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The Federal Reserve's commercial paper funding facility

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The Federal Reserve's Commercial Paper Funding Facility

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Karin Kimbrough
Dina Marchioni

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The Federal Reserve's Commercial Paper Funding Facility

Tobias Adrian, Karin Kimbrough, and Dina Marchioni

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Abstract

The Federal Reserve created the Commercial Paper Funding Facility (CPFF) in the midst of severe disruptions in money markets following the bankruptcy of Lehman Brothers on September 15, 2008. The CPFF finances the purchase of highly rated unsecured and asset-backed commercial paper from eligible issuers via primary dealers. The CPFF was a liquidity backstop to U.S. issuers of commercial paper, and its creation was part of a range of policy actions undertaken by the Federal Reserve to provide liquidity to the financial system. This paper documents aspects of the financial crisis relevant to the creation of the CPFF, reviews the operation of the CPFF, discusses usage of the facility, and draws conclusions for lending of last resort facilities in a market based financial system.

Key words: Federal Reserve, lender of last resort

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1. Introduction

The commercial paper market experienced considerable strain in the weeks following Lehman Brothers' bankruptcy on Monday, September 15, 2008. The Reserve Primary Fund---a prime money market mutual fund with \$785 million in exposure to Lehman Brothers---“broke the buck” on September 16, triggering broad investor flows within the money market sector. This unprecedented flight to quality from high-yielding to Treasury-only money market funds severely disrupted the ability of commercial paper issuers to roll over their short term liabilities.

As redemption demands accelerated, particularly in high-yielding money market mutual funds, investors became increasingly reluctant to purchase commercial paper, especially for longer-dated maturities. As a result, an increasingly high percentage of outstanding paper had to be refinanced each day, interest rates on longer-term commercial paper increased significantly, and the volume of outstanding paper declined sharply. These market disruptions had the potential to constrain the economic activities of commercial paper issuers. Indeed, a large share of outstanding commercial paper is issued or sponsored by financial intermediaries, and the difficulties they faced in placing commercial paper further reduced their ability to meet the credit needs of businesses and households.

In light of these strains, the *Commercial Paper Funding Facility (CPFF)* was announced by the Federal Reserve on October 7, 2008, with the aim of supporting the orderly functioning of the commercial paper market. Registration for the CPFF started on October 20, 2008, and the facility became operational on October 27, 2008. The CPFF operated as a lender of last resort facility for the commercial paper market. It effectively extended access to the Federal Reserve's discount window to issuers of commercial paper, even if these issuers were not chartered as commercial banks. Unlike the discount window, the CPFF was a temporary liquidity facility that was authorized

under section 13(3) of the Federal Reserve Act due to “unusual and exigent circumstances” and expired on February 1, 2010.¹

The goal of the CPFF was to address temporary liquidity distortions in the commercial paper market by providing a backstop to U.S. issuers of commercial paper. This liquidity backstop provided assurance to both issuers and investors that firms would be able to roll over their maturing commercial paper. The facility enabled issuers to engage in term lending funded by commercial paper issuance which, in turn, enhanced the ability of financial intermediaries to extend crucial credit to U.S. businesses and households. The CPFF did not address the solvency of issuing firms. Rather, the focus was on shielding the allocation of real economic investment from liquidity distortions arising from the run on high-yielding money market instruments triggered after the bankruptcy of Lehman Brothers. The CPFF was explicitly designed to protect the Federal Reserve from potential credit losses. Issuance to the CPFF was either secured by collateral or subject to an additional surcharge, which was calibrated so as to protect the Federal Reserve against any potential credit losses.

This paper offers an overview of the Commercial Paper Funding Facility. We explain the economic role of the commercial paper market as a source of funding for various financial intermediaries. We briefly review the events surrounding the turmoil that led to the creation of the CPFF in the fall of 2008. We also present operational details of the CPFF and document its usage and effectiveness. In addition, we discuss the economics of the facility within the context of the financial system and in relation to the Federal Reserve’s role as lender of last resort. Also considered are issues associated with the risk of moral hazard that have been raised following the launch of the CPFF.

¹ Initially the CPFF was set to expire on April 30, 2009, but was then extended to October 30, 2009 and, subsequently, to February 1, 2010.

The remainder of the paper is organized in four sections. In section 2), we provide background explaining the functioning of the commercial paper market and describing the market disruptions of 2008 prior to the creation of the facility. In section 3), we describe the design and operation of the CPFF in detail. In section 4), we discuss the usage of the CPFF, its impact on the commercial paper market. In section 5), we conclude.

2. Background on the Commercial Paper Market

The commercial paper market is used by commercial banks, non-bank financial institutions, and nonfinancial corporations to obtain short-term external funding. There are two main types of commercial paper: unsecured and asset-backed.

Unsecured commercial paper consists of promissory notes issued by financial or nonfinancial institutions with a fixed maturity of one to 270 days, unless the paper is issued with the option of an extendable maturity. Unsecured commercial paper is not backed by collateral, which makes the credit rating of the originating institution a key variable in determining the cost of issuance.

Asset-backed commercial paper (ABCP) is collateralized by other financial assets and therefore is a secured form of borrowing. Historically, senior tranches of asset-backed securities (ABS) have served as collateral to the ABCP. As such, ABCP is a financial instrument that has frequently provided maturity transformation: while the underlying loans or mortgages in the ABS are of long maturity (typically 5-30 years), ABCP maturities range between one day and 270 days. Institutions that issue ABCP first sell their assets to a bankruptcy-remote special purpose vehicle

(SPV).² The SPV then issues the ABCP, which is backed by the assets in the vehicle and backup credit lines of the sponsoring institution. In the case of bankruptcy of the sponsoring institution, the assets of the SPV do not enter into the asset pool of the sponsor. All commercial paper is traded in the over the counter (OTC) market, where money market desks of securities broker-dealers and banks provide underwriting and market making services. In the U.S., commercial paper is cleared and settled by the Depository Trust Company (DTC).³

Commercial paper provides institutions direct access to the money market. In traditional bank-intermediated financial systems, borrowing institutions obtain loans from commercial banks, which are, in turn, primarily funded by deposits. Since the early 1980's, however, the U.S. financial system has undergone a major transformation as an ever increasing fraction of credit intermediation migrated from banks to financial markets. One way to gauge the degree to which this process of disintermediation affected the commercial paper market is to compare outstanding commercial paper to the money stock. Commercial paper represented only 30 percent of the money stock measure M1 in 1980; it overtook M1 in mid-1998; and it was 60 percent larger than M1 at its peak in August 2007 (see Figure 1).⁴ The sharp contractions of commercial paper in 2007 and 2008 have led the ratio of commercial paper to M1 to fall below 72 percent in the second half of 2009, a fraction not seen since the mid-1990s.

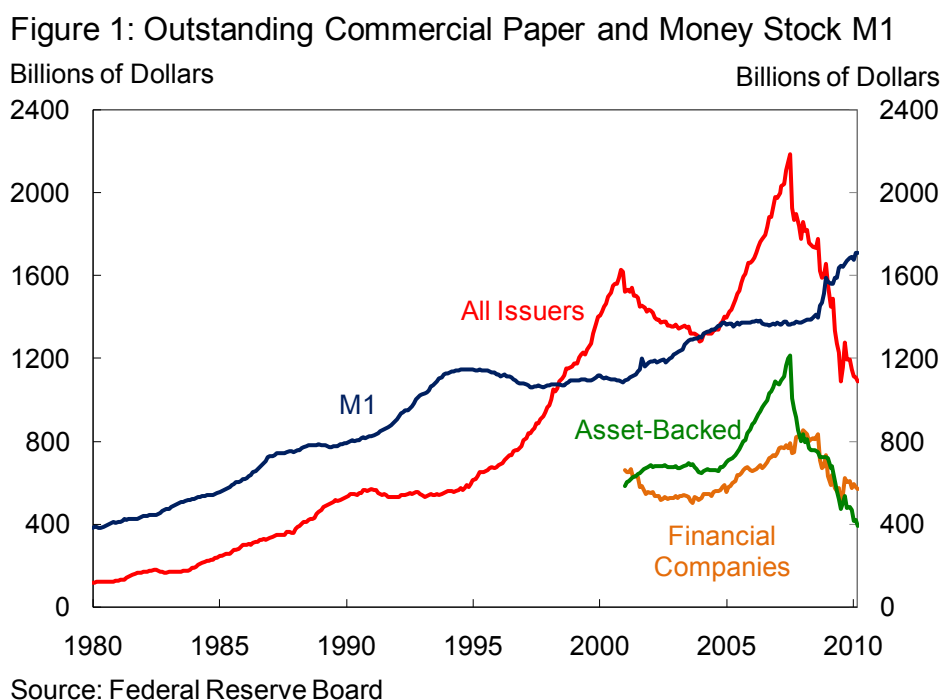
The mix of unsecured commercial paper and ABCP in the market has varied considerably over the last few years with ABCP comprising over 45 percent of the market between 2001 and 2007. The rise of ABCP is tightly intertwined with the growth of securitization. Since 1998,

² An SPV is a legal entity created to serve a particular function, in this case, purchasing or financing specific assets. Bankruptcy remoteness refers to assets of the SPV being shielded from the bankruptcy of the sponsoring institution.

³ DTC is a subsidiary of the Depository Trust & Clearing Corporation. See <http://www.dtcc.com/>.

⁴ M1 consists of (1) currency outside the U.S. Treasury, Federal Reserve Banks, and the vaults of depository institutions; (2) travelers checks of nonbank issuers; (3) demand deposits; and (4) other checkable deposits.

financial intermediaries have increasingly relied on ABCP as a source of funding for assets warehoused for securitization.⁵ In the decade prior to the crisis, ABCP increased from \$250 billion in 1997 to over \$1 trillion by 2007 (i.e., from roughly 20 percent to as much as 50 percent of outstanding commercial paper), fueled by the considerable distribution of residential mortgage exposure through structured finance products.



Outstanding commercial paper peaked with a total market value of \$2.2 trillion in August 2007 (see Figure 1). ABCP accounted for more than 52 percent of the total market in August 2007, while financial commercial paper accounted for an additional 38 percent, and nonfinancial commercial paper accounted for approximately 10 percent. Between August 15, 2007, and September 15, 2008, the market experienced a notable decline associated with mounting credit problems of ABCP collateral. The initial decline of outstanding ABCP is often used to date the

⁵ For an overview of asset-backed commercial paper see Covitz, Liang, and Suarez (2009). Overviews of the securitization markets are provided by Adrian, Ashcraft, and Pozsar (2009) and Acharya and Schnabl (2010).

beginning of the first wave of the recent financial crisis.⁶ With the accelerated deterioration of the U.S. housing market in the summer of 2007, the riskiness of the ABS that was used as collateral in ABCP transactions increased. As a result, ABCP issuers struggled to issue commercial paper. Between September 2007 and January 2008, total assets of commercial banks grew unusually fast as many ABS that were previously funded in the ABCP market were moved from ABCP issuers to commercial bank balance sheets. As a result of the drying-up of funding in the ABCP market, commercial banks started to fund the ABS in unsecured money markets, such as LIBOR, Eurodollars and commercial paper, all of which would also become compromised at the peak of the crisis as credit risk reached extreme levels.

2.1 Major Commercial Paper Issuers

Figure 2 provides an overview of issuers in the commercial paper market since the early 1980's according to the Flow of Funds of the Federal Reserve. In the past decade, ABS issuers were the largest issuer of commercial paper, usually in the form of ABCP. Commercial paper funding of ABS stopped growing after the Enron fraud was revealed in 2001, as changes in accounting and regulatory practices concerning off-balance sheet entities required that additional capital be held against them on balance sheet.⁷ At the end of 2003, capital regulation regarding off-balance sheet conduits changed, resuming the growth of ABS-issued commercial paper. Indeed, the growth in ABS issuance goes hand in hand with the growth of outstanding ABCP.

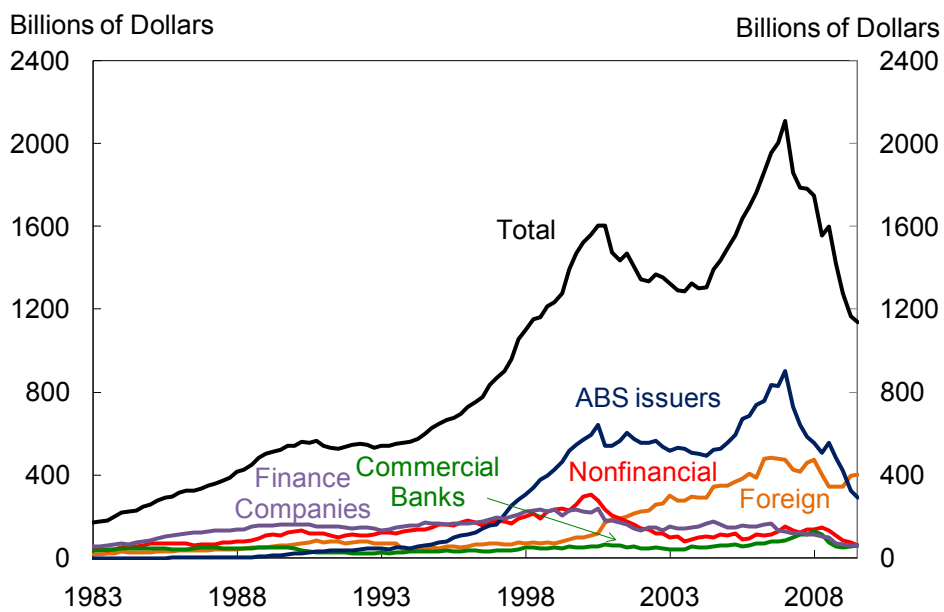
The second largest issuers of commercial paper in recent years have been foreign issuers of U.S. dollar denominated paper, which include foreign banks and other financial institutions. Other issuers of commercial paper include finance companies, nonfinancial corporations, and commercial

⁶ For a comprehensive timeline of the financial crisis, see <http://timeline.stlouisfed.org/>.

⁷ For an overview of recent accounting changes concerning off balance sheet vehicles see http://www.fasb.org/cs/ContentServer?c=FASBContent_C&pagename=FASB%2FFASBContent_C%2FNewsPage&cid=1176155633483.

banks. For commercial banks, commercial paper issuance is relatively expensive; a combination of deposits ---checking deposits, term deposits, or certificate of deposits---and borrowing in the Federal Funds market are usually cheaper funding alternatives than commercial paper (see Figure 3), though bank holding companies might more readily issue commercial paper given the limited availability of deposits and financing that can be transferred from its commercial banks.⁸ However, commercial paper does provide a marginal source of funding to the commercial banking sector and, at times and at least for certain issuers, commercial paper rates are actually cheaper than other money market rates such as Eurodollar rates.

Figure 2: Issuers of Commercial Paper

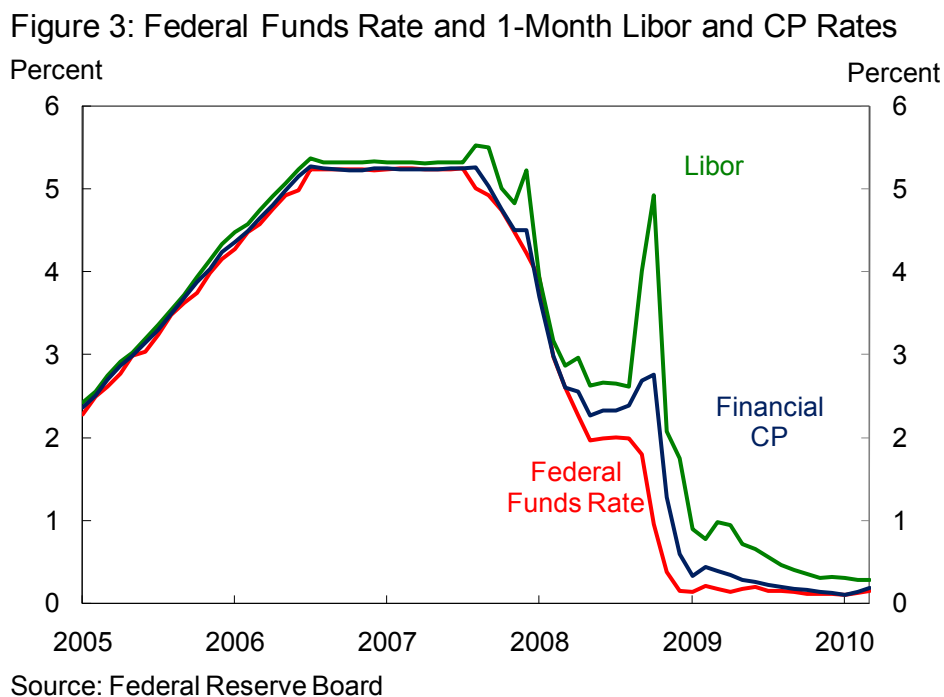


Source: Federal Reserve Board

As credit conditions deteriorated in the second half of 2007, many commercial banks took obligations that were formerly held in off-balance sheet vehicles and funded in the ABCP market back onto their balance sheets. As a result, funding for these loans, mortgages, and securities

⁸ The relationship of commercial banks with affiliated subsidiaries is constrained by the Federal Reserve Act's section 23A; see <http://www.federalreserve.gov/aboutthefed/section23a.htm>.

migrated from the ABCP market to the unsecured interbank market, leading to a widening of the Libor-Fed Funds spread.



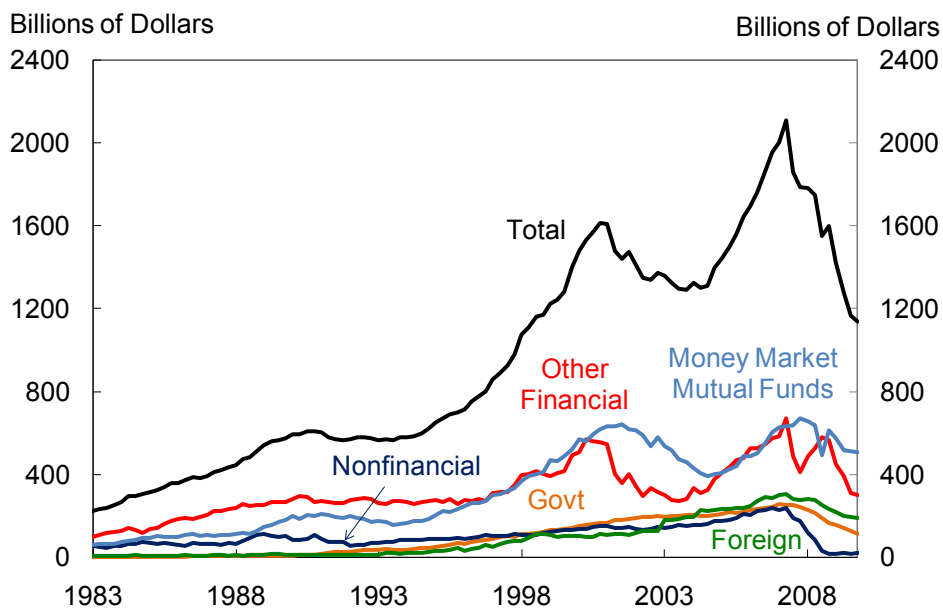
2.2 Lenders in the Commercial Paper Market

Figure 4 plots the holdings of commercial paper by different investors. The largest share of ownership is by money market mutual funds, followed by the foreign sector, and by mutual funds that are not money market mutual funds. Other financial institutions that hold commercial paper include non-financial corporations, commercial banks, insurance companies, and pension funds.

The creation of the CPFF is intimately tied to the operation of money market mutual funds. Money market funds in the U.S. are regulated by the Securities and Exchange Commission's (SEC) Investment Company Act of 1940. Rule 2a-7 of the act restricts investments by quality, maturity and diversity. Under this act, money funds are limited to invest mainly in highly-rated debt with maturities of less than 13 months. A fund's portfolio must maintain a weighted average maturity of 90 days or less, and money funds cannot invest more than 5 percent in any one issuer, except for

government securities and repurchase agreements (repos). Eligible money market securities include commercial paper, repurchase agreements, short-term bonds or other money funds.

Figure 4: Holdings of Commercial Paper by Investor Classes



Source: Federal Reserve Board

Money market funds seek a stable \$1 net asset value (NAV). If a fund's NAV drops below \$1, the fund is said to have “broken the buck.” In order to allow money market funds to preserve a stable NAV, securities must be liquid and have low credit risk. Since the first money market fund was created in the U.S. in 1971, and prior to September 2008, only one 2a-7 fund had “broken the buck”: the Community Bankers U.S. Government Money Market Fund of Denver in 1994. In light of the disruptions to the sector in 2008, the SEC is currently reevaluating 2a-7 guidelines, including the consideration of floating NAVs and shorter weighted average maturity requirements.⁹

2.3 The Commercial Paper Crisis of September 2008

⁹ See <http://www.sec.gov/answers/mfmmkt.htm> for more detail on the money market mutual fund universe, and the regulation of 2a-7 funds.

Considerable strains in the commercial paper market emerged following the bankruptcy of Lehman Brothers Holdings Inc. on September 15, 2008. Exposure to Lehman forced the Reserve Primary Fund to ‘break the buck’ on September 16, 2008 and, as a result, money market investors reallocated their funds from prime money market funds to funds that hold only government securities (see Figure 5). This reallocation unleashed a tidal wave of redemption demands that overwhelmed the funds’ immediate liquid reserves. In the week following the Lehman bankruptcy, prime money market mutual funds redeemed over \$117 billion to investors who were concerned about losses on presumably safe investments, possible contagion from Lehman’s bankruptcy, and financial institutions with large exposures to subprime assets. As a result 2a-7 money market mutual funds were reluctant and, in some cases unable, to purchase commercial paper (or other money market assets with credit exposure). Any purchases that were made were concentrated in very short maturities; shortening the duration of their asset holdings made it easier for the money market funds to manage the uncertainty about further redemptions. As demand from money market funds shrank, commercial paper issuers were unable to issue term paper and, instead, issued overnight paper. Thus, with each passing maturity date of commercial paper outstanding, an issuer’s rollover risk increased sharply. Banks bore the increasing risk of having their credit lines drawn by issuers unable to place commercial paper in the market precisely at a time when the banks themselves were having difficulty securing funding from the market and were attempting to reduce risk.¹⁰

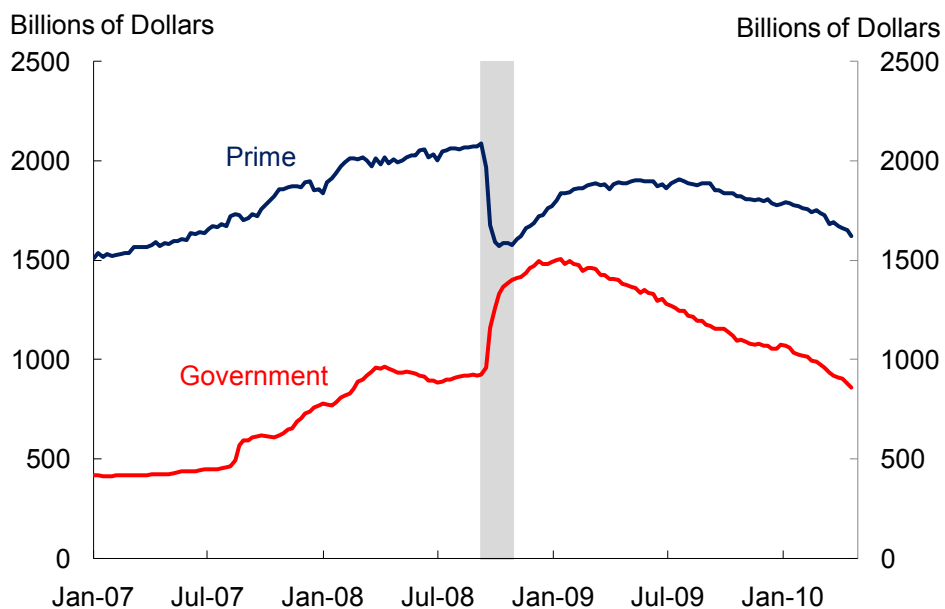
More broadly, the deepening dysfunction in the commercial paper market risked greater disruptions across the real economy. The sudden disruption in CP issuance led to higher issuing costs, forced asset sales by entities unable to raise cash, greater insolvency risk among issuers, and

¹⁰ Commercial banks provide a liquidity backstop for commercial paper issuers. Rating agencies require that the issuer have in place lines of credit in a stipulated percentage of the maximum dollar amount of commercial paper that may be outstanding under the program. See DTCC (2003).

increasingly placed pressure on credit lines from commercial banks, which together resulted in less credit availability to individuals and businesses generally.

The commercial paper market was vulnerable to the credit, rollover, and liquidity risks that, though minimal in a period of stable rates and high liquidity, emerged in the wake of the Lehman crisis. Credit risk-averse investors shunned commercial paper issuers who had previously been considered high-quality, but suddenly were considered as likely candidates for default. Domestic financial paper issuance plummeted 24 percent in late 2008. Likewise, rollover risk, whereby investors are compensated when the issuer rolls the maturing paper, is magnified when issuers face lack of demand. A combination of liquidity and jump-to-default risk manifested itself through sharp increases in the rates on A2/P2 nonfinancial paper, whose spreads in excess of OIS rose from 296 basis points on the Friday prior to Lehman Brother’s bankruptcy to 504 basis points one week later. Over the period from September 15 to December 31, the spread averaged 539 basis points. These inherent risks in commercial paper were heightened as money market mutual funds, the principal investor in commercial paper, retreated from these instruments.

Figure 5: U.S. Money Market Fund Assets by Fund Type



Source: iMoney

Note: Shaded area September 16 - October 21

In the month following the Lehman Brothers bankruptcy, commercial paper outstanding shrank by \$300 billion. 70 percent of this sharp decline was led by the financial commercial paper sector, while 20 percent was attributed to a shrinking of the ABCP market. Notably, the nonfinancial sector was responsible for only a 6percent retrenchment in the size of total commercial paper outstanding. In the period between the bankruptcy of Lehman Brothers and the start of CPFF, total outstanding commercial paper fell sharply, from \$1.8 trillion to \$1.5 trillion. By the end of September 2008, more than 75 percent of commercial paper financing was rolled over each day, leaving the market unusually exposed to additional liquidity shocks. As rollover risk escalated, institutions relying on commercial paper were increasingly vulnerable to bankruptcy should money market fund investors pull away from the commercial paper market. Concerned by this risk, the Federal Reserve considered ways to stabilize short term funding markets by providing added sources of funding to stave off liquidity-driven defaults and to help reduce rollover risk.

2.4 The Response of the Federal Reserve

The creation of the CPFF was part of a series of extraordinary policy interventions by the Federal Reserve and other U.S. government agencies. These included the expansion of eligible collateral for the Primary Dealer Credit Facility (PDCF) and the Term Securities Lending Facility (TSLF) on September 14; the expansion of foreign exchange swap lines with foreign central banks on September 19; the creation, also on September 19, of the Asset Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), which extended non-recourse loans at the primary credit rate to U.S. depository institutions and bank holding companies to finance their purchase of high-quality ABCP from money market mutual funds; the announcement of a temporary guarantee program for money market mutual funds on September 19; and by the announcement of the Money

Market Investor Funding Facility (MMIFF) on October 21.¹¹ In addition, on October 14, the FDIC announced the creation of the Temporary Liquidity Guarantee Program (TLGP) to guarantee the senior debt of all FDIC-insured institutions and their holding companies, as well as deposits in non-interest-bearing deposit transactions. Finally, on November 25th, the Federal Reserve announced the creation of the Term Asset-Backed Securities Lending Facility (TALF), under which the Federal Reserve Bank of New York was authorized to lend up to \$200 billion on a non-recourse basis to holders of AAA-rated ABS and recently originated consumer and small business loans.

3. The Design and Operation of the CPFF

The CPFF was designed to stabilize short term financing markets by providing an additional source of funding to institutions in order to reduce reinvestment risk and stave off liquidity-driven defaults. To accomplish this, an SPV, the CPFF LLC, was created to purchase 90-day commercial paper from highly-rated U.S. issuers and effectively pledge it to the Federal Reserve Bank of New York in exchange for cash.

In the twenty days between the announcement of the CPFF and its first purchases from registered users, the Federal Reserve staff fine tuned the terms and conditions and operational design of the facility, which included building a new legal, trading and investment, custodial and administrative infrastructure as well as establishing essential financial and operational risk controls. For the CPFF to be effective as a liquidity backstop, it needed to be simple to use, compliant with existing market conventions, open to a large cross section of the commercial paper market while

¹¹ See Adrian, Burke, and McAndrews (2009) for the PDCF, and Fleming, Hrungr, and Keane (2009) for the TSLF, Davis, McAndrews, and Franklin (2009) for an overview of MMIFF, and Adrian and Shin (2009) for an overview of the liquidity facilities in a broader context. The impact of the CPFF and other credit and liquidity programs on the Federal Reserve's balance sheet and its income statement can be found at http://www.federalreserve.gov/monetarypolicy/bst_fedfinancials.htm.

minimizing credit risk to the Bank, priced to relieve funding market pressures, and erected quickly to forestall another liquidity event. The facility's terms and conditions ultimately addressed these objectives.¹²

3.1 Operational Design of the CPFF

A market backstop required accessibility by any issuer in the market. However, purchases of commercial paper could not be open to any firm needing access to short-term funding, as this would have deviated from the intent of offering a backstop to issuers whose short-term funding was disrupted by liquidity events rather than the firm's own credit event. To minimize credit risk, purchases were limited to top-tier paper, rated A-1/P-1/F1 or higher, consistent with 2-a7 fund conventions in place at the time.¹³ In late 2008, top-tier commercial paper accounted for nearly 90 percent of the market, indicating that the criterion would allow the facility to backstop the vast majority of the market, while also shielding the Federal Reserve from lower-quality credits in the market.

To effectively reduce rollover risk, the CPFF needed to offer term financing beyond what the Federal Reserve had extended up to that point.¹⁴ Since term commercial paper is most liquid at 1- and 3-month tenors and funding concerns for the year end were mounting, 3-month commercial paper became the logical tenor to offer issuers under the CPFF. Furthermore, the facility gave assurance that the purchases of commercial paper were held to maturity rather than liquidated shortly thereafter.

¹² A comprehensive overview of terms and conditions, frequently asked questions, announcements, and operational details relating to the CPFF can be found at <http://www.ny.frb.org/markets/cpff.html>.

¹³ A split rating is acceptable if two ratings are top-tier ratings.

¹⁴ The Fed had started the 28-day Term Auction Facility (TAF) in December 2007, and an extension to an 84-day maturity had been announced on July 30, 2008, effective August 11, 2008. See Armentier, McAndrews, and Krieger (2008) for an overview of TAF.

In establishing the CPFF, the Federal Reserve faced the added complication of engaging in transactions that fell outside of the central bank's traditional operating framework. Prior to the creation of the CPFF, temporary emergency lending facilities created under section 13(3) of the Federal Reserve Act were forms of secured borrowing with traditional counterparties--- i.e., depository institutions or primary dealers. To address the risks that had emerged in the commercial paper market, the Federal Reserve had to expand its lending to include U.S. corporations and financial institutions---such as finance companies---that would otherwise not have direct access to the central bank's market operations.

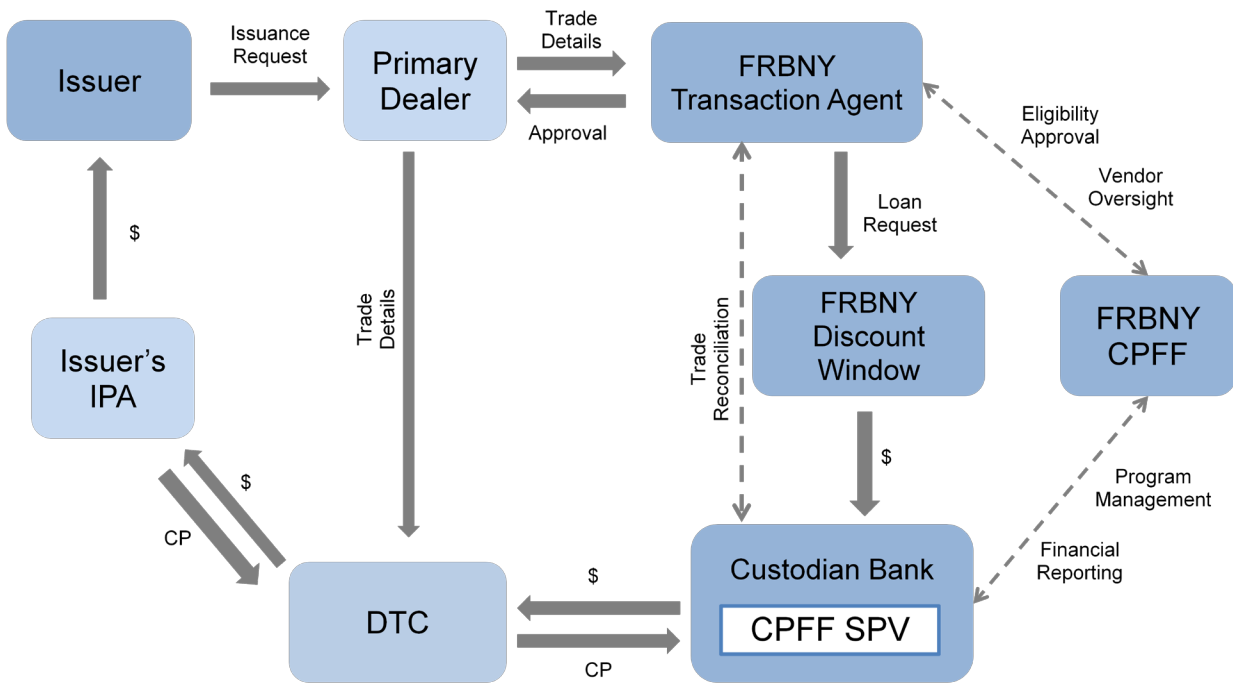
The Federal Reserve's financial transactions were limited to open market operations with the primary dealers or loans to depository institutions via the discount window.¹⁵ The CPFF operation married aspects of both types of Fed operations with the market conventions of the commercial paper market. To execute CPFF transactions, the Federal Reserve Bank of New York used its primary dealers as agents to the transactions between the Fed and commercial paper issuers. Primary dealers actively underwrite, place, and make markets in the commercial paper market, and they had the ability to funnel CPFF issuance from its clientele to the facility each day. By designating primary dealers as agents to the CPFF transactions, the facility effectively expanded its reach to hundreds of firms looking for backstop financing. Trade execution was conducted electronically, with controls and accuracy checks, and processed "straight-through" with limited manual intervention, allowing multitudes of trades to be quickly and accurately executed and settled same-day. The same-day settlement feature gave firms comfort that an unexpected liquidity need could be met by the CPFF.

¹⁵ These included cash and securities loans and purchases or sales of U.S. Treasury and government agency debt.

Building the facility's infrastructure in a compressed time frame proved a substantial challenge and, therefore, the Federal Reserve enlisted the services of experienced market participants including Pacific Investment Management Company ("PIMCO") and State Street Bank and Trust Company ("State Street"). The Federal Reserve created an SPV---CPFF LLC---which was held in custody at State Street, a depository institution. The creation of the SPV facilitated the extension of the discount window to the commercial paper market. Each day, CPFF purchases were matched by a loan of the Federal Reserve Bank of New York's discount window to the custodian bank, which then transferred the loan amount to the SVP in order to fund the purchases. At maturity, the transaction unwound: the issuer paid the CPFF LLC the loan principal plus interest, which was determined by the interest rate set on issuance date, and the SPV paid the Federal Reserve Bank of New York the principal and interest on its loan, set at the Fed Funds target on the original loan date.¹⁶ As the custodian, issuing paying agent (the financial institution hired by the issuer to administer the issuance and payments of the commercial paper), and all primary dealers cleared commercial paper through the DTC, the CPFF had in place a mechanism that allowed the facility to purchase commercial paper efficiently through the market's standard clearing institution. The mechanics of the CPFF are illustrated in Figure 6.

¹⁶ If the target federal funds rate is a range, then the loan is set at the maximum rate within the range.

Figure 6: Issuance to the Commercial Paper Funding Facility



In order to sell commercial paper to CPFF LLC, an issuer was required to register in advance of initial issuance.¹⁷ The registration process allowed the Federal Reserve Bank of New York to verify eligibility criteria (including the maximum amount the issuer could sell to the facility), review the issuer’s credit quality and, among other logistics, process the registration fee. While the vast majority of registrants issued to CPFF shortly after registering, some registered to retain the option of future issuance should the need arise. The CPFF’s registration period began on Monday, October 20, 2008, one week prior to the first purchase date, to allow time for processing the large number of issuers who wanted the option of issuing to the facility at its inception.

3.2 CPFF as Liquidity Backstop

¹⁷ For the purposes of registration in the CPFF, an “issuer” was defined by the legal entity that issues commercial paper. If a parent company and a subsidiary issued commercial paper separately, they were considered separate issuers for the purposes of the CPFF. Only U.S. issuers of commercial paper, including U.S. issuers with a foreign parent, were eligible to sell commercial paper to the SPV.

Eligibility requirements related to tenor, credit quality, pricing, and maximum issuance were structured so as to aid in limiting the use of the facility to backstop financing.¹⁸ Among these requirements, the facility’s pricing structure was the most influential. It was absolutely essential that the rates on CPFF issuance were precisely calibrated to ease financial market stress by offering financing at a rate below the extreme levels in the market. At the same time, the Federal Reserve needed to ensure that the rates were not too attractive; otherwise, issuers would rely heavily on the CPFF, potentially impairing long-run liquidity and market functioning in the commercial paper market. On October 14, the Federal Reserve released the pricing structure for the facility, as reported in Table 1.

Table 1: CPFF Pricing Structure

Rates and Fees	Unsecured Commercial Paper	Asset-Backed Commercial Paper
Lending Rate	3-month OIS + 100 basis points	3-month OIS + 300 basis points
Credit Surcharge	100 basis points	None
All-in Cost	3-month OIS + 200 basis points	3-month OIS + 300 basis points

The facility controlled for changes in short-term interest rates by setting the price of commercial paper issuance to the CPFF at a fixed spread above the daily 3-month overnight index swap (OIS) rate. As is common practice in the market, commercial paper issued to the CPFF was

¹⁸ The special purpose vehicle may only purchase 3-month U.S. dollar-denominated unsecured and asset-backed commercial paper that is rated at least A-1/P-1/F1 from U.S. issuers or U.S.-based issuers of a foreign parent company. While split ratings (such that one rating is Tier 2) are accepted, A2/P2 paper---which represents about 5 percent of issuance in the commercial paper market---is ineligible.

sold at a discount from the face value, as determined by the lending rate, using the standard interest calculations and actual-over-360 day count convention. The all-in costs of OIS plus 200 and 300 basis points per annum on unsecured and asset-backed commercial paper, respectively, were determined subsequent to performing historical analysis of several factors including investment grade financing rates in recent interest rate cycles, average spreads between unsecured and asset-backed paper, and estimation of potential losses on a diversified portfolio of commercial paper. The higher funding costs for ABCP in the market (and in the CPFF pricing structure) relative to unsecured issuance that was backed by the full faith and credit of the issuing entity were indicative of the riskiness and illiquidity of the underlying collateral in ABCP conduits. In addition to empirical analysis, Federal Reserve staff surveyed a large number of market participants to distinguish between the credit and liquidity components of commercial paper rates at the height of the crisis.

Purchases of commercial paper needed to be secured to the satisfaction of the Federal Reserve. As financial and non-financial commercial paper is unsecured, the Federal Reserve needed to find alternative means to secure the loans. Although financial institutions could pledge financial assets as collateral against a loan, similar to a discount window transaction, non-financial commercial paper issuers would not necessarily have the same luxury. Assessing the value of non-financial assets would further complicate lending. Lenders are generally compensated for taking risk by charging higher rates or, in the case of a line of credit, assessing fees on usage. An assessment of a credit surcharge more closely approximated market practices and, thus, became the default practice for securing the loan. Participation in the FDIC's Temporary Liquidity Guarantee Program (TLGP) qualified as a satisfactory guarantee for unsecured commercial paper, as the U.S.

government ensured repayment on the commercial paper at maturity, thus removing credit risk.¹⁹ TLGP issuers were not required to pay the unsecured credit surcharge. As the TLGP was not fully operational on the inception date of the CPFF, TLGP issuers were initially charged an unsecured credit surcharge for paper sold to the facility; however, these fees were subsequently reimbursed once it was established that the entity was covered by the TLGP.

The registration fee for the CPFF was an additional feature that further underlined the nature of the CPFF as a liquidity backstop. The pricing of the registration fee was not dissimilar to a commitment fee that a bank would charge to a borrower for an available line of credit. This fee effectively served as an insurance premium, whereby the issuer bought the option of issuing to the facility at any time over the life of the program. The 10 basis point fee was charged on the maximum amount an issuer may sell to the CPFF, or the greatest amount of U.S. dollar-denominated commercial paper the issuer had outstanding on any day between January 1 and August 31, 2008. The maximum amount of issuance to the CPFF was reduced by any commercial paper outstanding with investors at the time of issuance, including the CPFF. These criteria supported the backstop nature of the facility by limiting issuance to the amount of paper that the institution maintained prior to the market disruptions in September 2008, rather than providing additional funding to grow or leverage issuer balance sheets. These terms also disqualified firms who were not previously active participants in the commercial paper market from accessing funding via the CPFF.²⁰

¹⁹ For each unsecured commercial paper transaction to the CPFF, the issuer is charged 100 basis points per annum, calculated from the face value of the commercial paper at the time of settlement. When distributing the proceeds of the new commercial paper issuance, the SPV reduces the proceeds due to the issuer by an amount equal to the unsecured credit surcharge.

²⁰ An issuer is deemed inactive if it did not issue ABCP to institutions other than the sponsoring institution for any consecutive period of three-months or longer between January 1 and August 31, 2008. A few months after the facility's inception, the Federal Reserve clarified these terms for

The CPFF's pricing structure and other program requirements helped ensure that the facility played a constructive role in restoring stability to the market. At the same time, they also served to (a) prevent artificial inflation of issuance beyond what may be absorbed by investor demand under normal conditions, (b) ensure the facility was used as a backstop in times of stress while also providing a disincentive to issue to the facility in more liquid market conditions, and (c) mitigate the credit risk associated with adverse selection to minimize the Federal Reserve's exposure to loss relative to its accumulated capital from program fees.

3.3 The Fed's Counterparty Credit Risk Management

From the Federal Reserve's perspective, CPFF lending rates were analogous to setting haircuts on a "non-recourse loan", a secured loan where the lender can seize pledged collateral to minimize loss upon a default. In setting CPFF rates for eligible commercial paper, the Federal Reserve faced a trade-off: on the one hand, higher haircuts protect the central bank from credit risk, but, on the other, they limit the amount of liquidity available to the financial system. For a given CPFF interest rate, a lower rate than those available in the market could potentially provide market participants with arbitrage opportunities. In essence, the Federal Reserve lent against specific collateral types, in this case highly rated commercial paper, at a penalty rate and held a margin of excess collateral, including cash collateral that should protect it against any loss under normal market conditions.

The anticipated credit risk of the facility's aggregate exposure was an important factor that guided the selection of registration and credit enhancement fees, as well as rates for unsecured and asset-backed paper. An initial analysis of the facility's credit risk was conducted to determine ranges of expected and unexpected losses under normal and stressed market conditions.

Hypothetical stress losses of 1.03 percent to 1.38 percent were found to reflect historical loss

ABCP issuers, announcing that the CPFF would not purchase ABCP from issuers that were inactive prior to the creation of the CPFF.

probabilities based on downgrade probabilities of short-term and long-term ratings. Any estimated potential credit losses by the CPFF SPV were offset by the facility's invested income from fees and interest received on maturing paper. In this regard, the cumulative invested income represented the capital available to absorb potential credit losses. The large flow of interest income from the first wave of maturities increased the facility's total capital to over \$2 billion, yielding a leverage ratio of nearly 3.4 percent (the leverage ratio is the book value of equity---accumulated through the fee income---divided by the book value of total commercial paper held in the facility). This capital cushion provided a sufficient buffer to absorb the portfolio's stress losses at a 99 percent confidence level, as calculated by a team of Federal Reserve Bank of New York economists and PIMCO credit analysts. Nevertheless, the facility's credit exposures were more concentrated than a highly granular loan portfolio at a commercial bank, and so its ex-post loss results could vary significantly from historical loss trends. On the facility's expiration date, the facility had accumulated income in excess of the commercial paper held in the SPV, thus no losses would be incurred.

3.4 Moral Hazard

The mere existence of a liquidity backstop raises concerns of moral hazard. In the case of the CPFF, expectations that the Fed would act as a lender of last resort and purchase commercial paper could have led issuers to engage in more risky behavior than they otherwise would have. Through its eligibility restrictions, the CPFF was structured to address this concern of possible moral hazard. For example, several months into the program, the eligibility rules were altered to deter the unintended consequence of reviving ABCP conduits that previously had exited the market. On January 23, 2009, the Federal Reserve announced that the CPFF would not purchase ABCP from issuers that were inactive prior to the creation of the CPFF. In this way, policymakers sought to

limit moral hazard through issuance that no longer had a natural investor base. In addition, the CPFF only accepted paper rated A1/P1. Presumably, issuers who engage in more risky behavior will risk their top tier credit rating and, consequently, jeopardize their eligibility for the facility.

Despite these eligibility restrictions, as long as a liquidity backstop exists for an asset market, there will always be some risk that issuers expect liquidity gaps to be filled for higher rated financial and asset-backed commercial paper. One way around this implicit moral hazard would be to publish information regarding participation with a lag. The attendant cost of such publication, however, is the associated stigma. This creates a risk that the facility is not used when most needed, even in cases where the liquidity risk is broad-based rather than firm-specific.

3.5 Relation to other Federal Reserve Liquidity Facilities

To address the strains in dollar funding markets that emerged immediately after the Primary Reserve Fund ‘broke the buck’, the Federal Reserve introduced two other facilities under section 13(3) in addition to the CPFF, the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF) and the Money Market Investor Funding Facility (MMIFF). All three facilities supported short-term funding markets and thereby increased the availability of credit through various mechanisms, though the CPFF was used more heavily than the other facilities. Two factors help to explain the CPFF’s considerable use. First, the CPFF addressed problems in short-term debt markets directly at their root – through lending directly to issuers – at a period when issuers faced potential liquidity shortfalls due to market dislocations. Indeed, the main factor distinguishing the CPFF from the other two facilities is that the CPFF serves as a backstop to issuers, while the other facilities provided emergency lending to institutional money market investors. Second, the CPFF backstopped issuance of both unsecured and secured commercial

paper, while the AMLF only funded ABCP and the MMIFF SPVs only purchase certificates of deposit, bank notes and commercial paper from specific financial institutions.

The economic rationale of the MMIFF is described in detail in the companion paper by Davis, McAndrews, and Franklin (2010). While the MMIFF was a liquidity facility for money market mutual funds in case of abrupt withdrawals by investors, the CPFF effectively bypassed the money market universe by allowing issuers to issue directly into the CPFF. Thus the two facilities addressed slightly different roles.

The AMLF was launched by the Federal Reserve Board on September 19, 2008. The Federal Reserve Bank of Boston was authorized to make loans to U.S depository institutions and bank holding companies to finance purchases of asset-backed commercial paper (ABCP) from money market mutual funds. This program specifically sought to aid money market mutual funds facing elevated redemption requests to meet their funding needs. The AMLF operated via a custodian bank, and lending was done directly via the discount window. Money market mutual funds sold ABCP to their custodian bank, which would subsequently pledge the ABCP to the discount window against a cash loan. It was possible to make the AMLF operational in a very short time frame, as its operational complexity was much lower than that of the CPFF. However, the AMLF only accepted highly rated ABCP and not unsecured commercial paper. AMLF usage peaked on October 8th, 2008.

The commonality of the CPFF, the PDCF, the TSLF, TALF, and the AMLF was that they were all liquidity facilities aimed at stabilizing funding in the money markets, and were created in order to counteract the financial market turbulences that threatened the stability of the system as a whole.²¹ Effectively, these facilities extended the Federal Reserve's lender of last resort to include

²¹ See also the testimony of Federal Reserve chairman Ben Bernanke before the Committee on Financial Services, U.S. House of Representatives, on the Troubled Asset Relief Program and the

non-depository institutions (this is the case for the PDCF, the TSLF, and the AMLF) or specific securities markets (as is the case for the CPFF and TALF). The facilities were based on the Federal Reserve's ability to extend credit to "any individual, partnership, or corporation" under "unusual and exigent circumstances" as per section 13(3) of the Federal Reserve Act.²²

4. Usage and Impact on the Commercial Paper Market

An issuer's decision to use the CPFF was predicated, in part, on the cost of issuance to the facility relative to the cost of issuance in the market or other alternative funding sources. As explained in the previous section, the facility's pricing was designed to be cost-effective during times of market stress, but prohibitively expensive during times of normal market function. Accordingly, as conditions in financing markets normalized in 2009, CPFF usage progressively declined.

4.1 Usage and Market Impact

The facility's assets grew rapidly at inception. In the first week of operation, it bought \$144 billion; it held \$293 billion after one month and \$333 billion by the end of December 2008 (see Figure 7).

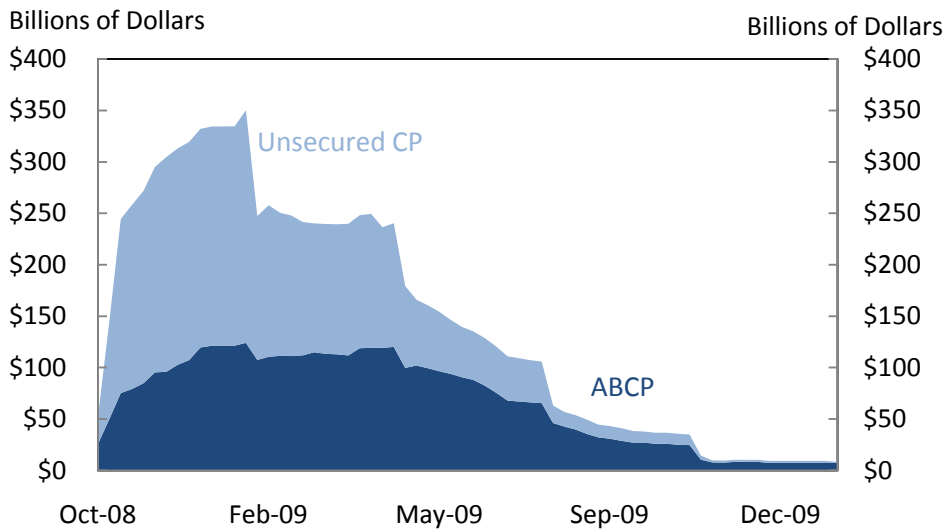
The peak of the CPFF was reached in the third week of January 2009, exactly three months after the first issuance date, with approximately \$350 billion in commercial paper held in the SPV.

Throughout 2009, usage of the CPFF steadily declined, reaching a level around \$10 billion in December 2009. At its peak level, the portfolio was primarily comprised of financial commercial paper. The composition of the CPFF's portfolio became more and more tilted towards ABCP after the first vintage of the CPFF matured at the end of January 2008. The large share of ABCP in the facility, which continued to increase during 2009, illustrates the continuing difficulties in obtaining funding in collateralized money markets.

Federal Reserve's liquidity facilities on November 18, 2008,
<http://www.federalreserve.gov/newsevents/testimony/bernanke20081118a.htm>.

²² <http://www.federalreserve.gov/aboutthefed/section13.htm>.

Figure 7: CPFF Outstanding



Source: Federal Reserve Bank of New York

CPFF issuers included a variety of ABCP conduits---including single seller, hybrid, multi-seller, and securities arbitrage conduits--- and other financial institutions that conducted banking, insurance and credit finance in the U.S. Issuance trends varied widely across registrants, reflecting issuers’ ability to finance in the market, reduced leverage in the financial system, a consolidation of issuers in the market place, and access to other government programs among other factors.²³

As of December 31, 2008, two-thirds of CPFF holdings were unsecured and the remaining one-third comprised ABCP. The unsecured paper was issued predominantly by banks and non-bank financials (“diversified financials”), some of which included TLGP-guaranteed paper. Insurance companies also issued unsecured paper, though to a lesser degree. By the end of 2009, many insurance companies faced losses in light of their exposure to mortgage financing, among

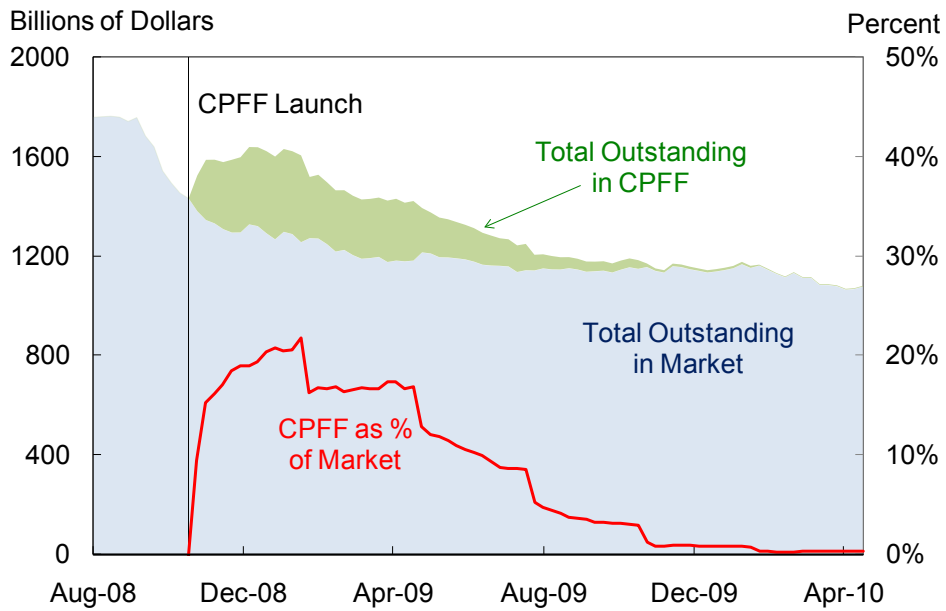
²³ Single seller conduits are established to fund the assets originated by one seller, or one seller and its subsidiaries and related entities, while multiseller conduits are structured to fund assets originated by a variety of sellers, typically all clients of the sponsoring commercial bank. Securities arbitrage issuers primarily fund highly-rated securities and investors in the conduits are exposed to the risk of default, or credit risk, of those securities. Hybrid conduits incorporate the structural features of two or more conduit types. Most hybrid conduits have multiseller and securities arbitrage characteristics. Moody’s (2003) contains further explanations of conduits.

other sectors adversely affected by the financial crisis and economic downturn. Ratings agencies subsequently downgraded the commercial paper ratings of several insurance companies and, as a result, eligibility for CPFF was compromised.

ABCP issuance accounted for a growing proportion of assets in the CPFF, suggesting that conduits had greater difficulty reentering the market, posing some risk of adverse selection in the facility. ABCP conduits were widely used as a means to finance “hard-to-finance” assets and, consequently, it was not surprising to observe a more gradual retrenchment from the facility in this sector. However, ABCP issuance in the market and CPFF naturally declined as assets amortized, securitization slowed, and assets were consolidated to parent balance sheets. In addition, ABCP programs shrank due to regulatory capital changes, and changes to accounting rules.

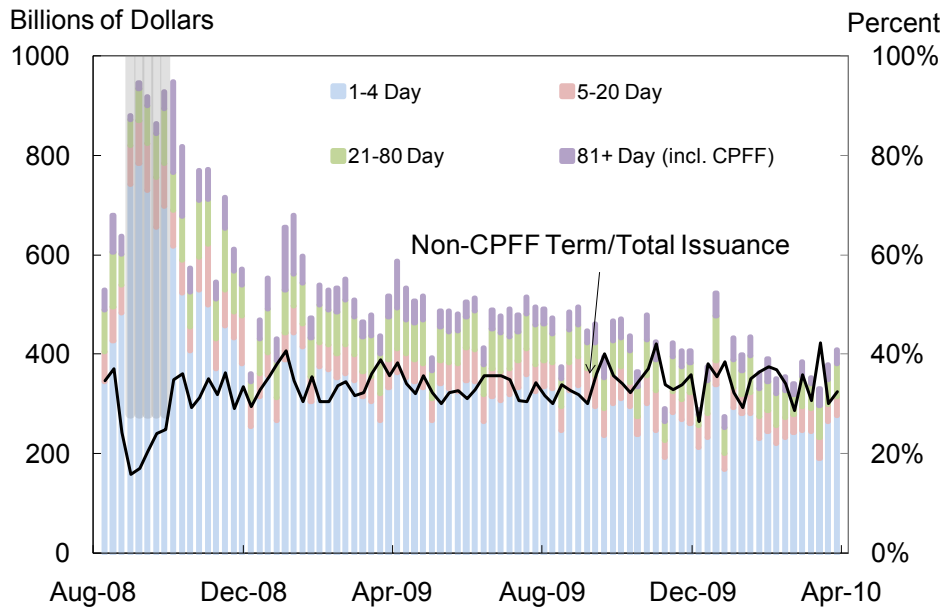
The stabilizing role that the CPFF played for the commercial paper market can best be seen in Figure 8, where the size of the CPFF, the total outstanding amount of commercial paper, and the share of CPFF as a proportion of total commercial paper are plotted. At the peak of the facility in January 2009, the CPFF held over 20 percent of all outstanding commercial paper. By the facility’s expiration, the facility has only comprised 1 percent of market issuance. The self-liquidating feature of the CPFF is illustrated by the steady decline of the outstanding amount throughout 2009.

Figure 8: Total Commercial Paper Outstanding



Source: Federal Reserve Board of Governors

Figure 9: Weekly Commercial Paper Issuance



Source: Federal Reserve Board of Governors

Figure 9 shows the maturity structure of commercial paper issuance. The crisis period after Lehman’s bankruptcy, and prior to the operation of the CPFF, is highlighted in grey. During the

crisis period, the fraction of term commercial paper issuance collapsed as money market funds shortened the duration of their assets to insure against further redemption pressures. In fact, over 75 percent of commercial paper issued in the second half of September and in early October consisted of maturities of only 1-4 days. As a result of the shortening of maturity, total commercial paper issuance rose rapidly in the crisis. Once the CPFF started to operate on October 27th, term commercial paper issuance started rising, and quickly reverted back to a tight range between 30 and 40 percent of total commercial paper.

The expansion of the CPFF was accompanied by the narrowing of the spreads between commercial paper rates and comparable OIS rates (see Figure 10). The degree to which the decline of the commercial paper spread was caused by the expansion of the CPFF requires further research, but the coincidence of the decline is suggestive of the impact of the program. Between the start of the program and December, the one-month AA financials spread declined from 188 basis points on October 27 to 38 basis points during the month of December (the latter being the average of daily business day rates during December), while the ABCP spread declined from 256 basis points to 86 basis points.²⁴ Over the same time period, the spread for the A2/P2 commercial paper---which was not eligible for the CPFF---rose from 483 to a December average of 503 basis points. The one month A2/P2 spreads to OIS continued to rise through the end of 2008 as creditors demanded increasing compensation from lower-rated issuers for use of their balance sheet over year end, a period when firms typically reduce leverage for the purpose of financial reporting and minimize risk amid a period of reduced market liquidity. Only after the passage of year end did the spread between eligible A1/P1 and ineligible A2/P2 narrow. CPFF holdings rose rapidly in the first three months following its creation likely because the rates charged by the facility were considerably

²⁴ The decline in the less liquid market of 3-month CP rates was also substantial. We report the 1-month rates due to the greater data availability.

below average market rates. As average commercial paper rates began to decline throughout 2009, CPFF usage declined as well.

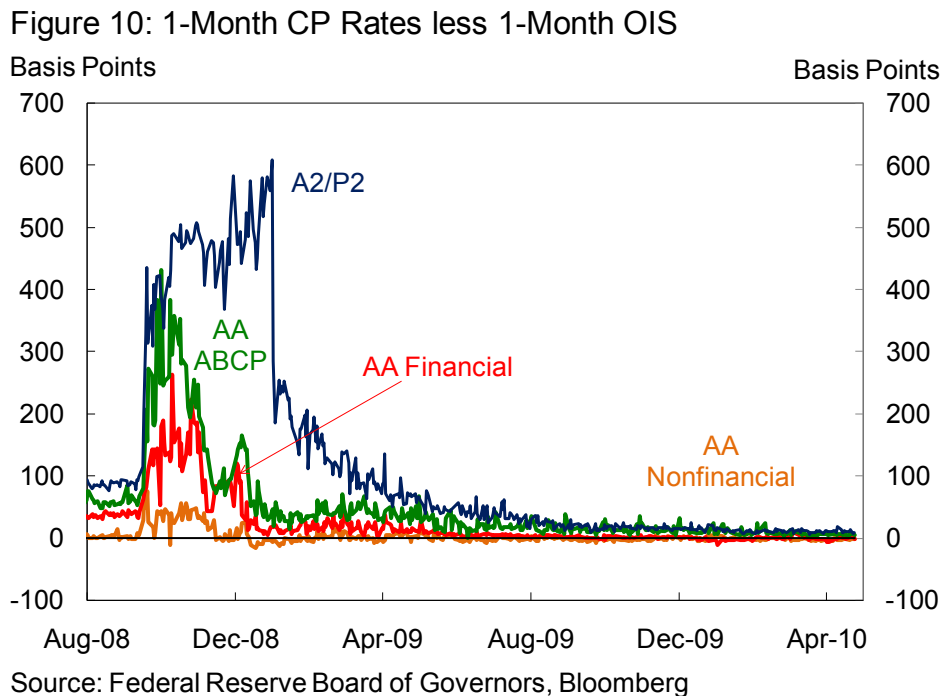


Figure 10 plots average spreads on commercial paper issued in the market and, as such, masks the actual cross-sectional dispersion of rates across issuers within each credit rating bucket. The underlying dispersion in rates is partially due to the fact that investors, particularly money market fund investors, have policies that limit their concentrations to counterparties to limit their credit exposure and maintain diversification. As money market funds effectively became more risk averse and attuned to credit differentiation, some funds responded to the financial crisis by either charging higher rates to issuers perceived as potentially more risky or barring certain names altogether from their portfolios. Continued issuance to the CPFF amid declining commercial paper rates highlights the wide range of rates transacted in the market. Despite the fact that the one-month commercial paper interest rate charged for AA ABCP averaged 32 basis points in the second half of 2009 and never exceeded 62 basis points, ABCP issuance into the CPFF at the penalty rate of 300 basis points (for the three month maturity) continued throughout the year. This suggests that some

issuers continued to find CPFF rates attractive relative to rates charged in the market. Another possible explanation is demand for issuance fell short of some issuers' required funding needs. At the onset of the crisis, investors were less willing to hold large positions in commercial paper, thus issuers may have been left with no other option than to satisfy remaining liquidity needs by issuing to CPFF.

4.2. Roll

The "roll" refers to times when commercial paper issuers retire existing commercial paper at its maturity but still require funding and therefore issue new commercial paper, i.e. the times when commercial paper is reissued or "rolled over". Because the maturity of the CPFF is 90 days, rolls occurred once a quarter. From the beginning to the end of the CPFF, there were five rolls of 90-day paper. The first roll was most significant given that CPFF holdings represented 20 percent of the total commercial paper market. Market analysts had speculated that the still fragile commercial paper market might come under additional strain if the maturing paper was reissued over a highly concentrated period into the private market. However, the first roll went smoothly as issuance into the private market remained small and whatever financing returned to the commercial paper or other private markets was relatively dispersed, with some issues pre-funding their CPFF maturities and using the proceeds to pay the maturing issuance in the CPFF. Throughout the second and third rolls, an increasing percentage of a smaller dollar amount came due and was paid down. By the fourth roll in October 2009, approximately 80 percent (\$28 billion) of the commercial paper in CPFF matured, of which approximately \$20 billion was paid down. As a result, commercial paper holdings in the CPFF amounted to just one percent of the total commercial paper market following the penultimate roll.

The most dramatic effect of the rolls was on the composition of the CPFF holdings. With each roll, ABCP became an ever greater share of the CPFF holdings as money funds continued to shun secured paper, particularly those with worse credit quality. Most of the remaining ABCP may have been of lower credit quality and had no natural buyer. For policymakers, this transformation in the CPFF composition raised concerns about adverse selection into the program and complication upon the program's conclusion if certain issuers could not have repaid.

4.3. Impact on the Federal Reserve Balance Sheet

The launch of the CPFF had a significant impact on the overall size of the Federal Reserve's balance sheet. Relative to other newly created liquidity facilities or outright purchases, the CPFF had one of the largest impacts on the Fed's balance sheet growth --- only the FX Swaps, and TAF had larger contributions. During this period of relatively rapid expansion in assets, the Fed's liabilities expanded primarily through excess reserve balances, though some of the balance sheet expansion was sterilized by increased issuance of Treasury SFP bills.²⁵ While the CPFF contributed to reserve growth, the contraction in the facility's holdings also outpaced other Federal Reserve programs given its punitive rate structure. This significantly offset the reserve creation of later programs such as the Large-Scale Asset Purchase programs.²⁶

The penalty fee of the CPFF represented income for the Federal Reserve. As of December 2009, net income generated by the facility was estimated by Fleming and Klagge (2009) to be \$5.3 billion. This represented a relatively large share of total profits from the liquidity facilities, which

²⁵On September 17, 2008 Treasury announced the Supplementary Financing Program (SFP), where Treasury issues a series of Treasury bills, separate from Treasury's current borrowing program, and deposits the proceeds from these issuances in an account at the Federal Reserve Bank of New York. Funds in this account drain reserves from the banking system, and therefore offset the reserve impact Federal Reserve lending and liquidity initiatives. Interest on reserves are discussed in Keister and McAndrews (2009).

²⁶ The impact of the CPFF and other credit and liquidity programs on the Federal Reserve's balance sheet and its income statement can be found at http://www.federalreserve.gov/monetarypolicy/bst_fedfinancials.htm

were estimated to be \$12.9 billion as of December 2009. These profits were transferred by the Federal Reserve to Treasury, and ultimately contributed to a reduction in the burden on taxpayers.

The economic interpretation for the income generated by the CPFF is as follows. During the fall of 2008, the private market for commercial paper became severely disrupted due to the reallocation of short-term savings from prime money market funds to Treasury-only funds. As a result, the Federal Reserve established the CPFF as a lender of last resort facility to address the temporary liquidity distortions created by the money market reallocations. However, by law, the Federal Reserve had to protect itself against any potential credit losses. It thus lent to commercial paper issuers at a penalty rate which, in turn, generated income from the facility. While market rates for commercial paper were unusually high, commercial paper issuers were willing to pay the penalty rate, thereby transferring money to the tax payer. As such, U.S. households gained in the aggregate. While obtaining the fee income generated by the CPFF, taxpayers also benefited from the fact that the facility potentially prevented commercial paper issuers from being forced into bankruptcy and, thereby, potentially distorting real investment decisions.

5. Conclusion

The CPFF serves as a noteworthy model for the Federal Reserve's role as a lender of last resort that reaches beyond depository institutions. In contrast to traditional discount window lending, the CPFF supports liquidity in a particular market, not the liquidity of a particular set of institutions. Similarly to the discount window, the CPFF is constructed as a backstop---not a permanent source of funding. While the discount window accepts a very broad range of collateral---including loans, mortgages, and securities---the CPFF focuses on a particular asset class, but has less stringent requirements as to the types of institutions that can borrow. The CPFF can be considered as a model of liquidity

provision in a market-based financial system, where maturity transformation is done outside of the commercial banking sector in a quantitatively and economically important magnitude.

The legal basis for the CPFF stemmed from section 13(3) of the Federal Reserve act, requiring “unusual and exigent circumstances.” As such, the Federal Reserve does not have the authority to make the CPFF a permanent liquidity backstop. This, in turn, has implications for the ongoing debate on regulatory reform. The financial market crisis of 2007-2009 demonstrated the vulnerabilities of the current financial architecture to liquidity crises emanating from non-depository institutions. As such, an important component of regulatory reform efforts focuses on the improvement of the resiliency of money markets to financial and economic shocks. Many ongoing reform efforts are aiming at reducing the vulnerability of money markets to liquidity crises; these efforts focus particularly on reforming money market funds, the commercial paper market, and the repo markets.

It has been long understood that the public sector plays a crucial role in the provision of liquidity. In times of aggregate liquidity shortages, only the monetary authority can act as lender of last resort, due to its ability to create money.²⁷ Traditionally, the lender of last resort has been available only to depository institutions because the vast majority of maturity and liquidity transformation took place in those institutions. Since the mid 1980s, however, the rapid growth of a market-based system of credit formation has allowed for maturity transformation by a wide range of institutions such as money market funds, finance companies and security broker dealers, and via a range of market instruments including asset-backed commercial paper and triparty repo. Despite the recent crisis, it seems likely that large amounts of maturity and liquidity transformation will continue to be conducted outside of depository institutions---and therefore without access to

²⁷ See Holmström and Tirole (1998) for a theory of public liquidity provision, and Diamond and Dybvig (1982) for a classic justification of discount window lending, and Acharya, Gale and Yorulmazer (2008) for a setting with rollover risk.

traditional lender of last resort---in this so-called "shadow banking system". The public sector's role in providing backstop liquidity to the shadow banking system will continue to be debated. Though the life of the CPEF was necessarily limited, the facility provides a model for a market-based lender of last resort liquidity backstop, which could serve as a guide for future policy.

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