

1 **MONEY MARKETS**

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6 **ABSTRACT**

7 Money markets offer monetary services and short-term finance in the capital market with
8 the credit support of institutional sponsors. Investors finance money market instruments at low
9 interest because their salability on short notice confers an implicit monetary services yield. Low
10 interest attracts borrowers to money markets. The fragile equilibrium depends on collective
11 confidence in the credit quality of instruments supplied to the market. Federal Reserve monetary
12 and credit policies have influenced interest rates and credit intermediated in the money market,
13 especially during the credit turmoil. Permissive regulatory rulings have allowed borrowers to
14 take increasing advantage of low interest funding in money markets via securitization and
15 structured finance—vastly increasing maturity, credit, and liquidity transformation through asset
16 backed commercial paper, repurchase agreements, and money market mutual funds. Funding in
17 such instruments and runs on these instruments helped to create the credit cycle that culminated
18 in the turmoil of 2007-2009.

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1	MONEY MARKETS
2	1. Introduction
3	2. Money, Banking, and the Origin of the Money Market
4	2.1 The Evolution of Money and Banking
5	2.2 The Origin of the Money Market
6	3. Equilibrium in Money Markets
7	3.1 The Demand for Monetary Services
8	3.2 The Supply of Monetary Services, Interest Rates, and Credit Intermediation
9	3.3 Monetary Services and Money Market Fragility
10	4. The Federal Reserve and the Money Market
11	4.1 Monetary and Credit Policies
12	4.2 The Transmission of Fed Interest Rate Policy to Money Market Rates
13	4.3 Expansive Fed Policies in the Credit Turmoil
14	5. Money Market Instruments, Securitization, and the Credit Turmoil
15	5.1 Securitization and Structured Finance
16	5.2 Asset Backed Commercial Paper
17	5.3 Tri-party Repurchase Agreements
18	5.4 Money Market Mutual Funds
19	6. Conclusion
20	Literature Cited
21	JEL Classifications: E4 E5, G1, G2, G3, K2
22	Key Words: asset backed commercial paper, monetary and credit policy, money and banking,
23	money market mutual fund, securitization and structured finance, tri-party repurchase agreement

1 **1. Introduction**

2 Money markets occupy a central place in modern financial systems, offering monetary
3 services and credit intermediation in the “near bank capital market” at maturities most commonly
4 three months and less. The money market is so named because it enables participants to acquire
5 cash on short notice or to place excess funds in easily salable short-term marketable securities.
6 The core of the money market in the United States is the interbank “federal funds market,” where
7 financial institutions borrow and lend balances that they hold at the Federal Reserve.

8 Borrowers in the money market are many and varied, as are the instruments on which
9 they borrow. (Cook & LaRoche 1993, Stigum & Crescenzi 2007) For instance, depository
10 institutions augment retail deposits with “managed liabilities” such as certificates of deposit and
11 repurchase agreements. Both financial and non-financial corporations issue commercial paper.
12 The US Treasury issues Treasury bills, and state and local governments issue short-term
13 municipal bonds. Government Sponsored Agencies (Fannie Mae, Freddie Mac, and the Federal
14 Home Loan Bank System) issue agency discount notes. Entities popularly known as “shadow
15 banks” perform market-based securitized credit intermediation and fund themselves in lightly
16 regulated money markets with asset backed commercial paper and repurchase agreements via
17 money market mutual funds. (McCulley 2007, Tucker 2010). “Money market investors
18 effectively fund every step in the shadow credit intermediation process...they are the lifeblood of
19 the shadow banking system.” (Pozar et al. 2010, p. 50)

20 Individuals, businesses, and governments all invest in money market instruments. They
21 invest indirectly through regulated money market mutual funds and unregulated money market
22 intermediaries. Large individual and institutional investors acquire wholesale money market
23 instruments indirectly and directly. According to Pozar et al. (2010, p. 52), in June 2007 just

1 prior to the onset of the credit turmoil, the money market was funded by roughly \$2.5 trillion
2 from regulated money market mutual funds, \$1.5 trillion from unregulated money market
3 intermediaries, and \$3 trillion directly from money market investors. By comparison, aggregate
4 bank deposits in the United States at the time totaled around \$6 trillion, so that aggregate liquid
5 assets nearly equaled the \$14 trillion GDP of the United States in 2007.

6 Money markets evolved initially to finance short-term assets with short-term securities.
7 Bills of exchange have been employed for centuries to finance international trade. Commercial
8 paper originated in the 19th century to enable businesses to finance working capital such as
9 accounts receivable and inventory in the capital market. Until recently, there was relatively little
10 “maturity transformation.” Since the 1980s, long-term, illiquid cash flows have been increasingly
11 “securitized” and funded in the money markets, where investors accept low pecuniary interest in
12 exchange for the “implicit monetary services” that money market instruments offer.

13 Pozar et al. (2010, p. 49) trace the lengthening of the term of assets funded in money
14 markets to: (1) the introduction of regulatory capital requirements for depository institutions in
15 the 1980s, (2) the threat posed to depositories as credit intermediaries by investment banks
16 through the latter’s innovative use of long-term securitization, and (3) the use of short-term
17 securitization by depositories through off balance sheet asset backed commercial paper conduits
18 to counter the threat.

19 Maturity and credit transformation associated with money and banking has long created
20 fragility at the heart of the financial system. The recent credit turmoil of 2007 and beyond is the
21 latest instance. This time the crisis involved not only the banking system but also the money
22 markets, where long-term mortgages financed via securitizations fueled an unsustainable
23 appreciation of housing prices.

1 The credit turmoil was marked, in particular, by three high-profile runs in the money
2 market. The first, beginning on August 9, 2007 erupted when depository institutions became
3 reluctant to lend to each other in the federal funds market and in the closely related offshore
4 Eurodollar interbank market. A massive run from asset backed commercial paper that depository
5 institutions had guaranteed precipitated a hoarding of interbank credit on evidence of a
6 widespread impairment of AAA mortgage securitizations previously thought safe.

7 The second run, this time on the investment bank Bear Stearns, precipitated the March 13,
8 2008 collapse of the firm after money market investors, concerned about Bears' losses on
9 subprime mortgage investments refused to roll over repurchase agreements with Bear. The run
10 on Bear Stearns was contained only after the Federal Reserve assisted the acquisition of Bear
11 Stearns by JP Morgan Chase.

12 The third run, began on September 17, 2008, involved the widespread redemption of
13 money market fund shares when the share price of a large public money fund, the Reserve
14 Primary fund, fell below \$1 due to large holdings of Lehman Brothers commercial paper that lost
15 most of its value when Lehman filed for bankruptcy on September 15th. The run on money
16 market funds abated only after the US Treasury made an extraordinary offer on September 19th
17 to guarantee money market mutual fund assets for a year.

18 The article proceeds as follows. Section 2 reviews the origin of money markets as an
19 outgrowth of money and banking. Section 3 describes the central role of monetary services in the
20 equilibrium determination of interest rates and credit intermediated in money markets, and in the
21 fragility of that equilibrium itself. Section 4 distinguishes between Federal Reserve monetary
22 policy and credit policy. It describes the transmission of Fed interest rate policy to money market
23 interest rates and the influence of expansive Fed monetary and credit policies on money markets

1 during the credit turmoil. Section 5 describes the role of securitization and structured finance in
2 the money market and their relationship to three money market instruments that featured
3 prominently in the credit turmoil: asset backed commercial paper, tri-party repo, and money
4 market mutual funds. Section 6 is a brief conclusion.

5

6 **2. Money, Banking, and the Origin of the Money Market**

7 The money market grew out of depository banking over time and remains dependent
8 today on depository institutions for credit enhancement. This section presents a stylized history
9 of money and banking drawn from Goodfriend (1991a) to provide perspective on the origin and
10 nature of the money market.

11 **2.1 The Evolution of Money and Banking**

12 As the medium of exchange, money famously overcomes inconveniences of barter
13 known as the “double coincidence of wants.” Money also facilitates specialization in production
14 by providing a means of settling exchanges independent of the creditworthiness of either party.
15 To provide “monetary services” the value of monetary assets must be authenticated
16 inexpensively. Monetary assets must be accepted without question in the knowledge that they
17 will be received in payment for future goods and services with little price risk.

18 Gold and silver long served as “commodity monies,” their divisibility and certification by
19 coinage serving to economize on transactions costs in everyday exchange. The production and
20 use of commodity money to make payments is costly, however, and monetary systems evolved
21 to substitute credit claims on particular institutions for commodity money. The substitution of
22 credit money for commodity money proceeded in stages. When placed in storage, claim checks
23 against gold or silver could circulate in place of the gold or silver coin itself. Security required

1 costly oversight and management that could be provided efficiently by a wealthy person of long-
2 standing reputation whose wealth and reputation could serve as a performance bond to guarantee
3 the gold or silver behind the claim check.

4 Paper claims could circulate freely and yield monetary services indefinitely. Hence, a
5 large fraction of warehoused gold or silver could be lent at interest to defray the cost of
6 managing the warehouse. To obtain these monetary services, claimants became “general
7 creditors,” entitled only to an equal value of their gold or silver upon withdrawal, rather than the
8 specific items of gold or silver initially deposited. Paper claim checks became bank notes and
9 warehouses became financial intermediaries.

10 Gradually, interest earning “demand deposits” became the primary form in which the
11 public held money. The low interest paid on bank deposits reflected the monetary services that
12 deposits offered in comparison to longer-term, less liquid assets. The “demand for money” by the
13 public balances the interest opportunity cost against the monetary services yield (McCallum &
14 Goodfriend 1987).

15 Aggregate bank deposits constitute a sizable source of loanable funds. The banking
16 system evolved to employ the pool of deposits to provide long-term “information intensive”
17 relationship lending on the basis of line of credit commitments (Kashyap, Rajan, & Stein 2002).
18 The equilibrium loan rate exceeded the deposit rate by the marginal cost of relationship lending
19 including the cost of capital necessary to maintain the impeccable credit rating required to attract
20 demand deposits.

21 Banks utilize an extensive network of interbank credit relationships to support payment
22 services for their depositors. Connectivity makes the banking system as a whole vulnerable to
23 doubts about the solvency of banks anywhere in the system. Yet the fractional reserve system

1 cannot satisfy a widespread demand to convert deposits into currency.(Allen & Gale 2007;
2 Diamond & Dybvig 1983; Goodhart & Illing 2002; Haldane 2009).

3 Private clearinghouse associations emerged in the 19th century United States to supervise
4 and enforce asset quality throughout the banking system. In 1873, 1893, and 1907 the
5 clearinghouses responded to widespread bank runs by temporarily coordinating general
6 restrictions on the convertibility of deposits into currency (Sprague 1010). The 1907 run was
7 precipitated by concerns in the money market regarding “trust companies,” the shadow banking
8 institutions of the day (Tallman & Moen 1990). In the 20th century the supervisory and
9 regulatory duties of clearinghouses were assumed by the Federal Reserve with the help of the
10 Federal Deposit Insurance Corporation which implemented nationwide deposit insurance.

11 **2.2 Origins of the Money Market**

12 The money market grew out of depository banking over time. (Bagehot 1873; Flandreau
13 & Ugolini 2010; Myers 1931; Simmons 1951; Sprague 1903) Banks assisted and supported the
14 early development of the money market in three ways illustrated below. First, banks created
15 negotiable bills of exchange by substituting their own credit for that of the borrower. Later,
16 banks back-stopped commercial paper programs with lines of credit. More recently, banks issued
17 their own “managed liabilities” such as negotiable certificates of deposit.

18 The bill of exchange, or bankers acceptance as it is also known, arose centuries ago to
19 finance international trade. A bill of exchange is created when an importer asks his bank to send
20 a letter of credit to the exporter for the goods to be exported. Upon shipment, the exporter uses
21 his letter of credit to draw a time draft on the importer’s bank and discount the draft at his own
22 bank to obtain immediate payment. The exporter’s bank, in turn, sends the time draft with the

1 shipping documents to the importer's bank for "acceptance" and payment (Cook & LaRoche
2 1993, Chapter 10).

3 The importer's bank could hold the bill on its balance sheet or sell, or rediscount, the bill
4 in the money market if the bank were widely-known to be creditworthy. Bills of well-known
5 reputable banks traded actively in secondary markets, providing a monetary services yield in
6 addition to their pecuniary interest. The importer would pay his bank the face value of the bill of
7 exchange at maturity often after the imported goods have been sold. Bills of exchange have been
8 replaced in recent years, in large part, with commercial paper issued directly into the money
9 market by firms involved in international trade (Bagehot 1873, Chapter 11).

10 Commercial paper arose in the 19th century United States as a substitute for bank loans
11 then constrained by the interstate prohibition of branch banking. Subsequently, commercial
12 paper developed as a short-term unsecured promissory note issued by large, widely-known,
13 creditworthy corporations to exploit their favorable visibility to borrow directly in the capital
14 market and "cut out the banker-middleman."

15 In contrast to other money market instruments which trade actively, there is little trading
16 in secondary markets for commercial paper. This reflects the lack of standardization due to the
17 heterogeneous characteristics of the broad range of issuing firms, and the tailoring of paper to the
18 needs of individual issuers or investors. Also, commercial paper has an average maturity of a
19 month or less and so carries considerable "rollover risk." Hence, commercial paper programs
20 do not generally access the money market directly without the assistance of depository
21 institutions in the form of back-stop lines of credit.

22 Commercial paper has grown in recent decades into one of the most important money
23 market instruments, with around \$2 trillion outstanding in 2007 prior to the credit turmoil.

1 Roughly half of commercial paper outstanding is unsecured and tied to the issuer's financial
2 condition. The remainder is asset backed commercial paper, a relatively recent innovation first
3 appearing in 1983, whose creditworthiness is tied to the cash flows from explicitly specified
4 assets. (Cook & LaRoche 1993, Chapter 9; Kacperczyk & Schnabl 2010)

5 Depository institutions in the United States began to sell large negotiable certificates of
6 deposit in 1961, initially to replace lost corporate demand deposits that could not then pay
7 interest, and later as a means to manage liabilities flexibly and enhance balance sheet capacity.
8 Certificates of deposit trade actively in secondary markets. A surge in the institutional corporate
9 demand in recent years expanded the market for certificates of deposit outstanding in the United
10 States to around \$1.5 trillion in 2006 before the credit turmoil. (Cook & LaRoche 1993, Chapter
11 4; Stigum & Crescenzi 2007, Chapter 20)

12

13 **3. Equilibrium in Money Markets**

14 The equilibrium determination of interest rates and credit intermediation in money markets
15 and their inherent fragility are best understood in terms of the demand and supply of monetary
16 services.

17 **3.1 The Demand for Monetary Services**

18 Money market instruments yield monetary services to investors confident that the
19 instruments can be sold on a moment's notice for cash without question at little cost and price
20 risk. Individual entity holdings of money market instruments fluctuate considerably over time.
21 The turnover is how liquid money market investments yield monetary services. Ordinarily,
22 however, the aggregate demand for money market instruments is relatively stable since "one
23 entity's receipts are another's expenditures."

1 Individual economic entities have an incentive to target a buffer stock of money market
2 assets on average over time that depends positively on their income or net worth and negatively
3 on the interest opportunity cost. The choice balances the convenience of avoiding “liquidity
4 stock outs” (requiring costly asset sales or costly external borrowing) against interest forgone by
5 holding money market instruments instead of higher-yielding less liquid assets. In other words,
6 investors finance money market instruments at low interest because they yield monetary services
7 (Bates, Kahle, Stulz 2006; Miller and Orr 1966; Opler et al. 1999).

8 **3.2 The Supply of Monetary Services, Interest Rates, and Credit Intermediation**

9 Money markets are an attractive source of loanable funds for borrowers in a position to
10 create money market instruments suitable for providing monetary services. Borrowers supply
11 money market instruments up to the point where the marginal cost of securitizing less liquid,
12 longer-term assets for funding in the money market rises to equal the risk-adjusted net interest
13 saved by funding in the money market. Investors demand money market instruments up to the
14 point where their marginal monetary service yield falls to equal the risk-adjusted interest
15 opportunity cost of holding low-interest money market instruments rather than higher-interest,
16 less liquid, longer-term assets. Money market interest rates adjust relative to interest on less
17 liquid assets to clear the money markets. The less costly is the production of instruments for
18 funding in the money market, the greater will be credit intermediated in the money market and
19 the higher will be equilibrium interest in the money market relative to interest on less liquid
20 assets elsewhere in the capital market (Goodfriend & McCallum 2007; Holmstrom & Tirole
21 1998).

22

23

3.3 Monetary Services and Market Fragility

Money market equilibrium is fragile because money market instruments provide monetary services only if everyone thinks that everyone else will accept them on short notice without question with little price risk. Money market instruments provide monetary services only if participants remain “insensitive” to underlying asset quality in Gorton’s (2010) terminology. The requisite insensitivity, together with the dependence on collective confidence makes money markets vulnerable to perceived credit quality concerns anywhere in the market.

In a good equilibrium, money market investors forego due diligence on the transfer of money market instruments. Implicitly, the vast majority of money market investors rely on the diligence of others to monitor and assure asset quality. Financial institutions in particular do so by guaranteeing or providing back-stop credit lines for commercial paper and overseeing conduits that securitize assets for funding in money markets. Asset quality is disciplined by the incentive of borrowers to sustain a reputation that allows them to borrow at low interest cost in the money market.

Yet, when confidence is high due diligence is low. It is particularly tempting then for issuers to create assets to securitize and fund at low interest cost in the money market by secretly cutting corners. If not detected and stopped, such surreptitious behavior lowers equilibrium credit spreads in money markets and crowds out higher quality assets more costly to create and securitize. Other borrowers must either follow suit and degrade their asset quality or withdraw from the market. Either way, the temptation secretly to cut corners in asset quality endangers the absolute confidence needed to sustain the monetary services yield, without which money market equilibrium would collapse.

1 As discussed in Section 5 below, money markets operate under a variety of regulatory
2 arrangements, many designed to enforce the quality of assets backing money market instruments.
3 This is a tall order, as the weakening of asset quality and the collapse of money markets in the
4 recent credit turmoil attest. For instance, to supplement the reliance upon private reputation alone
5 to enforce the credit quality, the SEC has long required commercial paper issued in the money
6 market to be certified by credit rating agencies. The credit turmoil showed that rating agencies
7 could not effectively oversee the money market. In fact, ratings may have given investors a false
8 sense of security--reducing the incentive of participants to monitor issuers and the incentive for
9 issuers to invest in their own reputation. (Atkeson, Hellwig & Ordonez 2010)

11 **4. The Federal Reserve and the Money Market**

12 The Federal Reserve exercises a major influence on interest rates and credit
13 intermediation in the money market with its monetary and credit policies. Fed monetary and
14 credit policies are described in Section 4.1. Section 4.2 describes the mechanism by which
15 depository institution arbitrage ordinarily transmits Fed interest policy to money market interest
16 rates. Section 4.3 reviews expansive Fed policy initiatives undertaken to overcome widening
17 interest rate spreads in the credit turmoil.

18 **4.1 Monetary and Credit Policies**

19 Monetary policy involves purchases or sales of Treasury securities to expand or contract
20 aggregate reserve balances available to depository institutions in order to influence their scarcity
21 and marginal liquidity services yield. For instance, by draining reserves and increasing the
22 liquidity services yield, a central bank drives up the equilibrium overnight interbank rate relative
23 to interest paid on reserve balances. The equilibrium interbank rate is then determined by

1 monetary policy in conjunction with the rate of interest the central bank chooses to pay on
2 reserves (Goodfriend 2002a). Until the recent credit turmoil, the Fed satisfied virtually all of its
3 asset acquisition needs in support of monetary policy by purchasing Treasury securities, an
4 acquisition policy known as “Treasury only.” This was done to avoid carrying credit risk on the
5 Fed’s balance sheet.

6 Credit policy involves lending to depositories or other private institutions through the Fed
7 discount window, or purchasing private securities or agency securities, with the proceeds from
8 the sale of Treasury securities from the Fed portfolio. Credit policy has no effect on the federal
9 funds rate because it does not change aggregate bank reserves or interest paid on reserves. Credit
10 policy is debt-financed fiscal policy carried out by the central bank. Why? Fiscal policy involves
11 the use of public funds acquired with current taxes or by borrowing against future taxes; so fiscal
12 policy includes the lending of public funds to particular borrowers financed by selling Treasury
13 securities against future taxes. Since the Fed returns to the Treasury the interest earned on
14 Treasury securities that it holds, when the Fed sells Treasuries to finance a credit initiative, such
15 as a discount window loan or the purchase of mortgage-backed securities, the result is just as if
16 the Treasury financed the credit initiative by borrowing from the public. The Fed undertook
17 monetary and credit initiatives in combination during the credit turmoil by funding credit policy
18 with newly created bank reserves (Goodfriend 2011).

19 **4.2 The Federal Reserve and Money Market Interest Rates**

20 The Federal Open Market Committee (FOMC) employs monetary policy and interest on
21 reserves to manage the overnight federal funds (interbank) rate over time to stabilize inflation
22 and employment (Clarida, Gali, and Gertler 1999; Goodfriend 2002b; Woodford 2002). Federal
23 funds rate policy actions are transmitted to the financial system and the rest of the economy

1 through their influence on term interbank lending rates (such as the 3-month overnight index
2 swap rate and 3-month Libor in the Eurodollar market) and then via arbitrage to money market
3 interest rates. Federal funds rate target changes are “highly persistent and seldom quickly
4 reversed” so that a change in the overnight federal funds rate carries expected future overnight
5 federal funds rates with it and thereby exerts maximum leverage on term interbank rates with a
6 minimum of movement of the overnight federal funds rate (Goodfriend 1991b).

7 Competition among depository institutions active in the (interbank) federal funds market
8 determines term commercial bank loan rates roughly as the sum of the average expected
9 overnight federal funds rate over the term of the loan plus a spread that covers the cost of
10 managing and monitoring the loan (the external finance premium). Likewise, competition
11 among depositories keeps interest on certificates of deposit (CDs) in line with average expected
12 overnight federal funds rates over the term of the CD.

13 Arbitrage ties interest rates on money market instruments such as repurchase agreements
14 (RPs), commercial paper (CP), and Treasury bills (TBs) to rates in the banking system.
15 Depository competition for loanable funds keeps RP rates in line with the federal funds rate.
16 Investors in money market funds keep CP rates and TB rates in line with CD rates of comparable
17 maturity. Money market interest rates ordinarily differ slightly from each other for a variety of
18 reasons. For instance, TB rates typically trade below term federal funds rate because federal
19 funds are unsecured while Treasuries carry the “full faith and credit of the US government.”
20 Perceived default risk differentials also induce money market yield differentials. Finally, given
21 risk-adjusted total returns on money market instruments, implicit monetary service yield
22 differentials among money market instruments can create offsetting explicit interest rate
23 differentials to some extent.

1 **4.3 Expansive Fed Policies in the Credit Turmoil**

2 The Fed vastly expanded its monetary and credit policies in the credit turmoil to offset
3 the unprecedented elevation of interest rate spreads in money markets and facilitate credit
4 intermediation. The credit turmoil greatly weakened depository arbitrage that links the expected
5 federal funds rate target to term interbank rates such as 3-month Libor. Ordinarily, depository
6 arbitrage would keep 3-month Libor within 10 basis points of the 3-month Overnight Indexed
7 Swap (OIS) Rate which captures the expected interest rate that would accrue from repeatedly
8 rolling over a loan at the overnight federal funds rate for three months (Cecchetti 2009).
9 Following the onset of the credit turmoil in August 2007, the 3-month Libor/OIS spread reached
10 a temporary peak of 85 basis points in September and then fluctuated roughly between 1
11 percentage point and 40 basis points until the failure of Lehman in September 2008 when it
12 jumped to more than 350 basis points before coming back down in 2009. To offset the elevation
13 of the Libor/OIS spread on term interbank lending rates such as Libor, the Fed cut its target for
14 the federal funds rate from 5.25% in August 2007 to 2% by March 2008, and expanded bank
15 reserve balances from around \$10 billion in early September 2008 to over \$1 trillion by year end
16 as it then drove the overnight federal funds rate nearly to zero.

17 The Fed pursued a combination monetary and credit policy, adding reserves to the
18 banking system by extending over \$400 billion of discount window loans to depository
19 institutions by April 2009, far beyond the previous record high of \$30 billion of Fed credit
20 extended briefly following the 9/11 terrorist attacks (Armantier, Krieger & McAndrews 2008;
21 Taylor & Williams 2009). Moreover, the Fed extended its credit reach well beyond depository
22 institutions. By April 2009, it had utilized part of its \$1 trillion reserve creation to purchase

1 around \$400 billion of mortgage-backed securities guaranteed by Fannie Mae, Freddie Mac, and
2 Ginnie Mae, and to finance a \$200 billion loan to its Commercial Paper Funding Facility.

3 Federal Reserve credit policies played an important role in the money market directly and
4 indirectly. For instance, commercial paper and mortgage backed securities purchased directly by
5 the Fed helped to offset the loss of funding following the run on money market mutual funds in
6 September 2008. Indirectly, Fed discount window lending helped to finance lines of credit that
7 depositories offered to back-stop commercial paper programs and conduits in the money market.

8

9 **5. Money Market Instruments, Securitization, and the Credit Turmoil**

10 The credit turmoil was initiated, amplified, and propagated by high-profile runs involving
11 three money market instruments: asset backed commercial paper, tri-party repurchase
12 agreements, and money market mutual funds. These instruments were particularly susceptible to
13 runs because they relied on two stages of “monetization” of underlying assets. In the first stage,
14 relatively illiquid, long-term cash flows were “securitized” and “structured” into tranches. In the
15 second stage, tranches rated AAA were funded through asset backed commercial paper,
16 repurchase agreements, and money market mutual funds. The two-stage process of securitization
17 for funding in the money market is summarized below. Each instrument is described in full and
18 its collapse in the credit turmoil is reviewed.

19 **5.1 Securitization and Structured Finance**

20 The following description of securitization and structured finance draws on Board of
21 Governors of the Federal Reserve System, “Report to the Congress on Risk Retention” (2010). A
22 financial intermediary securitizes a pool of underlying financial assets when it creates securities
23 backed by the cash flows from those assets and sells some or all of these securities to investors

1 (Klee & Butler2002). The intermediary may or may not retain responsibility for servicing the
2 cash flows by collecting payments from borrowers, monitoring the performance of the
3 underlying assets, and distributing the cash flows generated to investors.

4 Importantly, securitization also involves the sale of the underlying assets to a
5 “bankruptcy-remote entity” known as a conduit (or special purpose vehicle) if created
6 specifically for an individual securitization, or a master trust if it issues new liabilities on an
7 ongoing basis (Langbein 1997-1998; Elmer 1999). The use of a conduit or master trust assures
8 that assets transferred into a securitization cannot be seized by creditors upon the bankruptcy or
9 failure of the transferors or securitizers of the assets.

10 Securitization may also utilize “structured finance,” the creation of a capital structure
11 with different payment priorities. For instance, a pool of assets may be transformed into a “senior
12 tranche” composed of securities that are first in line to receive cash flows and a “junior tranche”
13 containing securities that are next in line to receive cash flows. Junior claims “protect” senior
14 claims to the extent that defaults are uncorrelated in the underlying pool of assets, so that senior
15 claims can have credit risk that is below the average of the asset pool as a whole (Coval, Jurek &
16 Stafford 2009).

17 Structured securities that appeal to different types of investors can reduce the cost of
18 funding the entire structure by “tailoring” components to particular investor preferences. For
19 instance, investors specializing in risk-taking might prefer junior tranches. Senior tranches
20 perceived to be relatively “risk free” would be held by investors with a preference for safe assets.
21 Credit ratings and credit enhancements have been employed to assure credit quality of assets in
22 securitizations (McAndrews & Rochet 2007; Skreta & Veldkamp 2007). AAA credit ratings
23 conferred on senior tranches a degree of “information insensitivity” that prepared them for

1 financing in the money market. As it turned out, AAA-rated tranches performed poorly in the
2 credit turmoil, in large part because default rates on underlying assets proved much more highly
3 correlated than previously supposed (Coval, Jurek & Stafford 2009).

4 **5.2 Asset Backed Commercial Paper**

5 Asset backed commercial paper originated in 1983 to finance trade receivables and credit
6 card receivables securitized in conduits sponsored by depository institutions, in part, to move
7 such financing “off balance sheet” to avoid capital requirements then recently imposed on banks
8 (Pozar et al. 2009). Short maturity asset backed commercial paper, typically 30 days or less,
9 matched the short maturity and predictability of the cash flows. There was relatively little
10 “maturity transformation.” The range of collateral expanded over time to include longer-term
11 financial assets such as auto loans, commercial loans, student loans, and mortgage backed
12 securities. By early 2007, most conduit assets backing commercial paper were medium- to long-
13 term, with maturities of three to five years.

14 Asset backed commercial paper has been structured in three ways to be funded at low
15 interest cost in the money market, and in money market mutual funds in particular. First, asset
16 backed commercial paper conduits have restricted themselves to AAA-rated assets or their
17 equivalent, in part via extensive purchases of AAA-rated senior tranches structured from
18 securitizations produced by their sponsoring financial institution or elsewhere. Second, asset
19 backed commercial paper is generally short maturity, under 30 days on average.

20 Third, sponsoring institutions have agreed to “guarantee” the purchase of maturing paper
21 at par if the conduit is unable to refinance maturing paper itself. Depository institutions have
22 stopped short of providing binding commitments of support known as “full credit guarantees,”
23 which would require them to satisfy regulatory capital requirements. Nevertheless, fee income

1 earned for sponsoring conduits motivates depositories voluntarily to support their conduits
2 financially when needed. The presumption that voluntary guarantees will be honored has enabled
3 asset backed commercial paper to qualify for credit ratings that satisfy regulatory eligibility for
4 funding in money market mutual funds (Acharya, Schnabl, and Suarez 2010; Board of
5 Governors of the Federal Reserve System 2010; Kacperczyk and Schnabl 2010).

6 Acharya, Schnabl, and Suarez (2010) report that the volume of asset backed paper
7 outstanding doubled from 2004 to around \$1.1 trillion by 2007. Large depository institutions
8 then sponsored around \$900 billion or about 75 percent of asset backed commercial paper. About
9 one-third of bank-sponsored conduits has been invested primarily in residential mortgage backed
10 securities and collateralized debt or loan obligations. Another third has been invested primarily
11 in business receivables.

12 The start of the credit turmoil of 2007 is generally dated to August 7th, when the French
13 bank BNP Paribas halted withdrawals from three of its funds invested in mortgage-backed
14 securities (Kacperczyk and Schnabl (2010, p.37). Within two days the interest rate spread on
15 overnight asset backed commercial paper over the federal funds rate rose from 10 basis points to
16 150 basis points, as investors refused to roll over their commercial paper in the face of ratings
17 downgrades in structured mortgage securities, especially on those previously information
18 insensitive “AAA-rated tranches” backed by subprime mortgages up to that time thought free of
19 default risk (Covitz, Liang & Suarez 2009). Depository institutions, in turn, drove up credit
20 spreads in interbank markets, elevating 1-month term LIBOR relative to the average expected
21 federal funds rate from under 10 basis points to around 90 basis points as they hoarded funds to
22 support their credit guarantees and back-stop lines of credit for commercial paper (Acharya, Gale
23 & Yorulmazer 2008).

1 By December 2007, asset backed commercial paper outstanding had contracted by \$350
2 billion from a peak around \$1200 billion; and it contracted further to around \$700 billion in 2008
3 reversing all its growth since 2004, as average maturity shrank to 15 days. Thus, began the
4 dynamic that intensified and perpetuated the credit turmoil. See Bernanke (2010) for an overview.

5 Coval, Jurek & Stafford (2009), p. 4 report that “During the past decade, risks of all kinds
6 have been repackaged to create vast quantities of AAA-rated securities...roughly 60 percent of all
7 global structured products were AAA-rated, in contrast to less than 1 percent of the corporate
8 issues...these products were eagerly bought up by investors around the world...By 2008...a
9 huge fraction of existing products saw their ratings downgraded, with the downgrades being
10 particularly widespread among what are called “asset backed security collateralized debt
11 obligations—which are comprised of pools of mortgage, credit card, and auto loan
12 securities...By mid-2008, structured finance activity was effectively shut down”

13 **5.3 Tri-party Repurchase Agreements**

14 The thorough description and analysis of the tri-party repurchase market in Copeland,
15 Martin & Walker (2010) serves as the basis for the discussion below. A repurchase agreement is
16 a transaction in which one participant acquires cash by selling securities and simultaneously
17 agrees to repurchase the same or similar securities after a specified term at a given price which
18 includes interest at an agreed rate. In essence, a repurchase agreement is a short-term cash loan
19 where the cash borrower posts “collateral” such as Treasury securities, corporate bonds, agency
20 securities, or asset backed securities. The majority of repos are overnight or short-term. The
21 performance risk on a repo is usually mitigated by a “haircut,” a deduction on the value loaned
22 against the security.

1 The modern conception of the repurchase agreement as a cash loan against an absolutely
2 secured collateral interest derives from Congressional legislation in 1984 that exempted Treasury
3 and federal agency securities, bank certificates of deposit, and bankers acceptances from the
4 automatic stay in bankruptcy, enabling lenders to liquidate any repo securities in their possession
5 in the event of a cash borrower default (Cook and LaRoche 1993, Chapter 6; Garbade 2006).
6 Congress extended the automatic stay in a 2005 law to include mortgage loans and mortgage-
7 related securities (Acharya and Oncu (2011, p. 330). Roe (2009) presents a critical perspective
8 on these legislative actions.

9 Tri-party repurchase agreements (repo) are the most prevalent form of repo contract in
10 the United States. Cash lenders in tri-party repo are primarily money market mutual funds.
11 Money market funds use repo extensively because repo is regarded as a safe, liquid asset with
12 which to provide monetary services to their investors. Custodial banks also lend on tri-party repo
13 with cash acquired from their clients who have loaned securities to facilitate short sales by others.

14 Cash borrowers in tri-party repo are mainly “broker-dealers” in fixed-income securities
15 who wish to acquire securities at low interest cost to trade on behalf of their clients. Primary
16 dealers obtain around 50 percent of secured funding through tri-party repo (Acharya & Oncu
17 2011, p. 328). Broker-dealers use repo to leverage their capital in order to acquire a large
18 portfolio of securities to trade. The size of the repo haircut governs the leverage that can be
19 obtained. For instance, a broker-dealer starting with \$100 of its own capital invested in
20 securities with a 5% haircut can borrow \$95 against his initial capital. The broker-dealer can then
21 purchase \$95 of new securities with the loan and repeat the process, borrowing against 95% of
22 the \$95 of new securities. Continuing to “rehypothecate,” or “repo out” securities, the broker-

1 dealer can leverage his initial capital 20 times in the repo market to finance a portfolio of
2 securities worth \$2000 with only \$100 in capital (Gorton & Metrick 2010; Singh & Aitken 2010).

3 Traditionally, tri-party repo investors have insisted on the safest collateral such as US
4 Treasury and government agency securities. During the credit boom, however, riskier less liquid
5 collateral including securitized structured mortgage products rose to make up around 30 percent
6 of the total collateral in tri-party repo. Tri-party repo has also been collateralized by corporate
7 bonds, municipal bonds, and more generally collateralized debt obligations and other asset
8 backed securities.

9 At its peak before the failure of Bear Stearns in March 2008, outstanding tri-party repo
10 reached around \$2.8 trillion, up from around \$0.8 trillion in 2002 (Federal Reserve Bank of New
11 York 2010). Tri-party repo volume fell back sharply thereafter to around \$1.6 trillion by 2010
12 as investors pulled back their funding and dealers deleveraged. Prior to their failures, the
13 investment banks Bear Stearns and Lehman Brothers had leverage ratios of over 30 with
14 significant dependence on overnight repo finance (Duffie 2010, p. 61) .

15 Dealer banks create value at the heart of tri-party repo by offering a variety of market
16 making services which enhance the liquidity of the underlying securities. For instance, dealers
17 underwrite and market new bond issues; and dealers stand ready to buy and sell securities in
18 secondary markets. Dealers negotiate private trades in over-the-counter markets (Duffie 2010).

19 The three-sided nature of tri-party repo comes about because a dealer must maintain an
20 account with a “clearing bank” in order to provide market-making services. There are two tri-
21 party repo clearing banks in the United States, JP Morgan Chase and Bank of New York. The
22 clearing banks have played a crucial role as intermediaries in tri-party repo.

1 Clearing banks intermediate between lending and borrowing on tri-party repo. Cash
2 lenders such as money market funds hold cash balances on the books of a clearing bank, and
3 cash borrowers such as dealers hold securities balances at a clearing bank, respectively. Clearing
4 banks act as agents to the two sides of tri-party repo, providing operational services such as
5 custody of securities, settlement, valuation of collateral, and efficient allocation of collateral.
6 Each morning, the clearing bank “unwinds” the prior day’s repos, sending cash back to lenders
7 and collateral back to dealers. Clearing banks then finance the dealer’s portfolio of securities
8 during the day with intraday credit, giving dealers access to their securities during the day so
9 they can conduct their market-making activities.

10 Importantly, tri-party repo has been structured as “general creditor” finance. In return for
11 a slightly higher repo rate, cash lenders give up the right to specific securities as repo collateral
12 and instead agree to a general class of securities. General creditor repo maximizes the flexibility
13 with which dealers can trade securities during the day and thus facilitates the liquidity services
14 that dealers provide in securities markets. The clearing bank utilizes this degree of flexibility
15 afforded by general creditor repo to allocate available securities when it allocates collateral to
16 overnight repo trades at the end of the business day (Fleming & Garbade 2003).

17 Tri-party repo has had two major vulnerabilities. First, as is the case with all overnight
18 repurchase agreements, the daily unwind facilitates runs by cash lenders. Second, the exposure of
19 the clearing bank to a dealer default during the day creates an incentive for the clearing bank to
20 refuse to finance the dealer. Federal Reserve Bank of New York (2010) discusses these
21 vulnerabilities and recommends reforms to mitigate them.

22 The vulnerability of tri-party repo was made real in the run on Bear Stearns that
23 precipitated its failure on March 13th, 2008. Geithner (2008) provides an account. Duffie (2009)

1 provides an understanding of the “failure mechanics” of a dealer bank such as Bear. Essentially,
2 lending to Bear on repo against collateral did not offer security against default because Bear was
3 large enough that a widespread “fire sale” of repo collateral created the possibility that losses
4 could exceed the haircuts. In particular, money market funds have had restrictions, eg, maturity
5 limits, on the types of assets they are permitted to hold, so they would have been required to sell
6 much of the collateral they might have received in the event of a repo default by Bear,
7 exacerbating the fire sale.

8 The Federal Reserve pursued two expansive credit policy initiatives in the money
9 markets in connection with the failure of Bear Stearns. First, to facilitate the acquisition of Bear
10 by JP Morgan Chase, the Fed created a special purpose entity (Maiden Lane LLC) to acquire \$30
11 billion of assets of questionable value from Bear financed with a \$29 billion loan from the sale of
12 a like amount of Treasury securities from the Fed’s portfolio. Goodfriend (2011) describes the
13 “off budget” fiscal policy nature of this and other Fed credit initiatives during the credit turmoil.

14 Second, on March 16th the Fed created the Primary Dealer Credit Facility (PDCF) to
15 extend Fed credit to 19 primary investment banks and brokers unsupervised by the Fed and
16 previously without access to Fed credit. The PDCF was used widely. Borrowing averaged over
17 \$30 billion per day before declining to \$10 billion by the end of May. Most importantly, the
18 PDCF stabilized the tri-party repo market with the knowledge that broker-dealers could borrow
19 even more extensively at the Fed on short notice, if need be, against a relatively broad range of
20 collateral (Adrian, Burke & McAndrews 2009; Copeland, Martin, Walker 2010; FRB New York
21 2010).

22
23

1 **5.4 Money Market Mutual Funds**

2 Money market mutual funds are financial intermediaries that purchase pools of short-
3 term financial instruments and sell shares in these pools to investors. Money funds emerged in
4 the 1970s as an alternative to bank deposits when money market interest rates rose well above
5 the Regulation Q ceiling rates that depository institutions were then permitted to pay on small
6 time and savings deposits. In spite of the elimination of interest rate ceilings on bank deposits in
7 the 1980s, money funds continued to compete successfully with bank deposits, reaching around
8 \$2.5 trillion in total assets by 2007.

9 Organized as mutual funds, money funds operate under the jurisdiction of the Investment
10 Company Act (ICA) of 1940. The ICA requires a mutual fund to adjust its price per share to the
11 daily market value of its securities so that investors know immediately the true value of the
12 securities held on their behalf. From the beginning, however, money fund managers sought to
13 market themselves as close substitutes for bank deposits, and asked the Security and Exchange
14 Commission (SEC) for an exemption from the ICA so that money funds could offer investors a
15 stable share value of \$1. That way, investors could withdraw money from a fund anytime at par
16 without penalty as if they had deposited their funds in a bank.

17 The SEC agreed to grant money funds an exemption from mark-to-market accounting so
18 their securities could be valued at acquisition cost, with interest rate adjustments absorbing
19 amortization of premium or accretion of discount. The SEC stipulated that a money fund would
20 have to “break the buck” and re-price its shares if the mark-to-market per-share value of the
21 fund’s assets deviated by more than one half percent from the \$1 per-share price. In 1983, the
22 SEC issued “Rule 2a-7” which began to codify restrictions on the maturity, credit quality, and
23 diversification of the assets of a money fund that wished to offer a stable share value. For

1 instance, the rule required money funds to hold securities rated “high quality” by a major rating
2 service, or if unrated, judged by the fund’s board of directors to be of comparable quality. The
3 SEC has renewed the mark-to-market exemption and tightened asset restrictions on other
4 occasions, most recently following the September 2008 run on money market funds (Cook &
5 LaRoche 1993, Chapter 12; Report of the President’s Working Group on Financial Markets
6 2010).

7 Kacperczyk and Schnabl (2010, p. 36) report data from early 2007 for taxable money
8 market funds, then with roughly \$2 trillion in total assets, showing that commercial paper
9 accounted for around 33% of assets, government debt and government-backed agency debt
10 accounted for about 25%, repurchase agreements for 20%, and depository obligations for 15%.
11 Non-taxable money funds hold primarily instruments issued by state and local governments. The
12 largest 15 institutional money funds accounted for around 25% of total money fund assets.

13 Money market mutual funds have grown rapidly since the 1970s for four reasons, in spite
14 of the elimination by the early 1980s of most interest rate ceilings on bank deposits. First, with
15 SEC complicity money funds succeeded in marketing their shares like bank deposits, ordinarily
16 insensitive to underlying asset values. Second, a long history of voluntary support of money
17 funds by their sponsoring institutions contributed substantially to their perceived safety. Third,
18 the creation of asset backed commercial paper via securitization and structured finance produced
19 a growing supply of assets for funding in money funds. Fourth, regulators allowed depository
20 institutions to guarantee asset backed commercial paper purchased by money funds without
21 requiring that regulatory capital be set aside against these guarantees (President’s Working
22 Group on Financial Markets 2010).

1 Bank deposits and money funds have long coexisted with average interest rate spreads
2 consistently favoring money funds. One reason is that underpriced deposit insurance depressed
3 interest on deposits relative to money funds; although the advantage to deposits is probably
4 offset to some degree today by the perceived underpriced implicit government support of money
5 funds. Another reason is that depository institutions have a comparative advantage in delivering
6 monetary (payments) services because depositories hold reserve balances at the central bank. For
7 a common total return—including explicit interest plus an implicit marginal monetary services
8 yield—deposits carry a higher marginal monetary services component than money funds. Hence,
9 interest on deposits must fall below interest on money funds and other money market instruments
10 of comparable risk. Deposit rates fall still lower than money market rates to the extent that banks
11 deduct overhead costs and transactions fees from interest on deposits instead of charging for such
12 items separately.

13 Money funds fared well in the early stage of the credit turmoil following the August 7th
14 2007 revelation that began the collapse of the asset backed commercial paper market. Somewhat
15 surprisingly, there was no run on the money market funds even though some funds had invested
16 heavily in asset backed paper. Managers had cultivated in money fund investors a sense of
17 confidence that served them well. Once before, a small money fund had “broken the buck,” but
18 on over a dozen occasions that threatened to break the buck, money fund sponsors had stepped in
19 to maintain a \$1 share value (Birdthistle 2010, p. 1179). Money funds simply downsized their
20 holdings of asset backed paper as it matured. Financial institution sponsors paid out investors in
21 maturing paper that could not be rolled over.

22 Nevertheless, weaknesses were apparent. SEC regulations had prohibited money funds
23 from buying mortgage backed securities directly. But money funds were exposed to long-term

1 mortgage credit risk indirectly via asset backed commercial paper. Although money funds fared
2 reasonably well at this point, they helped finance mortgages that precipitated the unsustainable
3 appreciation of house prices, and their rescue by depository sponsors froze interbank credit and
4 depleted capital in the banking system.

5 Money market investors were more nervous by the time Lehman Brothers filed for
6 bankruptcy on September 15, 2008. That day, the Reserve Primary Fund with \$62 billion in
7 assets announced it was heavily invested in Lehman's commercial paper. The Reserve Fund was
8 run immediately and forced to "break the buck" on September 16th, precipitating a run on other
9 money funds also invested in commercial paper. Kacperczyk and Schnabl (2010), report that
10 institutional investors withdrew \$172 billion from money funds that week.

11 As late as March 2006 Stecklow and Guillapalli (2008) report that the Reserve Primary
12 Fund stated in its filings with the SEC that it did not invest in commercial paper. A week later it
13 deleted a line from its prospectus saying the fund couldn't buy commercial paper. At the time of
14 the Lehman bankruptcy the Reserve Fund held nearly \$800 million of Lehman paper, a good
15 example of the temptation discussed in Section 3 for money market managers to "reach for
16 yield" surreptitiously by degrading their asset quality.

17 On September 19, 2008, the US Treasury and the Federal Reserve announced two
18 unprecedented market interventions that succeeded in stopping the run. Treasury offered to
19 guarantee money fund assets for a year for those funds that elected to participate in its program.
20 The Federal Reserve extended credit to US banks and bank holding companies to finance their
21 acquisitions of high quality asset backed commercial paper from money funds. In October, the
22 Fed established the Commercial Paper Funding Facility and ultimately financed the facility with
23 \$200 billion of loans to purchase commercial paper from issuers (Adrian, Kimbrough &

1 Marchioni 2010). Also in October 2008 the FDIC extended unlimited deposit insurance to non-
2 interest bearing transactions balances which the 2010 Dodd-Frank Law extended to January 2013.

3 Acharya, Schnabl, Suarez (2010), pp. 31-2 report that credit guarantees of conduits
4 covered virtually all maturing asset backed commercial paper and repaid 97 percent at maturity
5 or shortly thereafter from January 2007 to December 2008 as asset backed commercial paper
6 outstanding contracted from around \$1200 billion to \$600. Sponsoring depository institutions
7 absorbed most of the huge losses on asset backed commercial paper due to the collapse of the
8 prices of underlying collateralized mortgage obligations. An ex-ante regulatory capital charge
9 likely would have discouraged depositories from offering guarantees on asset backed paper
10 (Admati et al. 2010).

11 The SEC in January 2010 adopted new rules regulating money funds to require more cash
12 on hand, to reduce credit risk, and to reduce interest rate risk. Among other things, the new rules
13 allow a money fund threatened with a run to promptly suspend redemptions and liquidate its
14 portfolio in an orderly manner. Also, new rules restrict money funds' exposure to long-term debt
15 securities through repurchase agreements collateralized by securities other than cash equivalents
16 or government securities. The SEC continues to require money fund assets to be rated "high-
17 quality" by a major credit rating agency. However, the SEC reconsidered, but declined to revoke
18 the exemption granted to money funds from having to mark their shares to market (although the
19 SEC has begun to release monthly "shadow" prices that reflect the actual market value of money
20 fund assets). The President's Working Group on Financial Markets (2010) contains a
21 comprehensive discussion of reform options for money market mutual funds. See also Volcker
22 and Frenkel (2009).

23

6. Conclusion

Money markets originated long ago as a dull corner of the capital market where businesses financed short-term trade and working capital. They've since grown in size with the help of securitization and structured finance to rival the volume of credit intermediated through the banking system, taking on massive maturity mismatch, credit risk, and liquidity risk in the process. The modern transformation of the money market was facilitated by a series of permissive regulatory rulings most importantly—exempting money market mutual funds from marking their shares to market, exempting repurchase agreements from the stay in bankruptcy, allowing depository institutions to guarantee asset backed commercial paper without setting aside regulatory capital, and allowing rating agencies to qualify asset backed commercial paper for financing in money market mutual funds on the basis of non-binding voluntary credit guarantees by depository sponsors. The result was a credit cycle fueled by money market finance that collapsed with runs in asset backed commercial paper, tri-party repo, and money market mutual funds. The disastrous role of money market finance in the credit cycle should prompt a reconsideration of the permissive regulatory rulings above so that money markets do not again become the financial fuel for a future catastrophe.

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