx/assets*, *Acq/assets*, and *Dividend/assets*, all as defined in Table I. We control (X_{it}) for *firm size*, *Net debt/assets*, and *M-B ratio*. Firm fixed effects (α_i) and time fixed effects (γ_t) are included, and ε_{it} is an error term. Due to multicollinearity between the crisis customer indicator ($CrisisCustomer_i$) and firm fixed effects (α_i), the difference-in-differences equation, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CrisisCustomer_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm (α_i) fixed effect and $CrisisCustomer_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Dependent variables	***NetTC/assets*** (I)	***Rec./assets*** (II)	***AP/assets*** (III)	***EDF*** (IV)	***(Cash+LC)/assets*** (V)	***LC/assets*** (VI)	***Cash/assets*** (VII)	***CapEx/assets*** (VIII)	***Acq./assets*** (IX)	***Log(Emp)*** (X)	***Div./assets*** (XI)
Panel A. Short sample period: 2008-2009											
*Post*CrisisCustomer*	-0.2488 **	-0.0098	0.2437 **	-2.7304 **	-0.1856 *	0.0157	-0.2013 **	0.0074 *	0.0125 **	0.1210 **	-0.0067
	[0.1244]	[0.0085]	[0.1213]	[1.2126]	[0.0957]	[0.0153]	[0.0919]	[0.0038]	[0.0056]	[0.0503]	[0.0089]
Observations	1,086	1,086	1,093	1,049	1,093	1,093	1,093	1,071	1,032	328	1,069
R-squared	0.914	0.037	0.914	0.256	0.563	0.022	0.564	0.018	0.016	0.686	0.024
Panel B. Long sample period: 2007-2010											
*Post*CrisisCustomer*	-0.2816 **	-0.0084	0.2771 **	-2.974 **	-0.1717 *	0.0163	-0.1881 **	0.0083 **	0.0153 **	0.0937 *	0.0013
	[0.1334]	[0.0087]	[0.1296]	[1.2377]	[0.0877]	[0.0153]	[0.0839]	[0.0039]	[0.0060]	[0.0531]	[0.0057]
Observations	2,178	2,178	2,189	2,109	2,189	2,189	2,189	2,029	1,942	654	2,022
R-squared	0.877	0.044	0.876	0.216	0.404	0.092	0.405	0.016	0.038	0.499	0.008

Table AI. Impact of the CPFF: Excluding the Cash for Clunkers Period

This table shows changes in financing activities and profitability around the introduction of the CPFF, from 2008:Q1 through 2009:Q2, which excludes the period when the *Cash for Clunkers* program was implemented. Panel A considers A (lowest long-term rating among A-1 rated firms) and A- rated (highest long-term rating among A-2 rated firms) CP issuers. Panel B considers A-1 and A-1+ rated CP issuers. Panel C considers BBB, BBB+, and A- (A-2 rated) CP issuers. All firms considered have CP outstanding during 2008:Q1-Q2. To focus on firms with high CP demand, we exclude the bottom quintile of *CP/asset* firms. Observations are measured at quarterly frequency. This table uses a difference-in-differences specification as defined in Table II. The dependent variables (y_{it}) are *Debt/assets* (Column I), *CP/debt* (Column II), *Interest/debt* (Column III), Cash/*(Cash+LC)* (Column IV), *Revenue/assets* (Column V), *NI/assets* (Column VI), *NetTC*/asset (Column VII), and *Inventory/assets* (Column VIII), all as defined in Table I$Post_{it}$ is an indicator variable that is one if the observation is taken from the post-CPFF period (after 2008:Q4) and zero otherwise. $CPFF_i$ is an indicator variable that is one if a firm is CPFF-eligible. A CP issuer is eligible for the Commercial Paper Funding Facility (CPFF) if it is A-1 rated as of August 2008 and has commercial paper outstanding between January and August of 2008. We control (X_{it}) for *firm size*, *Net debt/assets*, and *M-B ratio*. Due to multicollinearity between the CPFF indicator ($CPFF_i$) and firm fixed effects (α_i), the difference-in-differences, Equation (1), is estimated using a first differences specification, $\Delta y_{it} = \Delta\gamma_t + \beta_1 \times \Delta(Post_{it} \times CPFF_i) + \delta \times \Delta X_{it} + \Delta\varepsilon_{it}$, following Wooldridge (2002, Equation 10.73). The first differences of firm fixed effects (α_i) and $CPFF_i$ are zero, and that of $Post_{it}$ is absorbed in time fixed effects (γ_t). Controls (X_{it}) and time fixed effects (γ_t) are included but not shown in the table. Standard errors are clustered at the firm level and are significant at the 1% (***), 5% (**), and 10% (*) levels.

Dependent variables	*Debt/assets* (I)	*CP/assets* (II)	*Interest/debt* (III)	*Cash/(Cash+LC)* (IV)	*Revenue/assets* (V)	*NI/assets* (VI)	*NetTC/assets* (VII)	*Inventory/assets* (VIII)
Panel A. Boundary DD: A-1 and A-2 boundary (A vs. A-)								
*Post*CPFF-eligible*	0.0109	0.0318 *	-0.0029 *	-0.4717 ***	0.0403 **	0.0193 *	0.0586 **	-0.0079 *
	[0.0145]	[0.0157]	[0.0014]	[0.1553]	[0.0179]	[0.0095]	[0.0257]	[0.0043]
Observations	85	85	83	85	85	85	85	85
R-squared	0.321	0.164	0.314	0.071	0.275	0.188	0.319	0.144
Panel B. Placebo test I: Within CPFF-eligible CP issuers (A-1 vs. A-1+)								
*Post*A-1+ rated*	-0.0162	-0.0081	0.0003	-0.1248	-0.0125	0.0099	0.0268	-0.0014
	[0.0154]	[0.0110]	[0.0008]	[0.1656]	[0.0116]	[0.0122]	[0.0241]	[0.0057]
Observations	112	112	110	112	112	112	112	111
R-squared	0.260	0.162	0.198	0.137	0.246	0.213	0.127	0.118
Panel C. Placebo test II: Within CPFF-ineligible A-2 rated CP issuers (A- vs. BBB and BBB+)								
*Post*A- rated*	-0.0137	-0.0168	0.0006	0.6884 ***	-0.0364 **	0.0057	-0.0614 **	0.0061
	[0.0155]	[0.0171]	[0.0012]	[0.2048]	[0.0147]	[0.0122]	[0.0236]	[0.0045]
Observations	75	75	71	75	75	75	75	75
R-squared	0.303	0.091	0.537	0.171	0.427	0.418	0.478	0.187

Figure 1: Total Outstanding Commercial Paper Purchased by the CPFF Program

This graph shows monthly total outstanding commercial paper ($billion) purchased by the CPFF program for financial and non-financial CP issuers from October 2008 through January 2010. Data come from the Board of Governors of the Federal Reserve System.

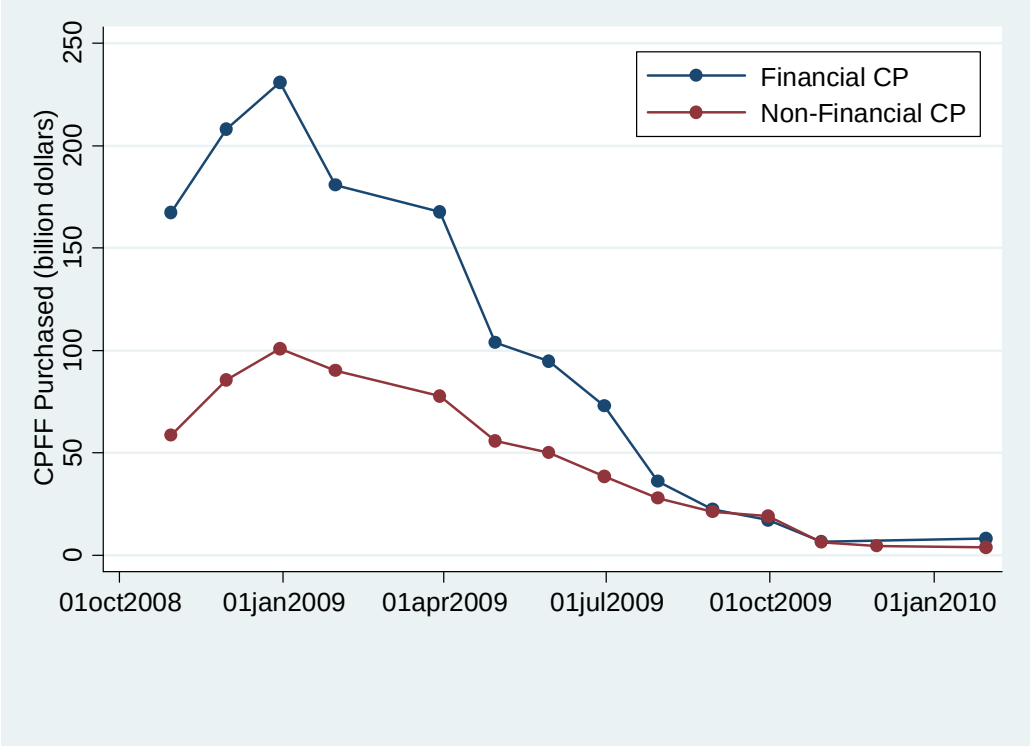
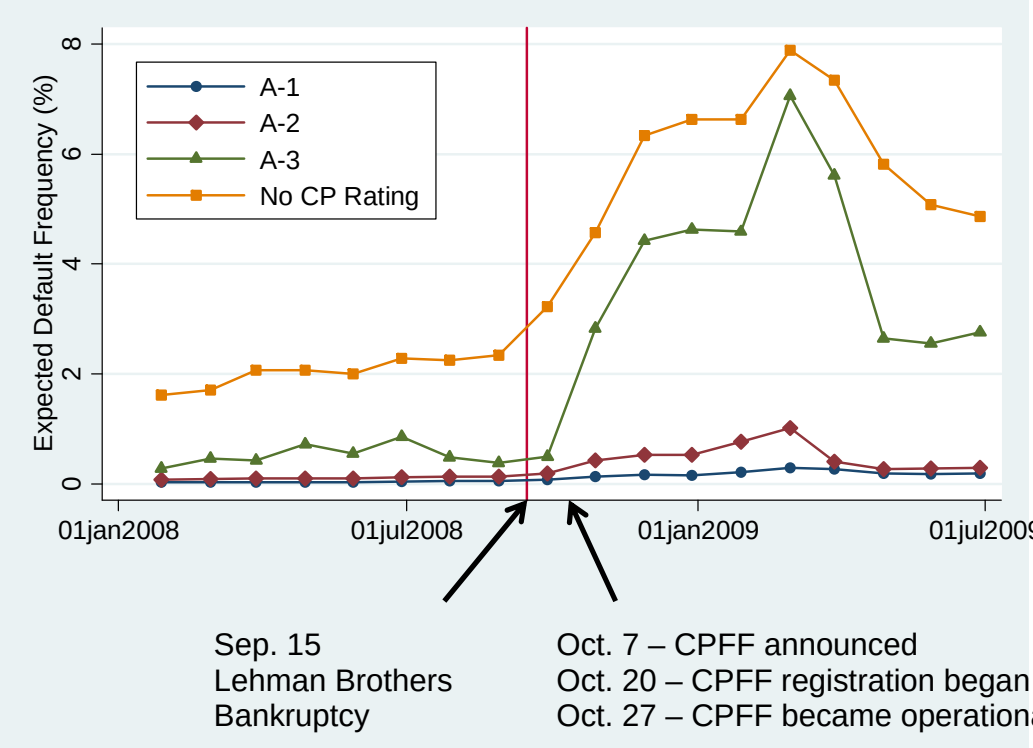
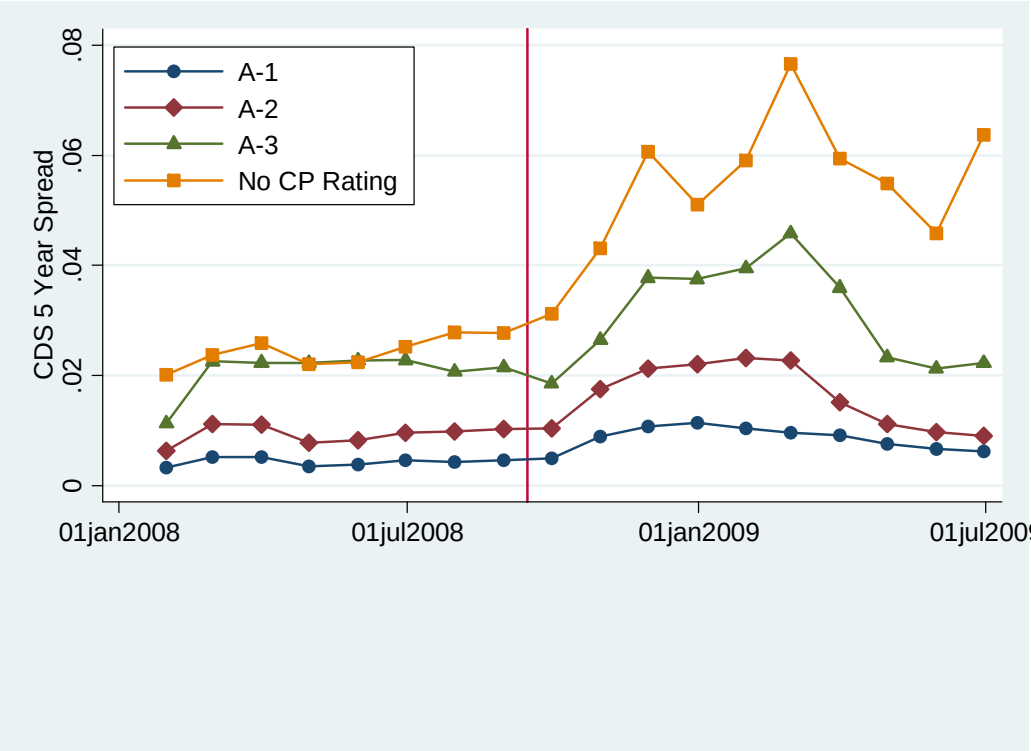


Figure 2: Expected Default Frequency and CDS Spread of Non-Financial CP Issuers Around Lehman Brothers' Bankruptcy

These graphs show the expected default frequency (EDF) and credit default swap (CDS) for manufacturing (SIC codes 2000–3999) firms from January 2008 through June 2009. The expected default frequency (EDF) data for each firm are provided by Moody's KMV, and the CDS data are provided by Markit. Each marker indicates monthly average EDF value (Figure 1a) and CDS spread (Figure 1b) as of the last day of each month, starting in January 2008. The vertical line indicates the announcement date of the Lehman Brothers bankruptcy (September 15, 2008). The CPFF was announced on October 7. Detailed eligibility criteria were announced October 14. Registration began on October 20, and the CPFF became operational on October 27, 2008.



(a)


CDS 5 Year Spread
0
.02
.04
.06
.08
A-1
A-2
A-3
No CP Rating
01jan2008
01jul2008
01jan2009
01jul2009

(b)

Figure 3: Description of Comparison Groups

This figure shows control (CPFF ineligible CP issuers) and treatment (CPFF-eligible) groups. A CP issuer was eligible when it was top-rated and had CP outstanding between January and August of 2008. CP issuers are further subdivided according to their S&P long-term rating. For example, A-1 rated firms are divided into A and A+ long-term ratings. A-2 rated firms are divided into BBB, BBB+, and A- long-term ratings. In the baseline empirical specification, we consider firms with CP outstanding between January and August of 2008. Among these firms only A-1 and A-1+ rated firms are eligible for the CPFF. We expect the CPFF effect to be the strongest when we compare firms at the CPFF eligibility boundary (A and A- long-term ratings). We perform several placebo tests against flight-to-quality concerns. Placebo test I compares CPFF-eligible firms (A-1+ vs. A-1). Placebo test II compares CPFF-ineligible firms (A- vs. BBB and BBB+). In these two placebo tests, CPFF eligibility is homogeneous (i.e., the CPFF is available for all firms in placebo test I, and is not available for all firms in placebo test II), and only the flight-to-quality effect is present.