The Evolution of a Financial Crisis:
Runs in the Asset-Backed Commercial Paper Market*

by

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Abstract

The $350 billion contraction in the asset-backed commercial paper (ABCP) market in the last five months of 2007 played a central role in transforming concerns about the credit quality of mortgage-related assets into a global financial crisis. This paper attempts to better understand why the substantial contraction in ABCP occurred by measuring and analyzing runs on ABCP programs over the period from August 2007 through December 2007. While it has been suggested that commercial paper programs, like commercial banks, may be prone to runs, we are the first to conduct a comprehensive empirical analysis of runs in the ABCP market. Our analysis uses a rich issue-level data set for all ABCP programs in the U.S. market to identify runs and evaluate whether they were driven by panic or fundamentals, such as credit and liquidity risk. We define a program as entering a run during a week in which it does not issue paper despite having a substantial share of its outstandings scheduled to mature, and then continuing in a run until it issues. We find substantial evidence of runs: more than 100 programs (one-third of all ABCP programs) were in a run within weeks of the onset of the turmoil and the odds of leaving the run state were very low. We also find that runs were linked to fundamentals. Further, we find that runs in the first several weeks of the turmoil appeared to be driven importantly by panic, suggesting the ABCP market may be inherently unstable.

Keywords: Commercial paper, asset-backed commercial paper, bank runs, financial crisis, panics

JEL Codes: G01, G10, G21

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I. Introduction

The U.S. asset-backed commercial paper (ABCP) market played a pivotal role in the global financial market turmoil that erupted in the summer of 2007. A narrative of the turmoil begins with mounting delinquencies of subprime mortgages triggering a decline in investor confidence in mortgage financial intermediaries and ratings downgrades of structured mortgage securities. Reflecting these concerns, investors became reluctant to roll over ABCP, causing yields on new issues of ABCP to soar and outstanding paper to plummet $190 billion, almost 20 percent, in August, and fall by an additional $160 billion by the end of the year (see Figures 1 and 2). In the ABCP market, where investors expect to be able to access their funds on demand at par value, even limited concerns about risk can instigate flight from the market. The steep contraction in ABCP, in turn, sparked concerns about whether banking institutions that explicitly provided program back-up liquidity support or implicitly provided liquidity as a sponsor would be able to meet their obligations. As a result, banking institutions began to hoard their cash and became extremely hesitant to lend in inter-bank funding markets, and LIBOR spreads even at overnight terms widened sharply. In addition, the investor pullback from the ABCP market led programs to reduce their demand for highly-rated tranches of mortgage backed securities (MBS), which made it difficult to structure new securitizations of mortgages. Thus the events in the ABCP market had far-reaching and long-lasting consequences for the broader financial markets and the economy.

An open question with implications for the stability of the U.S. and other financial systems with sizable ABCP markets is whether panic played a role in the events in the ABCP market. The alternative is that these events can be explained as runs on ABCP programs that were driven primarily by fundamental factors related to the value of the program's assets and the strength of its liquidity support. A pure panic-driven run can be thought of as an equilibrium in which investors refuse to rollover a program's paper because they believe that other investors will do the same, perhaps forcing the program to sell assets at fire sale prices. Knowing whether

a market is prone to panic is important because, by definition, panic magnifies shocks and thus poses significant risks for financial stability.

The possibility that the ABCP market is prone to panic-driven runs is suggested by the similarities between ABCP programs and banks. Like banks, ABCP programs issue liquid short-term debt to finance illiquid and long-term assets. Moreover, if we define banks as entities that create informationally-insensitive debt, as argued in Gorton and Pennacchi (1990), then ABCP conduits are similar to banks because they issue debt that is highly-rated, collateralized, and short-term. As a consequence, the well-accepted theoretical notion formalized most classically in Diamond and Dybvig (1983) that banks may be vulnerable to panic-based runs suggests that ABCP programs may be vulnerable as well. In addition, the fact that ABCP conduits and banks appear to require some form of liquidity support to issue short-term debt suggests that they are both prone to runs.[1] Of course, ABCP programs, like banks, may also be subject to fundamentals-driven runs, whereby investors quickly flee from potentially insolvent and poorly supported programs.[2]

In this paper, we measure runs in the ABCP market during the financial turmoil and evaluate whether the runs are linked to fundamental factors, such as credit and liquidity risk, or can be attributed instead to panic. Thus, we are looking for a strong form of panic that leads investors to run from all types of programs, even ones with solid liquidity support and no apparent credit impairment. We focus on the period from August 2007 through December 2007 to better understand the origins of the financial crisis. It is during this period that concerns first surfaced about commercial bank liquidity positions, and the demand by ABCP conduits and investors in the repurchase market for highly-rated MBS disappeared, which set the stage for the shutdown of new MBS without explicit backing by the government.[3] [4]

[1] To be more precise, the need for liquidity support is suggestive of runs, while the existence of liquidity support should help to mitigate runs.

[2] Diamond and Dybvig (1983) are the first to make the distinction between panic- and fundamentals-driven runs.

[3] See Gorton (2009) for a discussion of the link between the sharp increase in haircuts and other difficulties in the repurchase market and the collapse of securitization activity in the summer of 2007.

[4] We plan to investigate whether panic played a role in the commercial paper market in the fall of 2008 in a separate paper. Events in the fall of 2008 are distinct from those in August to December of 2007, the period of study in this paper. In particular, runs occurred on ABCP programs but not unsecured programs in 2007, whereas there was a steep rise in runs on unsecured CP programs in the fall of 2008. Moreover, the runs on CP programs in 2008 appear to have been accompanied by large withdrawals from money market mutual funds, which are major investors in CP, whereas flows to money market mutual funds were relatively stable during August to December 2007.

While we are the first to conduct a comprehensive empirical analysis of runs in the ABCP market, others have suggested that runs of one kind or another have taken place in the unsecured segment of the commercial paper market. For example, Calomiris (1995) uses the term "run" to describe the events in the unsecured commercial paper market surrounding the failure of Penn Central in 1970, during which it defaulted on about $80 million of unsecured commercial paper. Apparently alarmed by the default, investors refused to roll over large quantities of maturing paper at other unrelated programs, and issuers were forced to turn to commercial banks for emergency financing. Another run on unsecured commercial paper programs reportedly occurred following Enron's failure in 2001. As Gatav and Strahan (2006) describe, many firms faced difficulty borrowing in the commercial paper market during that time as the accuracy of financial statements came into question. They cite (p. 870) a WSJ article describing the commercial paper market as the corporate world's automated teller machine, which began sputtering after Enron's collapse and sent firms scrambling for funds 'after getting a cold shoulder from commercial-paper investors." More recently, Acharya, Gale, and Yorulmazer (2009) provide a theoretical model that explains sudden freezes in secured debt markets when assets are financed with short-term debt subject to rollover risk, even when the assets are subject to very limited credit risk. Similarly, He and Xiong (2009) model rollover risk as an equilibrium bank run when short-term debt contracts are staggered and investors use fundamental impairment as a coordination device for their decision to run or stop rolling short-term debt contracts.

In addition, a number of studies have analyzed the nature of bank runs. Calomiris and Mason (2003) find that panic-driven (i.e., non-fundamentals-driven) runs played only a small role in the bank failures of the 1930s. In addition, Gorton (1988) finds that banking crisis in the National Banking Era (1863-1914) could be predicted by deteriorations in economic conditions, and so were not pure panics—though he also points out that the deteriorations in fundamentals could cause panics. Similarly, Demirguc-Kunt and Detragiache (1998) find that systemic banking crises in a variety of countries from 1980-1994 tended to occur when growth in a country was low and inflation high.

In our empirical analysis, we contribute to the understanding of runs using a rich issue-level data set of ABCP transactions in 2007. We define a program as entering a run during a week in which it does not issue paper despite having 10 percent or more of its outstandings scheduled to mature, and then continuing in a run until it issues again. Our data set contains proprietary information from the Depository Trust Corporation (DTC) on the prices and quantities of almost 700,000 transactions by about 340 ABCP programs in the U.S. commercial paper market, as well as weekly information on outstandings at these commercial paper programs. Our data also contain a number of proxies for fundamentals, including type of program, bank and non-bank sponsor, ratings, and liquidity support characteristics. A key advantage of our analysis over prior studies of runs is the high frequency of our data, which allows us to study the weekly evolution of runs and their determinants at the onset and through the crisis. We also use daily information on yield spreads of new ABCP issues to buttress our interpretation of runs as constraints on the ability of conduits to borrow rather than a reduction in the demand for short-term financing.[5]

Our analysis yields substantial evidence of runs in the ABCP market. Indeed, we find that about 30 percent of programs were in a run within weeks of the onset of the turmoil and nearly 40 percent of programs were in a run at the end of 2007. We also find that apparent exposure to subprime mortgages and weak liquidity support were important determinants of runs throughout the five-month period, but that the rapid proliferation of runs in August and September was not well explained by deteriorating fundamentals, pointing to an initial period of panic. Notably, nearly all the runs that began in the early weeks of the crisis persisted in subsequent months. Thus, while panic may have been brief, its impact was prolonged. We also find that yield spreads ballooned in the first several weeks of the crisis for all types of programs, but increased more for the types of programs identified as being subject to runs. This difference suggests that runs represent an inability to issue or to issue only at high spreads, rather than a choice by high-quality programs to exit the market.

The remainder of this paper proceeds as follows. In Section II we discuss why one might expect ABCP programs to be subject to runs, types of ABCP programs, data, and summary

[5] The notion that the risk of a run can be priced is shown in Goldstein and Pauzner's (2005) theoretical model of bank runs, and more recently in Morris and Shin (2009).

statistics on outstandings and spreads that are suggestive of runs. Section III displays our methodology for estimating and analyzing runs, and our empirical results follow in Section IV. We conclude in Section V with a discussion of implications.

II. Background on the ABCP Market and Data

i. ABCP programs are like banks, but without explicit deposit insurance

There are different types of ABCP programs, but they share important common features that make them like banks. In general, ABCP conduits issue liquid short-term debt to finance assets, such as receivables, loans, or securities. These assets generally are longer term and more illiquid than its debt. Traditionally, liquidity of ABCP was achieved by limiting assets to assets with high credit quality and short maturity, and by explicit support provided by a line or letter of credit from the sponsoring commercial bank. Thus, like banks, ABCP provide liquidity and maturity transformation services. In addition, a prominent feature of many ABCP programs is that they were created by banks to fund bank assets in an off-balance sheet conduit, possibly as a way to avoid regulatory capital requirements.

More than half of ABCP daily issuance is expected to roll over the next day, that is has a maturity of 1 business day. ABCP is thought to be liquid because investors can liquidate their positions, as often as every day, with no price impact. ABCP is held largely by money market mutual funds, investors who are ultra-sensitive to any delay in payment, and do not want to risk a less than full payment. Pennacchi (2006) describes money funds as a safe haven asset, and thus want to hold only high quality assets to avoid "breaking the buck" (when the net asset value falls below $1).[6] The evident strains in the overall CP market around every year-end and around the century turn Y2-K – events related to the market and not the specific program -- also strongly indicate that investors are anxious about timely payments (Downing and Oliner, 2006).

[6] There are only two cases of money funds breaking the buck. The first case happened in 1994 when the net asset value of a fund that held structured notes fell to .96 as interest rates rose and this fund was consequently liquidated. The SEC later disallowed money funds from holding this type of structured notes that led to the loss. The second case occurred in September 2008, when a money fund with relatively large exposures to defaulted short-term debt issued by Lehman Brothers broke the buck. To prevent more money funds from breaking the buck or facing even more massive redemptions, the Treasury established a temporary guarantee program on existing 2a-7 money fund accounts, and the Federal Reserve implemented a liquidity facility to allow money funds to orderly liquidate their ABCP holdings.

Like bank assets, the maturity of assets in ABCP conduits is longer than the liabilities. Loan and lease receivables, which are commonly purchased by ABCP conduits, likely have terms of 30 days or more, and while relatively short, are still longer than most ABCP. Most loans and debt securities, which are also funded with ABCP, have even longer terms and may be even less liquid. In addition, asset holdings of ABCP conduits, like at banks, are not transparent. While the vast majority of ABCP programs have credit ratings from the major rating agencies, credit support mechanisms vary and the specific assets held in the programs are not widely known. For example, some ABCP programs view their holdings to be 'proprietary' investment strategies and deliberately do not disclose. Thus, random events or concerns about an economic downturn can create uncertainty about asset values. This uncertainty is greater when less information is available about the assets.

While ABCP programs are like banks, a key distinction, with important implications for financial stability, is that ABCP programs do not have explicit deposit insurance provided by the government. Most traditional ABCP programs are sponsored by commercial banks that also provide explicit liquidity support. As the ABCP market grew dramatically in recent years, nearly doubling in size between 2004 and 2007, some programs, as described below, began to employ other techniques for liquidity support or offered less than full support.

ii. Types of ABCP programs

ABCP programs differ importantly by type of assets held, sponsors, and services provided by the sponsor (see Table 1). Sponsors make all the economic decisions, such as which assets to purchase and how to finance in the ABCP market. Often the sponsor provides various forms of liquidity and credit support.

The most traditional ABCP program is a *multi-seller* program, in which a bankruptcy-remote conduit purchases receivables and loans from multiple firms. The sponsor is a financial institution that typically provides the conduit with a committed liquidity line, administers its daily operations, and sometimes also provides the conduit with credit enhancement through a letter of credit that absorbs credit losses. At the end of July 2007, just before the widespread turmoil, there were 98 multi-seller programs in the U.S. ABCP market with outstandings of $525 billion, about 45 percent of total ABCP outstanding.

Single-seller programs involve a conduit that issues paper backed by assets from only one originator, which frequently also sponsors the conduit. The majority of single-seller conduits mainly fund credit card receivables, mortgages, mortgage-backed securities, or auto loans. Such programs tended not to have explicit liquidity support, but were thought to be implicitly supported by originators. In addition, many of these programs issued extendible paper, which allows the issuer the option to extend the maturity of its paper and pay a pre-specified penalty rate to the investor. This feature presumably is an alternative for explicit liquidity support to mitigate roll-over risk. In July 2007, there were 40 *non-mortgage single-seller* programs, about 11 percent of the U.S. ABCP market. There also were 11 *mortgage single-seller* programs that primarily warehoused mortgages prior to their securitization.

Even more similar to a bank structure are the *securities arbitrage* programs. These programs involve banks sponsoring conduits to finance long-term assets through a special purpose entity that has a lower regulatory capital charge than if the assets were held on balance sheet. The sponsor banks provide full liquidity support. By using off-balance-sheet funding, commercial banks exploit regulatory capital arbitrage opportunities. In July 2007, there were 35 programs that accounted for about 13 percent of the U.S. ABCP market.

Similarly, *structured investment vehicles* (or SIVs) fund highly-rated securities. But unlike the securities arbitrage programs, SIVs do not have explicit agreements with their sponsoring banks for committed back-stop liquidity lines covering all their short-term liabilities. Instead SIVs relied on dynamic liquidity management strategies, which involved liquidating assets to pay investors if needed. Specifically, mark-to-market accounting for SIVs was implemented with liquidation clauses that transferred the control of the program to a trustee that could liquidate the SIV's assets if its junior liabilities eroded or asset prices declined rapidly. Before the financial turmoil caused SIVs to change their practices (and ultimately disappear), most SIVs issued medium-term notes (senior liabilities with longer maturity than commercial paper), in addition to ABCP, to attenuate liquidity risks. In addition, SIVs also issued junior

liabilities to absorb the first credit losses to attenuate credit risks to ABCP investors. At their peak in July 2007, there were 35 SIVs that accounted for $84 billion of U.S. ABCP.[7]

Some ABCP is issued by *collateralized debt obligations* (CDOs), sometimes called SIV-lites. CDOs are similar to SIVs in structure, but are not actively managed and tend to rely on explicit but only partial liquidity support. There were 36 ABCP CDO programs in July 2007, with ABCP outstanding of $47 billion.

Finally, *hybrid* programs combine features of securities arbitrage and multi-seller programs, combining securities and receivables in their portfolios. In January 2007, hybrid programs accounted for about 8 percent of the U.S. market, respectively, and other programs not classified elsewhere accounted for another 10 percent.

iii. Mortgage Exposures

An important trigger in this financial crisis was expected losses on subprime mortgages and highly-rated structured products that contained these mortgages. Runs in ABCP could arise because asset returns are expected to fall or become more uncertain, or because investors need more liquidity or become more risk-averse. Thus, when asset holdings are better understood and liquidity is more fully supported, investors can be more confident and runs would be less likely. However, while investors could easily categorize ABCP programs by the types of assets held, there is little information about the specific underlying assets and thus considerable uncertainty about expected loss exposures of individual programs.

Investors likely had the clearest insight into single-seller mortgage conduits, because their assets were mortgages originated by the lender, and liquidity was often also supported by that lender. Securities arbitrage, SIVs, and CDOs were also known or suspected to hold subprime MBS, but specific securities holdings often were not disclosed and, indeed, viewed as representing proprietary investment strategies. A Moody's report (2007a) documented that for SIVs that they rated, about one-quarter of the combined assets were in highly-rated private label mortgage-backed securities. In a separate report, Moody's (2007b) reports that securities

[7] Moody's (2008) reports that assets under management in SIVs totaled almost $400 billion in July 2007. Medium term notes financed about 65 percent of the assets, U.S. ABCP financed 21 percent, Euro CP and repos financed 5 percent, and junior debt financed about 9 percent.

arbitrage programs, like SIVs, also had about 27 percent of its assets in highly-rated private label mortgage-backed securities. While both SIVs and securities arbitrage programs had substantial subprime mortgage exposures, specific asset holdings were opaque. An important distinction between securities arbitrage and SIVs, however, is that the latter lacked explicit full liquidity support, which may help to explain a result below that investors ran on SIVs but not securities arbitrage programs.

iv. Contractual features of ABCP programs

Most ABCP programs are rated by the major nationally recognized statistical rating organizations. Money market mutual fund investors rely on ratings to determine eligibility for their purchase. Because many are secured by receivables, or underlying assets are AAA-rated, or because of its structure, the vast majority of ABCP programs carry the highest rating, designated as P1 by Moody's Investors Service. This rating is determined by the ability of the program to pay in full.

Some programs carried an extendibility provision that allowed it to extend the maturity of its paper past its due date for some period of time at a pre-set rate. Most single-seller programs and about 20 percent of multi-seller programs contained an extendible feature. Notably, American Home Mortgage, a non-bank mortgage lender, declared bankruptcy on August 6, 2007 and extended its ABCP program, named Broadhollow, at a rate that turned out to be well below market rates. For money market mutual funds, the extendibility feature can be costly because of the low rates earned during the extension period, and because the feature is mostly likely to be exercised by programs only when they are downgraded or they fail.

Programs also vary by type of sponsor. Large U.S. banks have long sponsored ABCP programs, mostly multi-seller and single-seller programs. Some smaller U.S. banks also sponsor some conduits, but represent a very modest share of the market. Foreign banks sponsor a substantial share of ABCP, about 40 percent in 2007, and relative to domestic banks were more likely to sponsor securities arbitrage programs.

Non-bank institutions, such as mortgage lenders, finance companies, or asset managers, also sponsor a considerable share of the market. Programs sponsored by non-bank institutions

grew more dramatically than other programs from 2004 to 2007, more than doubling in assets to $400 billion. As a sponsor, non-bank institutions can pay commercial banks to provide full liquidity support; otherwise they utilize extendibility features, dynamic liquidity management techniques, such as for SIVs, or simply offer less than full liquidity support, such as for SIV-lites. With the salient exception of Citigroup, no other U.S. institutions were substantially involved in the SIV segment of the market. Sponsor-type may provide to investors signals of program quality or liquidity support.

v. Data

Our raw data include all transactions in the asset-backed commercial paper (ABCP) market issued in the United States market in 2007: 693,762 primary market transactions (new issues) by 353 programs over 251 trading days. These data are from the Depository Trust and Clearing Corporation (DTCC), the agent that electronically clears and settles directly- and dealer-placed commercial paper. The issues in the sample are discount instruments paying face value at maturity. For each transaction, DTCC provides the identity and industry of the issuer, the face and settlement values of the transaction, and the maturity of the security. Using these data, we calculate implicit yields on new overnight paper (maturity of 1-4 days) paid by issuers using standard money market conventions.[8] We also calculate overnight risk spreads as the ABCP rate less the federal funds target, an overnight lending rate for banks set by the Federal Open Market Committee. Notably, our spread measures do not incorporate any fees charged by dealers. We also obtain from DTCC a separate weekly file that contains program-level information on the maturity distribution of outstandings. Further, we supplement the DTCC data with information on program type, credit ratings, and sponsor from Moody's Investors Service. We are able to find this information for 298 of the 353 programs in the raw data.

Data in table 2 shows that total outstanding ABCP grew slightly over the first half of 2007 to almost $1.2 trillion, but plunged by roughly $190 billion in August, and then fell another $160 billion over the remaining months of the year. As a result, the market at year-end was nearly 30 percent less than at mid-year. Program types were not hit equally hard. Outstandings at multi-seller programs fell about $56 billion, about 10 percent, from July to December. But outstandings in some other program categories plummeted. Notably, SIVs fell about $70 billion,

[8] Money market yields are annualized yields calculated under the assumption of a 360-day year.

about 80 percent, and mortgage single-seller programs virtually disappeared as outstandings fell from $23 billion to $2 billion.

Summary statistics on overnight ABCP yield spreads over the fed funds target rate are shown in Table 3 and Figure 3. Overnight spreads for the overall market were relatively narrow in the first seven months of 2007, ranging between monthly averages of 2 and 6 basis points. Spreads across all program types soared to an average 47 basis points in August, and remained high and volatile through the end of the year. While the jump in spreads was evident across all program types in August, spreads for single-seller and SIVs continued to escalate in subsequent months, while spreads on multi-seller programs narrowed relatively slightly until year-end pressures intensified.[9]

These patterns in our data are suggestive of runs in 2007 as outstandings dropped and programs were under substantial pricing pressure. Moreover, the continued escalation of spreads and contraction in outstandings for single-seller and SIVs relative to multi-seller programs after August suggests some tiering in the market along fundamentals, and so is less suggestive of panic-driven runs after the initial period. Of course, programs could contract while continuing to issue, and program types could be correlated with other factors, such as sponsor type, contract features, and ratings. To address these and other concerns, we develop a measure of runs and a methodology for more carefully measuring and studying the dynamics of runs over time.

III. Methodology

In traditional bank runs, depositors withdraw demand deposits from commercial banks. We define a run on a commercial paper program analogously as occurring when a program is unable to issue new paper to fund maturing obligations.

In our analysis, we define program *i* as being run in any period *t* in which it has more than 10 percent of its outstanding paper scheduled to mature but does not issue.[10] The program

[9] Average spreads bumped up to an average of 53 basis points in December as strains in the market were likely compounded by typical year-end pressures, while spreads for multi-seller programs rose to 41 basis points. See Downing and Oliner (2006), and Covitz and Downing (2007) for discussions of year-end effects in the commercial paper market.

[10] The 10 percent cutoff is arbitrary and intended to capture the program's need to issue. Our main results do not depend on small variations in this percentage.

is also considered to be in a run if it was defined as being run in the prior period and does not issue in the current period. That is, programs remain in a run state until they issue. More formally:

$$\text{Run}_{it} = \begin{cases} 1 \text{ if } \dfrac{\text{Maturing}_{it}}{\text{Outstanding}_{it}} > 0.1 \text{ and Issuance}_{it} = 0 \\ 1 \text{ if Run}_{i(t-1)} = 1 \text{ and Issuance}_{it} = 0 \\ 0 \text{ Otherwise} \end{cases} \quad (1)$$

In our analysis, *t* is a particular week because our data on program outstandings, used to measure the need to issue, are available only weekly. While daily frequency might yield some additional information, measuring runs on a weekly basis seems to be of sufficiently high frequency to help uncover changing run dynamics through the period of financial turmoil. The condition that maturing paper is more than 10 percent of outstandings is intended to capture the need to issue. The condition that issuance is zero is intended to capture the inability to issue. The zero-issuance condition makes our definition of runs conservative in the sense that programs that issue even a small amount relative to the amount of maturing paper, perhaps at very high cost, will not be classified as being in a run.[11]

Notably, our run measure cannot distinguish between issuers being shut out or just viewing it as too costly to issue ABCP. However, in either case, the program identified as experiencing a run by our measure will be contracting and perhaps forced to sell assets or draw on support from liquidity providers or sponsors. Whether shut out or higher cost, these developments would put pressure on the balance sheets of liquidity providers or sponsors, a key policy concern that motivates our analysis.

[11] One potential concern with our measure of runs is that programs that were not in a run in the prior week and that did not have at least 10 percent of their outstandings coming due in the current week will be recorded as not being in a run in the current week, even though a run was not a possibility. While the number of such "ineligible" programs each week is small, their inclusion could bias our coefficient estimates in favor of finding evidence of panic. For example, the propensity for runs say for a certain type of program may increase independently of fundamentals over time and thus look like panic, when in actuality the increase reflects only that such programs were ineligible for a run in the prior period and then became eligible for run in the current period. However, all our regression results are qualitatively and quantitatively similar if we restrict our sample each week to include only "eligible" programs.

Our primary hypothesis relating to runs is that runs are related to fundamentals, with the alternative being that runs are driven by panic.

H1: Runs are related to program fundamentals.

H2: Runs are driven by panic.

In our primary specification, we measure program "fundamentals" with program type, sponsor type, program rating, and extendibility feature. The presumption is that concern about the exposure of some program types to losses on mortgage-related assets or to weakness in liquidity support were the fundamental factors that triggered and maintained runs. A finding that runs are not well-explained by fundamental differences across programs would suggest a role for panic.

To test for panic in the proliferation of runs, we also include time dummies in the regressions: Increases in runs not explained by deteriorating fundamentals are attributed to panic. Of course, it is possible that panic could be triggered by program fundamentals (Gorton, 1988, and Demirgüç-Kunt and Detragiache, 1998, make similar points). As a result, even if we find that fundamentals are important determinants of runs, it could be that panic still plays a role in explaining runs. A finding that fundamental factors are not significant for explaining runs or that time dummies are significant would provide stronger evidence that panic was an important driver of runs.

More specifically, to empirically test for the drivers of runs, we estimate a probit model for the latent probability of a run on program *i* in week *t* as a function of program fundamentals and aggregate effects that vary over time. Our primary specification is as follows:

$$\Pr(\text{Run}_{it} = 1) =$$
$$F\left(\alpha + \sum_j \beta_j \text{Program Type}_{ji} + \sum_k \gamma_k \text{Sponsor Type}_{ki} + \delta \text{Extendibility}_i + \theta \text{Rating}_{it} + \sum_t \tau_t D_t\right) \quad (2)$$
$$\text{for } i = 1, \ldots, N,$$

where F denotes the cumulative distribution function of a standard normal variable and N is the number of programs. The first fundamental variable is $Program\ Type_{ji}$, which equals 1 if program i is type j and is 0 otherwise. The set of j program types includes multi-sellers, non-mortgage single-seller conduits, mortgage single-seller conduits, securities arbitrage programs, SIVs, CDOs, and other programs (includes hybrids and unclassified programs), the omitted category. The second fundamental variable is $Sponsor\ Type_{ki}$, which equals 1 if program i is sponsored by an institution of type k and is 0 otherwise. The set of k sponsors includes large U.S. banks (the omitted category), small U.S. banks, non-U.S. banks, and nonbanking institutions. A third fundamental variable is $Extendibility_i$, which equals 1 for programs that issue paper with the option of extending maturity at the issuer's request (often at a penalty rate that we do not observe), and $Rating_{it}$ is an indicator variable that equals 1 for programs rated P2 or P3 (i.e., the two lowest short-term prime ratings given to the programs in our data) by Moody's Investors Service. The final explanatory variables are weekly time dummies, denoted with D_t. To account for the likely correlation in errors within a particular program across time, we cluster standard errors at the program level.

Under the null hypothesis that runs are related to fundamentals, coefficients on single-seller mortgages, securities arbitrage, SIV, and CDO programs should be positive, while coefficients on the other types of programs that do not hold subprime mortgages would not be. In addition, coefficients on extendibility, non-bank sponsors, and on SIVs and CDOs, because these programs do not have full liquidity support, should be positive in the estimations.

We estimate a second model that augments the baseline model in equation (2) with interactions between program type and weekly returns on the AAA ABX index.[12] Exposure to subprime mortgages and expected performance of these assets were a major source of uncertainty about asset quality of ABCP programs. The ABX index is a widely-followed measure of the value of subprime mortgage assets, and prices are available daily. For program

[12] The return on the ABX index measures the change in the cost of insurance against defaults on the AAA tranches of MBS backed by subprime mortgages. There are four indexes, backed by subprime mortgages originated in different six-month periods starting from the second half of 2005 to the first half of 2007. We chose the index based on mortgages originated in the first half of 2006 as most representative of subprime mortgage performance, because that index reflects the start of the unexpectedly severe credit deterioration and because more subprime mortgages were originated in that period than in any of the others. The average correlation of weekly returns between the 2006:H2 index and each of the three others is very high, at [90] percent.

types with mortgage exposures—single-seller, securities arbitrage, SIVs, and CDOs—the coefficient on the interaction between the program type and the ABX return is expected to be negative. A positive coefficient on the program type and a negative coefficient on the interaction would be consistent with the null hypothesis that poor asset quality fundamentals are indicative of runs, but the likelihood of a run is lower if mortgage asset values are rising.

The two models of runs are estimated as a monthly panel regression with weekly run data. Our decision to estimate the models monthly differs from that in Gorton (1988), which attributes changes in the deposit-to-currency ratio to panic if they cannot be explained by changing fundamentals, where the relationship between fundamentals and the deposit-to-currency ratio is estimated in pre-crisis periods. By estimating our models each month, we allow for the possibility that the relationship between fundamentals and runs has changed due to the crisis, a possibility suggested by Martinez-Peria and Schmukler (2001).

To supplement our analysis of runs, we study daily new-issue yield spreads of those ABCP programs that were able to issue. Specifically, we estimate:

$$\text{Spread}_{it} = \alpha + \sum_j \beta_j \text{Program Type}_{ji} + \sum_k \gamma_k \text{Sponsor Type}_{ki} + \delta \text{Extendibility}_i + \theta \text{Rating}_{it} + \sum_t \tau_t D_t + \varepsilon_{it}, \quad \text{for } i = 1, \ldots, N, \tag{3}$$

where $Spread_{it}$ is the spread over the fed funds target rate paid by program i on day t to issue overnight paper. Similar to our analysis of equation (2), we estimate equation (3) as monthly panels with daily data.

The results from our analysis of new-issue spreads will help us interpret the findings from our analysis of runs. In particular, if fundamentals predict runs, they should also predict higher spreads. If this was not the case, then one might question whether our run variable is capturing runs or instead the ability of some programs to locate alternative funding sources.

IV. Empirical Analysis of Runs

a. Runs during financial turmoil were fully absorbing

The percent of ABCP programs in a run each week was quite low from January to July of 2007, but then shot up in August as the financial market turmoil erupted (see Figure 4). Before August, the share of programs experiencing a 'run' hovered at less than 5 percent each week. Starting in August, the percent of ABCP programs experiencing a run each week climbed sharply through September to above 30 percent of all ABCP programs. The share rose again, though less sharply, in November. By the end of 2007, more than 40 percent of programs were in a run. Our run variable is consistent with the plunge in outstanding ABCP that occurred from August to December 2007. While the fraction of programs that experienced a run was very large, and explaining which ones ran is the subject of this study, it is worth noting that many ABCP programs were able to continue issuing in the first few months even as outstandings were plummeting.

To further assess our identification of runs, we evaluate the likelihood that a program that enters a run subsequently exits a run. Such a pattern of cycling in and out of runs would seem inconsistent with the intuitive notion that a run is an absorbing state in which a program is essentially shut out of the market. The estimated unconditional hazard rate over time of the probability that a program in a run would leave the run state is shown by the dotted line in Figure 4. As shown in the first seven months of the year, the estimated hazard rate is high on average, and generally ranges from around 20 to 50 percent, suggesting that the few programs identified as having been in a run during this period may indeed not be "true" runs in the sense of being unable to subsequently issue new paper. In contrast, the estimated hazard rate fell notably to less than 10 percent on average in early August, and then declined to near zero by the end of the year, providing strong evidence that the mounting number of programs identified as having been in runs during this period were indeed subject to runs. In other words, the runs we identify during the financial crisis appear to be absorbing states.

b. Runs during financial turmoil are related to fundamentals, but runs in initial weeks were also driven partly by panic

We begin our analysis of runs by estimating equation (2), the probability of a run based on program characteristics and aggregate weekly time dummies. The model is estimated on five

monthly panels of weekly data from August 2007 to December 2007, the period for which we are confident that our measure accurately characterizes runs. The results from this baseline regression are shown in Table 4.

Our results indicate that runs are related to fundamentals, but that panic conditions were evident in the early weeks of the financial crisis. First, the p-values for the entire set of program variables representing fundamentals (i.e., all variables but the time dummies) in each month are all significant. Among program-type variables, we find evidence that investors were more likely to run from programs with substantial exposure to mortgage-related assets. The coefficients on *mortgage single-seller* were consistently positive, significant, and large, suggesting greater concerns about the credit risk related to mortgage warehouse lending activities. Coefficients on other single seller or multi-seller programs that do not have exposure to subprime mortgages were not significant, though the coefficients on multi-seller programs are consistently negative. Coefficients on *structured investment vehicle* were generally positive, significant, and large, consistent with investors concerns about credit losses on conduits that held highly-rated subprime MBS.

The higher propensity for runs on SIVs likely also reflects that SIVs lack full liquidity support. This possibility is further supported by the result that the coefficients on *securities arbitrage* were mostly insignificant despite the similarity of such programs to SIVs in their exposures to subprime mortgages. Recall that securities arbitrage programs have full liquidity support from their sponsor banks, unlike SIVs that use dynamic liquidity management strategies and rely on asset sales to protect investors. More direct evidence that liquidity is an important determinant is provided by the consistently significant and large coefficients on *extendibility*. If programs have the option to extend, then ABCP investors, such as money funds, may not receive a market rate or funds on demand, a feature that is especially costly if money funds are facing redemptions. In addition, the significant and large coefficients on *lower rating* indicates that programs with greater credit and liquidity risk were more subject to runs than fundamentally stronger programs, although only about 5 percent of programs are lower-rated by the end of 2007.

The importance of liquidity support is also suggested by the positive and significant coefficients on *nonbanking institutions* beginning in October. Nonbanks, unlike domestic large banks (the excluded category) do not have direct access to the sources of liquidity that are available to banks, such as brokered deposits, interbank funding markets, and the Federal Reserve discount window.

In addition to results suggesting runs are linked to fundamentals, we also find evidence that runs were induced by panic in the early weeks of the turmoil. In particular, the coefficients on the weekly time dummies in August were 9 percent, 14 percent, and 16 percent, indicating that the likelihood of a run increased with each subsequent week relative to the first week of August (the omitted week). Coefficients on the three weekly time dummies in September are also significant, but the magnitude increases only from the first to second week, suggesting panic subsided during the month, and by October, November, and December, the time dummies are not significant.

The possibility of panic in August and September is plausible given the major liquidity and credit events in money markets that took place during that period. The key events are tabulated for each week from July to December 2007 in Table 5. Of special note, BNP Paribas halted redemptions from its money market mutual funds after it announced on Thursday August 9 (Week 3 of August) that it could no longer value the holdings of U.S. subprime MBS, and the ECB announced they would supply reserves as needed to promote stability, which totaled $130 billion on Aug. 9 and an additional $84 billion on August 10.[13] On Aug. 10, the Federal Reserve announced they would also supply reserves, but still overnight ABCP rates in the U.S. market jumped to over 6 percent. The following Tuesday, the ABCP market in Canada was severely disrupted and some banks reportedly refused to provide emergency funding (under liquidity agreements that apparently are more limited than those in the U.S. ABCP markets). The speed and intensity of events around ABCP markets, especially at the onset, makes it very likely that investors would react to more than observable fundamental factors, which is captured by the positive coefficients on the weekly time variables.

[13] Because our data on CP outstandings are available for weeks ending Wednesday, week 3 of August starts on August 9.

So why did the panic diminish or end? It may be that investors became better informed about the credit and liquidity risks of individual programs, which allowed them to re-enter and selectively purchase new issues. Another calming salve may have been the actions that authorities took in the weeks after the onset of the panic to increase available information to investors and to provide funds to ease liquidity pressures. In particular, in September, SIFMA, ASF, and ESF, trade organizations representing securities dealers and investors, recommended improvements in disclosures of assets held in ABCP programs, and the Federal Reserve after initially making reserves available, announced that it would accept ABCP as collateral at the discount window, and then cut the fed funds target in mid September. However, even though we find that panic conditions apparently eased relatively quickly, our finding that runs were absorbing states suggest that the consequences were longer-lasting.

c. Robustness of result that initial runs were driven, in part, by panic

Results that include the interactions between program dummies and the weekly return on the AAA ABX index for 2006:H2 are shown in Table 6. The coefficients on the interactions between the AAA ABX return and program type dummies are negative and significant, as expected, in August for CDOs and securities arbitrage, programs which have mortgage exposures. However, most of the coefficients on the interactions are not significant, an indication that investors were not modulating their propensity to run from ABCP programs with weekly changes in expectations about subprime mortgages. In addition, the inclusion of the interaction terms does not affect the baseline results for program characteristics in table 4. Importantly, the coefficients on the time dummies in September and August remain significant, and are similar in magnitude to the baseline results, suggesting that our finding of panic is not because the time dummies are reflecting a continued deterioration in fundamentals not captured by our program variables.

The role that the ABX played in causing runs is also illustrated in Figure 5, which plots the percent of programs in runs against the AAA ABX value. The figure shows that in early August, the percentage of programs in runs increased as the AAA ABX fell by almost 10 percent, consistent with concerns about potential losses from subprime mortgages triggering the initial spate of runs in the ABCP market. However, from about mid-August through September, the AAA ABX rebounded substantially while the percent of programs in runs continued to

increase. That is, the proliferation of runs in the first two months of the crisis appeared to have its own momentum, which we interpret as evidence of panic.

d. Risk spreads for ABCP indicate runs reflect difficulties in issuing, not less willingness to issue

We next examine daily risk spreads on overnight ABCP to more fully characterize conditions in the market. If the types of programs subject to runs are also the types that are able to issue at relatively low spreads, one might argue that the runs indicate that such programs have access to low-cost alternatives to ABCP, and that such runs do not indicate expulsion from the market. But if similar programs are issuing, and the required spreads are high, that evidence would suggest stresses for that type of program and less ability to issue.

Prior to the eruption of turmoil in August 2007, yield spreads were extremely narrow, but did show significant differences across programs types and features. As seen in Figure 3 and in Table 3 (referenced earlier), daily spreads on overnight paper for ABCP programs averaged about 3 to 6 basis points above the target federal funds rate in the first seven months of the year. The results from estimating equation (3) are shown in Table 6. The results show that prior to the turmoil in August, coefficients on program type were generally insignificant, although mortgage single-seller and CDOs paid a slight premium of about 2-1/2 basis points relative to the omitted group. Lower-rated programs paid about 9 to 10 basis points more, extendible programs paid about 4 to 5 basis points more, and programs with sponsors that were not large US banks generally paid about 1 to 5 basis points more to issue.

As the crisis erupted, average spreads rose from about 15 basis points to about 90 basis points in the early days of the turmoil. Spreads rose for all types of programs, including multi-seller, SIVs, and securities arbitrage. The regression results in Table 6 tell a similar story. The constant in the regressions increases from less than 1 basis point in June and July to 57 basis points in August, consistent with a sharp rise in spreads across all types of programs.

The regression results also show that during the crisis, yield spreads were substantially higher for the programs identified earlier as being subject to runs, buttressing our interpretation of our run measure as an indication of a withdrawal of investor demand rather than a pull-back in supply. The coefficient on extendibility increased almost five times to 25 basis points in August

and rose again to 37 basis points in September, after which very few programs with extendibility issued any paper. The coefficient on rating rose similarly, as did the coefficient mortgage single sellers. Further, spreads on all types of sponsors that were not *large US banks* were also significantly larger in the last five months of the year. More generally, the finding that distinctions among key features were amplified after the crisis began is consistent with Martinez-Peria and Schmuckler (2001), who find that higher premiums were required for risk characteristics of financial institutions after the onset of troubles.

e. Summary of results

Overall, we find strong evidence of runs on ABCP programs in the last five months of 2007. And, throughout the period under study, programs that were run had a very low probability of accessing the market again. We also find that deteriorating fundamentals were an important determinant of runs. Indeed, by the end of the year, nearly all ABCP programs with exposures to possible mortgage credit losses and less-than-full liquidity support were shut out of the market. We also find evidence that runs in the early weeks of the crisis appeared to reflect panic, as the proliferation of runs was not well-explained by deteriorating fundamentals. In addition, any fundamentally impaired programs that were able to issue paper had to pay significantly higher spreads.

One question that we cannot address directly in our empirical analysis is why the panic subsided in a matter of weeks. One possibility is that more information became available about the various programs which permitted investors to make distinctions in risk. Another possibility is that investors came to the realization that not all programs would be run as many had no exposure to subprime mortgages or had full liquidity protection. A third and related possibility is that the Federal Reserve, in its role of lender of last resort, may have reassured investors by accepting ABCP as collateral at the discount window.

In any case, it is worth reiterating that the impact of the panic appeared to extend well beyond several weeks in which the panic appeared to take place. Programs that were run in the last five months of the year tended to stay in the run, and banks that supported such programs were left with persistent balance sheet difficulties.

V. Implications

Our results highlight how the ABCP market is central to understanding the current financial crisis. First, concerns about credit losses on subprime mortgages affected this market, through runs on programs with exposure to these assets. However, the effects through subprime mortgage losses are only part of the story, and it is likely that had only those programs been run, the effects on broader markets would have been more limited. Another channel is that concerns about these losses led investors in ABCP to question the strength of the liquidity support on other programs, and programs with extendibility features or less-than-full liquidity support were run. As investors lost confidence and ABCP could not roll over, explicit and implicit supports provided by banks were called on, pressuring bank balance sheets. Banks became uncertain about further draws on their commitments and, in turn, reduced lending to others, thereby magnifying the effects of the initial ABCP runs.

A third significant effect is that as investors ran, ABCP programs as a buyer of the AAA-rated tranches of new securitizations disappeared. Combined with the pull-back in the repo market, another market that funded AAA-rated tranches with short-term debt, securitizations became increasingly difficult, forcing banks to look for other ways to fund their origination of mortgages and other loans. As a consequence, at a time when banks were concerned about further calls on their explicit and implicit commitments to support ABCP, they also lost access to securitization as a source of funding, further magnifying the effects of ABCP runs.

Our finding of panic suggests that the ABCP markets may be inherently unstable: Investors appeared to run in some cases only because they feared that others would run as well. Even investors in programs with solid fundamentals may pull back on concerns that the bank as liquidity provider might not be able to support multiple programs at the same time. Indeed, it seems implausible that the entire ABCP market of $1.2 trillion could be fully supported by banks if supports were called upon all at once. Thus, investors may run from the entire market. Thus an important implication is that financial institutions, even in developed countries with credible deposit insurance systems, may be exposed to runs through off-balance-sheet exposures to ABCP programs.[14] A corollary to this is that the federal government can be exposed to runs

[14] This point is also made by Gorton (2007) in a discussion of the 2007 financial turmoil.

from entities other than banks, in particular off-balance sheet ABCP conduits sponsored and supported by banks.

The relevant policy question is how, if at all, to address the possibility that the ABCP market may be an important source of instability in the future. One option is to impose standards on liquidity support. Our results suggest that extendibility and "dynamic liquidity management" were poor substitutes for more traditional support from banks. However, we also found that in the early weeks of the crisis, even programs with strong liquidity support were run. Another option would be to restrict the size of the ABCP market. Such a policy would certainly limit the potential systemic impact of the ABCP market. However, it might not be feasible, as the optimal size of the ABCP market is unknown and such a policy would likely be difficult to enforce. In addition, restricting the size of the market might crowd out efficient methods for firms to finance short-term assets. Another option proposed by Gorton (2009) for an alternative purpose of preventing destabilizing runs in the repurchase market, is to provide and require government insurance for all AAA-rated tranches of securitizations. This policy might indirectly inhibit the growth of the ABCP market, particularly programs designed to arbitrage the difference between yields on long-term, near-riskless assets and yields on short-term ABCP. Indeed, this was the main purpose of SIVs, CDOs, and securities arbitrage, segments of the ABCP market that disappeared, at least for now, during the recent turmoil. The difficulty with such a policy is the traditional moral hazard created by the provision of insurance. The insurance would have to be priced and securitization processes monitored to ensure that the resulting AAA assets indeed had little or no credit risk.

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Figure 1: Commercial paper outstanding in 2007

The solid line plots the weekly face value of asset-backed commercial paper outstanding. The dotted line plots the weekly face value of unsecured (or corporate) commercial paper outstanding. Data are from the Federal Reserve Board based on program-level data from the DTC.

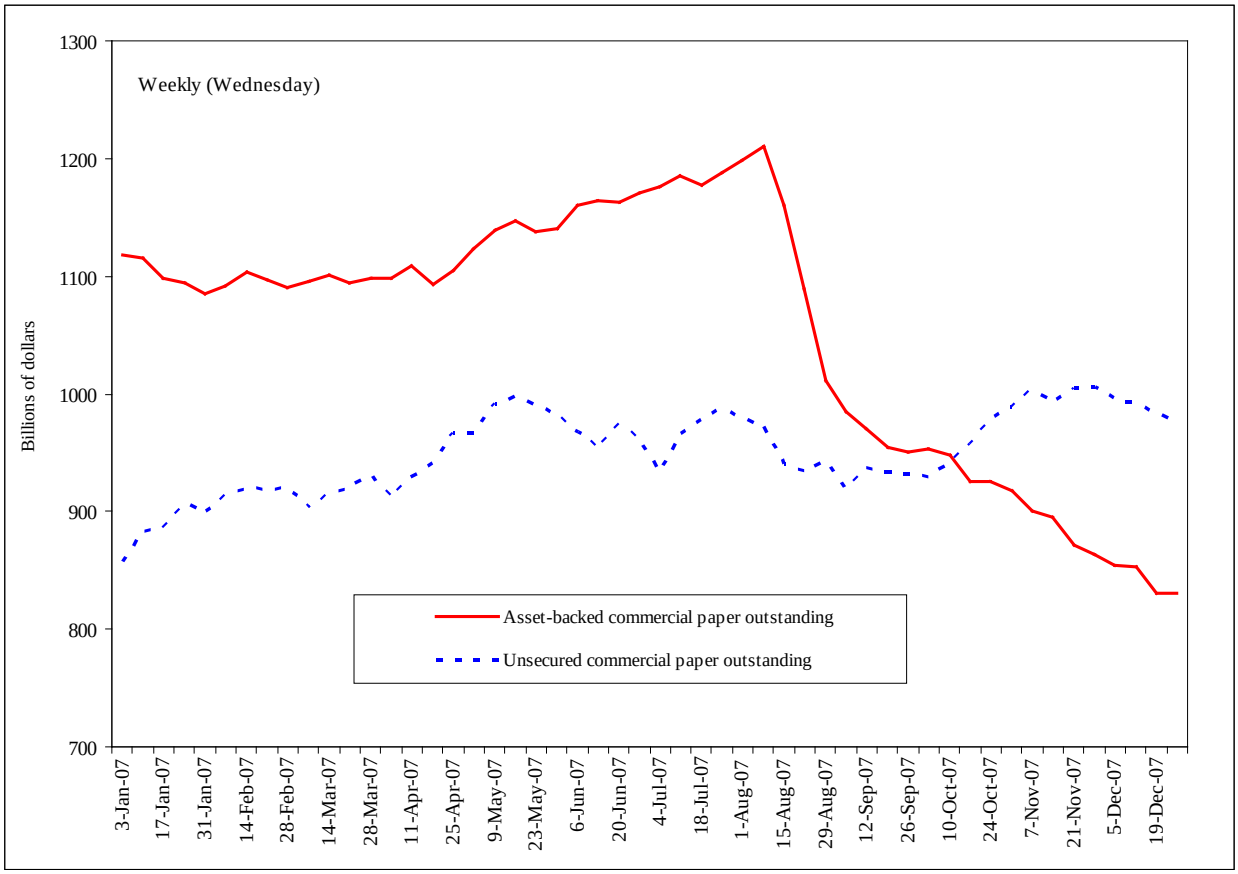

Figure 2: Risk spreads on overnight commercial paper issues

The solid line plots the spread of rates on AA-rated asset-backed commercial paper over the fed funds target rate. The dotted line plots the daily spread of A2/P2-rated unsecured commercial paper over the fed funds target rate. Data are from the Federal Reserve Board based on program-level data from the DTC.

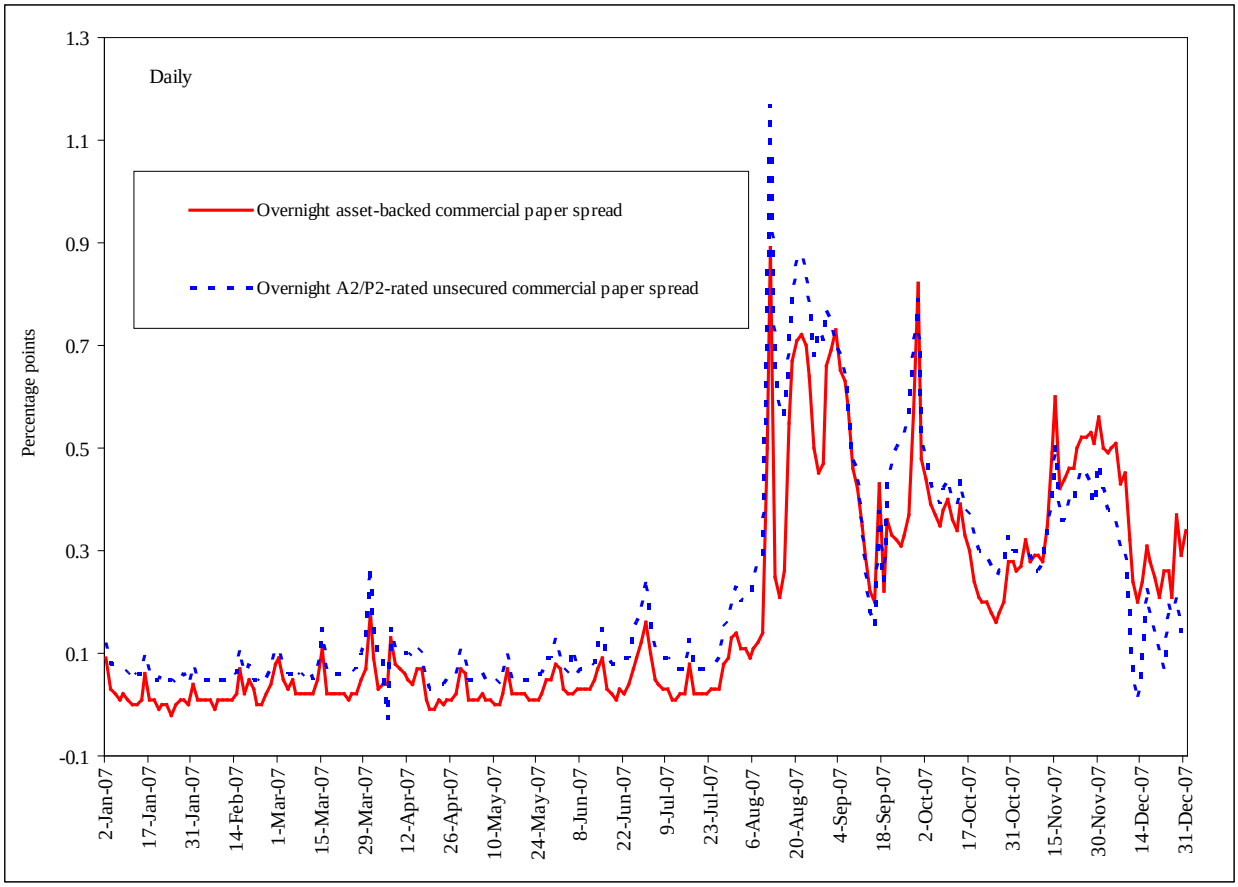

Figure 3: Risk spreads on overnight ABCP issues for selected program types

The solid line plots the spread of rates paid by multi-seller programs over the fed funds target rate. The dotted line plots the spread of rates paid by securities arbitrage programs over the fed funds target rate. The solid line with circles plots the daily spread of rates paid by structured investment vehicles over the fed funds target rate. Daily data on rates are computed using transaction-level data from the DTC.

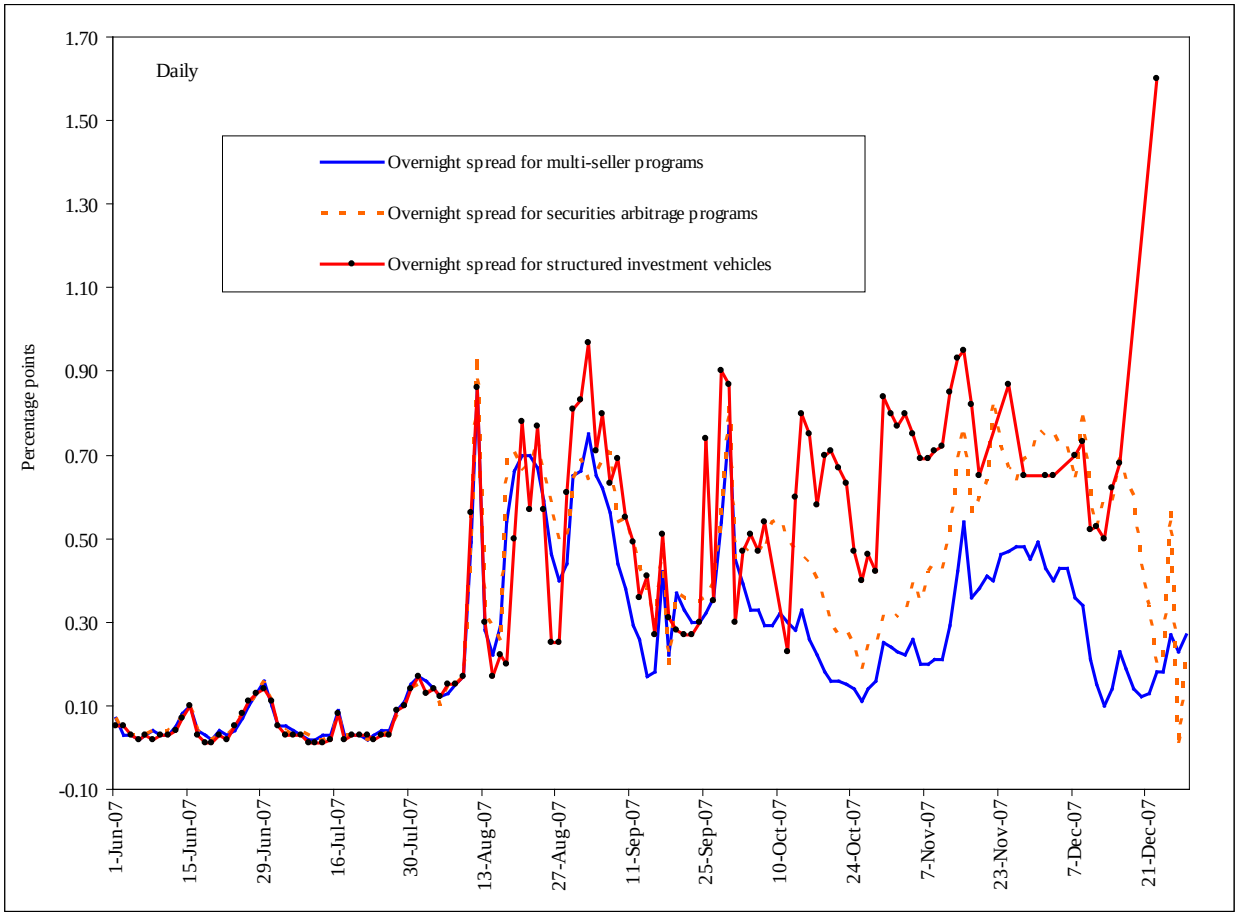

Figure 4: Runs on asset-backed commercial paper (ABCP) programs in 2007

The solid line plots the percent of programs experiencing a run. We define that a program experiences a run in weeks when it does not issue paper but has at least 10 percent of paper maturing or when the program continues not issuing paper after experiencing a run in the previous week (see equation (1) in the text). The dotted line plots the unconditional probability of not experiencing a run in a given week after having experienced a run in the previous week (i.e., the hazard rate of leaving the run state). The figure is based on weekly data from DTC on paper outstanding, maturities, and issuance for 349 ABCP programs in 2007.

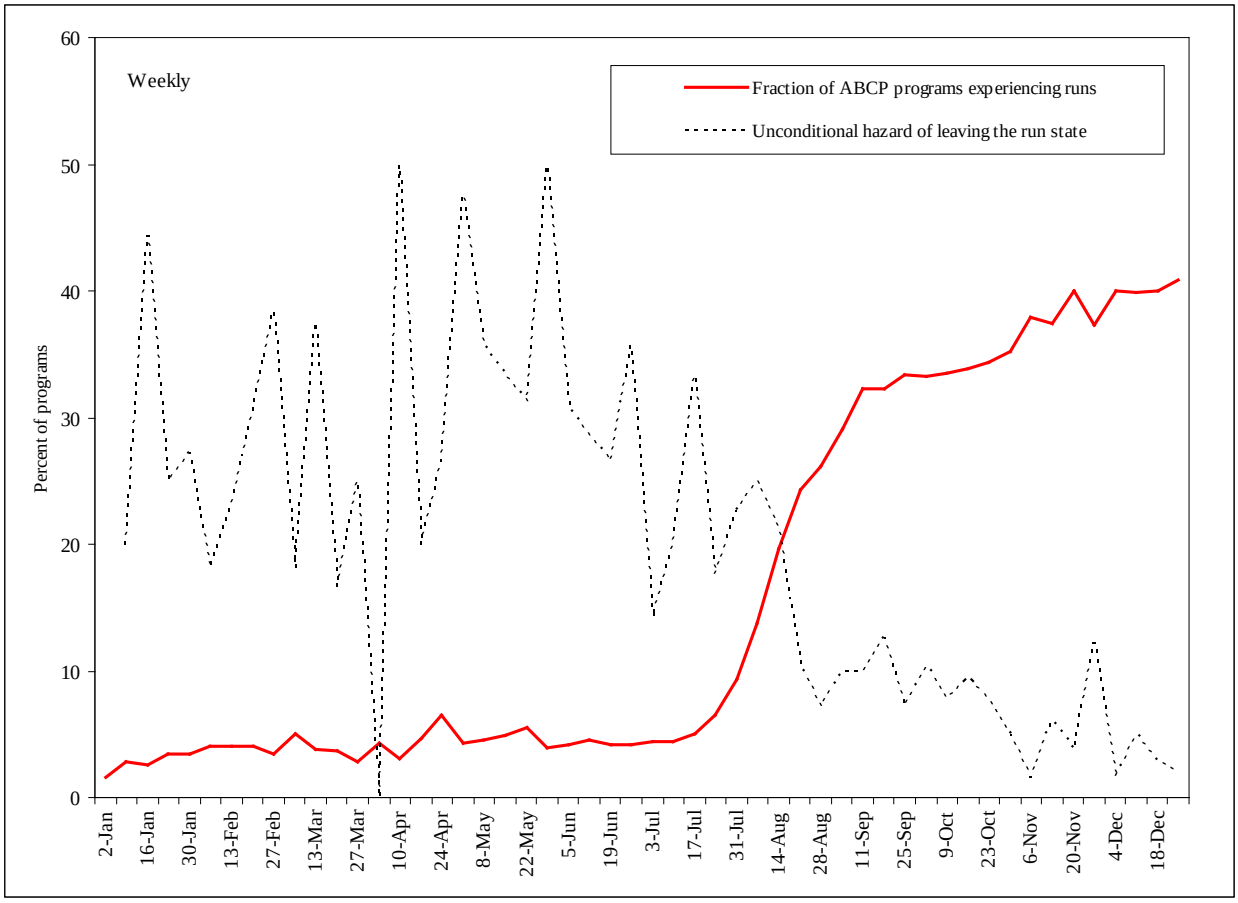

Figure 5: Runs on asset-backed commercial paper (ABCP) programs and value of AAA-rated subprime mortgage backed securities in 2007

The solid red line plots the percent of programs experiencing a run. We define that a program experiences a run in weeks when it does not issue paper but has at least 10 percent of paper maturing or when the program continues not issuing paper after experiencing a run in the previous week (see equation (1) in the text). The blue dotted line plots the ABX index that began trading in 2006:H2 based on securities issued in the first half of 2006, and represents the value of a AAA-rated tranche of those subprime mortgage-backed securities. The figure is based on weekly data from DTC on paper outstanding, maturities, and issuance for 349 ABCP programs in 2007.

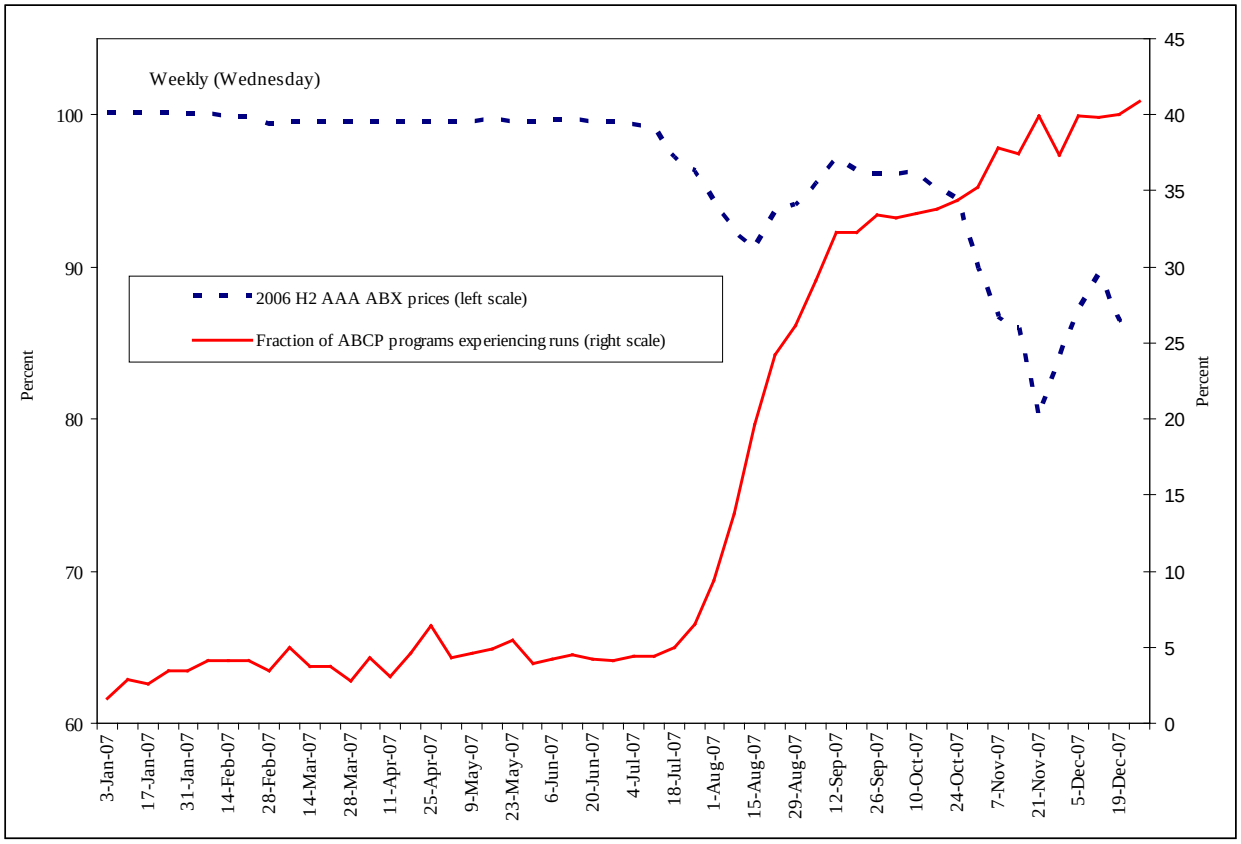

Table 1: Asset-backed commercial paper (ABCP) program types

Program Type	*Assets*	*Liquidity Support*	*Number of Programs*	*Percent of Outstandings*
Multi Seller	Receivables and loans	Full	98	45
Non-Mortgage Single Seller	Credit card receivables and auto loans	Implicit by originator	40	11
Mortgage Single Seller	Mortgages and mortgage-backed securities	Implicit by originator	11	2
Securities Arbitrage	Highly-rated long-term securities	Full	35	13
Structured Investment Vehicle	Highly-rated long-term securities	None	35	7
CDO	Highly-rated long-term securities	Partial	36	4
Hybrid and Other	n.a.	n.a.	84	18

Notes. Number of programs and percent of market outstandings are based on data as of July 2007, when outstandings peaked.

Table 2: Asset-backed commercial paper (ABCP) outstanding in 2007, by program type

This table reports the amount of paper outstanding at the end of each month in 2007 for all program types in the U.S. asset-backed commercial paper (ABCP) market. Data on paper outstanding are from DTC and program type classification is from Moody's Investors Service.

Billions of dollars, end of the month	Total	Multi seller	Non-mortgage single seller	Mortgage single seller	Securities arbitrage	Structured investment vehicle	CDO	Hybrid and other
2007 Jan	1,061	455	121	32	159	63	41	190
Feb	1,067	459	129	33	154	60	41	190
Mar	1,070	480	122	25	148	56	46	193
Apr	1,092	492	125	32	142	63	46	193
May	1,125	503	126	35	149	65	46	202
Jun	1,151	518	123	23	150	79	48	211
Jul	1,163	525	126	23	148	84	47	210
Aug	976	503	79	4	120	70	39	160
Sep	927	484	74	2	133	49	33	153
Oct	896	465	68	2	140	29	32	160
Nov	838	461	55	1	117	22	31	152
Dec	816	469	51	2	102	15	27	151

Table 3: Risk spreads on overnight asset-backed commercial paper (ABCP) issues, by program type

This table reports the spread of rates on overnight ABCP issues, by program type, over the target fed funds rate. Data on ABCP transactions are from DTC and program type classification is from Moody's Investors Service. Spreads are weighted averages of spreads on individual transactions using face value of transactions as weights.

Percentage points, month average	Market average	Multi seller	Total single-seller	Mortgage single seller	Securities arbitrage	Structured investment vehicle	CDO	Hybrid and other
2007 Jan	0.02	0.02	0.00	0.05	0.02	0.01	0.02	0.02
Feb	0.02	0.02	0.01	0.04	0.03	0.01	0.03	0.03
Mar	0.05	0.05	0.06	0.07	0.04	0.04	0.10	0.04
Apr	0.05	0.05	0.05	0.06	0.04	0.04	0.09	0.04
May	0.03	0.03	0.03	0.06	0.03	0.02	0.04	0.03
Jun	0.06	0.06	0.07	0.09	0.06	0.05	0.07	0.05
Jul	0.06	0.06	0.05	0.08	0.05	0.05	0.07	0.05
Aug	0.47	0.44	0.42	0.76	0.47	0.44	0.51	0.55
Sep	0.49	0.41	0.71	1.22	0.53	0.55	0.41	0.65
Oct	0.34	0.24	0.83	1.51	0.42	0.55	0.50	0.47
Nov	0.44	0.35	1.01	1.75	0.57	0.76	0.54	0.50
Dec	0.53	0.41	0.91	1.92	0.69	1.11	0.75	0.53

Table 4: Regressions of the probability of experiencing a run

This table reports the results of estimating equation (2) from the text using a probit model:

$$\Pr(\text{Run}_{it}=1)=F\left(\alpha+\sum_j \beta_j \text{Program Type}_{ji}+\gamma\text{Extendibility}_i+\delta\text{Rating}_{it}+\sum_k \theta_k \text{Sponsor Type}_{ki}+\sum_t \tau_t \text{D}_t\right),\ \text{for } i=1,\ldots,\ N.$$

The dependent variable is the probability of experiencing a run as defined in equation (1). F denotes the cumulative distribution function of a standard normal variable, and N is the number of programs. Program Type$_{ji}$, equals 1 if program i is type j and equals 0 otherwise. The set of j program types includes multi-sellers, non-mortgage single-seller conduits, mortgage single-seller conduits, securities arbitrage programs, SIVs, CDOs, and other programs (the omitted category). Extendibility$_i$ equals 1 for programs that issue paper with the option of extending maturity at the issuer's request, and Lower Rating$_i$ is an indicator variable that equals 1 for programs rated P2 or P3 by Moody's Investors Service (i.e., the two lowest prime short-term ratings). Sponsor Type$_{ki}$, equals 1 if program i is sponsored by an institution of type k and equals 0 otherwise. The set of k sponsors includes large U.S. banks (the omitted category), small U.S. banks, non-U.S. banks, and nonbanking institutions. D$_t$ denotes a weekly time dummy. Each column reports the marginal effects from estimating the model as a monthly panel with weekly data. Standard errors clustered by program are reported in brackets.

Dependent variable: Probability of experiencing a run

	Marginal effect	August	September	October	November	December
Program type	Multi seller	-0.024 [0.048]	-0.101 [0.068]	-0.067 [0.071]	-0.102 [0.076]	-0.104 [0.080]
	Non-mortgage single seller	0.059 [0.075]	0.005 [0.091]	0.065 [0.105]	-0.012 [0.107]	-0.045 [0.110]
	Mortgage single seller	0.266* [0.151]	0.404** [0.187]	0.362* [0.187]	0.428*** [0.159]	0.459*** [0.173]
	Securities arbitrage	0.025 [0.074]	-0.127* [0.075]	-0.107 [0.082]	-0.113 [0.093]	-0.060 [0.106]
	Structured invest. vehicle	0.069 [0.071]	0.161* [0.093]	0.324*** [0.094]	0.427*** [0.095]	0.397*** [0.097]
	CDO	0.104 [0.097]	0.078 [0.103]	0.090 [0.111]	0.051 [0.115]	0.081 [0.114]
	Extendibility	0.238*** [0.066]	0.338*** [0.081]	0.372*** [0.077]	0.437*** [0.076]	0.494*** [0.074]
	Lower Rating	0.440*** [0.146]	0.475*** [0.130]	0.302** [0.153]	0.233 [0.198]	0.445*** [0.131]
Sponsor type	Small U.S. bank	0.054 [0.094]	0.110 [0.153]	0.272 [0.186]	0.163 [0.209]	0.199 [0.201]
	Non-U.S. bank	0.038 [0.075]	0.120 [0.109]	0.140 [0.117]	0.198 [0.124]	0.246** [0.124]
	Nonbanking Institution	-0.017 [0.066]	0.067 [0.079]	0.132* [0.078]	0.176** [0.088]	0.172* [0.093]
	Week 1 dummy	-	-	-	-	-
	Week 2 dummy	0.032 [0.024]	0.061** [0.024]	0.001 [0.018]	0.009 [0.017]	0.015 [0.017]
	Week 3 dummy	0.089*** [0.031]	0.065*** [0.025]	0.008 [0.022]	0.030 [0.019]	0.013 [0.017]
	Week 4 dummy	0.141*** [0.036]	0.066** [0.027]	0.007 [0.023]	0.009 [0.021]	0.034* [0.020]
	Week 5 dummy	0.160*** [0.035]	-	0.012 [0.022]	-	-
	Observations	1385	1109	1427	1140	1143
	Number of programs	292	293	298	296	297
	Pseudo R-squared	0.159	0.163	0.163	0.192	0.202
	Chi-squared test for program variables, p-value	0.000	0.000	0.000	0.000	0.000
	Chi-squared test for time dummies, p-value	0.000	0.032	0.987	0.414	0.308

Robust standard errors in brackets
Indicator variables are excluded from the regression when their taking value 0 or 1 predicts run or no run perfectly.

Table 5: Calendar of events and time dummies in the regression analysis

The calendar of events below is organized around for weeks ending Wednesday. The second column of the table reports the corresponding week dummy in the monthly panel regressions on the probability of a run in Table 4. For example, the week ending on Wednesday, July 4 corresponds to the dummy variable for week 1 in the regression using weekly observations in July 2008.

Month	*Week time dummy*	*Events in Money Markets*
July	Week 1 (ending July 4)	
	Week 2 (ending July 11)	
	Week 3 (ending July 18)	
	Week 4 (ending July 25)	• Countrywide disappointing earnings announcement (July 24)
August	Week 1 (ending Aug 1)	
	Week 2 (ending Aug 8)	• American Home Mortgage declares bankruptcy (Aug 6) • Three single-seller mortgage ABCP programs extend the maturity of their paper (Aug 6)
	Week 3 (ending Aug 15)	• BNP halts redemptions at two affiliated funds (Aug 9) • ECB injects liquidity in money markets (Aug 9) • Federal Reserve provides liquidity (Aug 10) • Canadian ABCP market seizes up (Aug 14)
	Week 4 (ending Aug 22)	• Countrywide taps on its credit lines (Aug 16) • Federal Reserve cuts primary credit rate 50 basis points (Aug 17) • An ABCP program affiliated with KKR Financial extends the maturity of its paper (Aug 20) • An SIV-lite sponsored by Solent Capital defaults on its ABCP (Aug 22)
	Week 5 (ending Aug 29)	• A second ABCP program affiliated with KKR Financial extends the maturity of its paper (Aug 23) • Investment-quality ABCP accepted as discount-window collateral at the Federal Reserve (Aug 24)
September	Week 1 (ending Sept 5)	• An SIV program sponsored by Cheyne Capital Management draws on its credit lines (Aug 30). • Moody's downgrades or placed under review the ratings of several ABCP programs issued by SIVs (Sept 5)
	Week 2 (ending Sept 12)	• SIFMA, the American Securitization Forum, and the European Securitization Forum recommend disclosure of holdings by ABCP programs (Sept 12)
	Week 3 (ending Sept 19)	• Federal Reserve cuts fed funds target rate 50 basis points (Sept 18)
	Week 4 (ending Sept 26)	

Table 5: Calendar of events and time dummies in the regression analysis (continued)

Month	*Week time dummy*	*Events in Money Markets*
October	Week 1 (ending Oct 3)	
	Week 2 (ending Oct 10)	
	Week 3 (ending Oct 17)	• Citigroup, Bank of America, and JP Morgan Chase announced the M-LEC to backstop paper issued by SIVs (Oct 15) • An SIV program sponsored by Cheyne Capital Management defaults (Oct 17)
	Week 4 (ending Oct 24)	• An SIV program sponsored by IKB Credit Management defaults (Oct 18)
	Week 5 (ending Oct 31)	• Federal Reserve cuts fed funds target rate 25 basis points (Oct 31)
November	Week 1 (ending Nov 7)	• Moody's Investors Service downgrades and places under review several SIVs (Nov 7)
	Week 2 (ending Nov 14)	
	Week 3 (ending Nov 21)	
	Week 4 (ending Nov 28)	
December	Week 1 (ending Dec 5)	
	Week 2 (ending Dec 12)	• S&P downgrades many SIVs (Dec 7) • Federal Reserve cuts fed funds target rate 25 basis points (Dec 11) • Federal Reserve establishes Term Auction Facility (TAF) and coordinates foreign exchange swap lines with other major central banks (Dec 12)
	Week 3 (ending Dec 19)	• Citigroup announces that it will support its own-sponsored SIVs (Dec 13) • First TAF auction (Dec 17)
	Week 4 (ending Dec 26)	• Citigroup, Bank of America, and JP Morgan Chase abandon the idea of M-LEC (Dec 21)

Table 6: Regressions of the probability of experiencing a run: Interactions with the ABX

This table reports the results of estimating the following equation using a probit model:

$$\Pr(\text{Run}_{it}=1)=F\left(\alpha+\sum_j(\beta_{0,j}+\beta_{1,j}\text{ABX}_t)\text{Program Type}_{ji}+\gamma\text{Extendibility}_i+\delta\text{Rating}_{it}+\sum_k\theta_k\text{Sponsor Type}_{ki}+\sum_t\tau_t\text{D}_t\right),$$

for $i=1,\ldots,N$.

The dependent variable is the probability of experiencing a run as defined in equation (1). F denotes the cumulative distribution function of a standard normal variable, and N is the number of programs. Program Type$_{ji}$, equals 1 if program i is type j and equals 0 otherwise. ABX$_t$ is the weekly return of the AAA ABX.HE 2006:H2 index. The set of j program types includes multi-sellers, non-mortgage single-seller conduits, mortgage single-seller conduits, securities arbitrage programs, SIVs, CDOs, and other programs (the omitted category). Extendibility$_i$ equals 1 for programs that issue paper with the option of extending maturity at the issuer's request, and Lower Rating$_i$ is an indicator variable that equals 1 for programs rated P2 or P3 by Moody's Investors Service (i.e., the two lowest prime short-term ratings). Sponsor Type$_{ki}$, equals 1 if program i is sponsored by an institution of type k and equals 0 otherwise. The set of k sponsors includes large U.S. banks (the omitted category), small U.S. banks, non-U.S. banks, and nonbanking institutions. D$_t$ denotes a weekly time dummy. Each column reports the marginal effects from estimating the model as a monthly panel with weekly data. Standard errors clustered by program are reported in brackets.

Dependent variable: Probability of experiencing a run

		Regression 1		Regression 2		Regression 3		Regression 4		Regression 5	
		Sample: August 2007		Sample: September 2007		Sample: October 2007		Sample: November 2007		Sample: December 2007	
		Coefficient	Interaction with ABX.HE AAA index (2006:H2)	Coefficient	Interaction with ABX.HE AAA index (2006:H2)	Coefficient	Interaction with ABX.HE AAA index (2006:H2)	Coefficient	Interaction with ABX.HE AAA index (2006:H2)	Coefficient	Interaction with ABX.HE AAA index (2006:H2)
	Marginal effect										
Program type	Multi seller	-0.023	-0.012	-0.098	-0.009	-0.079	-0.010	-0.101	0.001	-0.113	0.006
		[0.049]	[0.014]	[0.068]	[0.017]	[0.071]	[0.012]	[0.086]	[0.021]	[0.080]	[0.006]
	Non-mortgage single seller	0.052	-0.027	0.006	-0.003	0.067	0.001	0.012	0.010	-0.057	0.008
		[0.074]	[0.017]	[0.091]	[0.023]	[0.105]	[0.010]	[0.115]	[0.020]	[0.109]	[0.007]
	Mortgage single seller	0.293*	0.009	0.430**	-0.057	0.347*	-0.010	0.267	-0.071	0.449**	0.008
		[0.160]	[0.021]	[0.187]	[0.045]	[0.195]	[0.013]	[0.196]	[0.076]	[0.178]	[0.005]
	Securities arbitrage	0.024	-0.025*	-0.139*	0.032	-0.122	-0.014	-0.124	-0.005	-0.064	0.003
		[0.073]	[0.014]	[0.074]	[0.024]	[0.082]	[0.014]	[0.097]	[0.019]	[0.105]	[0.007]
	Structured invest. vehicle	0.071	-0.007	0.160*	0.003	0.295***	-0.020	0.432***	0.002	0.387***	0.007
		[0.072]	[0.016]	[0.094]	[0.032]	[0.098]	[0.017]	[0.105]	[0.024]	[0.099]	[0.010]
	CDO	0.102	-0.034*	0.075	0.011	0.087	-0.003	0.022	-0.012	0.067	0.009
		[0.096]	[0.017]	[0.103]	[0.031]	[0.113]	[0.013]	[0.121]	[0.020]	[0.115]	[0.007]
	Extendibility	0.239***	-	0.339***	-	0.372***	-	0.437***	-	0.494***	-
		[0.066]		[0.081]		[0.077]		[0.076]		[0.074]	
	Lower Rating	0.451***	-	0.475***	-	0.306**	-	0.233	-	0.445***	-
		[0.147]		[0.130]		[0.152]		[0.198]		[0.133]	
Sponsor type	Small U.S. bank	0.052	-	0.110	-	0.273	-	0.163	-	0.198	-
		[0.093]		[0.154]		[0.186]		[0.209]		[0.201]	
	Non-U.S. bank	0.038	-	0.120	-	0.141	-	0.198	-	0.247**	-
		[0.075]		[0.109]		[0.117]		[0.124]		[0.124]	
	Nonbanking Institution	-0.019	-	0.066	-	0.132*	-	0.176**	-	0.172*	-
		[0.065]		[0.079]		[0.079]		[0.088]		[0.093]	
	Dummy for the first week of the month	-	-	-	-	-	-	-	-	-	-
	Dummy for the second week of the month	0.012	-	0.062*	-	-0.002	-	0.005	-	0.046	-
		[0.025]		[0.032]		[0.018]		[0.047]		[0.034]	
	Dummy for the third week of August	0.132***	-	0.065***	-	0.003	-	0.029	-	0.056	-
		[0.049]		[0.025]		[0.022]		[0.026]		[0.042]	
	Dummy for the fourth week of the month	0.181***	-	0.065*	-	-0.005	-	0.008	-	0.076*	-
		[0.052]		[0.037]		[0.025]		[0.027]		[0.044]	
	Dummy for the fifth week of the month	0.250***	-	-	-	-0.026	-	-	-	-	-
		[0.084]				[0.044]					
	Observations	1385		1109		1427		1140		1143	
	Number of programs	292		293		298		296		297	
	Pseudo R-squared	0.164		0.165		0.164		0.192		0.202	

Robust standard errors in brackets
Indicator variables are excluded from the regression when their taking value 0 or 1 predicts run or no run perfectly.

Table 7: Regressions of risk spreads on overnight ABCP issues

This table reports the results of estimating equation (3) from the text using monthly panels of daily observations:

$$\text{Spread}_{it} = \alpha + \sum_j \beta_j \text{Program Type}_{ji} + \gamma \text{Extendibility}_i + \delta \text{Rating}_{it} + \sum_k \theta_k \text{Sponsor Type}_{ki} + \sum_t \tau_t \text{D}_t + \varepsilon_{it}, \text{ for } i = 1, \ldots, N.$$

The dependent variable, Spread_{it}, is the spread over the fed funds target rate paid by program i on day t to issue overnight paper. N denotes the number of programs. Program Type_{ji}, equals 1 if program i is type j and equals 0 otherwise. The set of j program types includes multi-sellers, non-mortgage single-seller conduits, mortgage single-seller conduits, securities arbitrage programs, SIVs, CDOs, and other programs (the omitted category). Extendibility_i equals 1 for programs that issue paper with the option of extending maturity at the issuer's request, and Lower Rating_i is an indicator variable that equals 1 for programs rated P2 or P3 by Moody's Investors Service (i.e., the two lowest prime short-term ratings). Sponsor Type_{ki}, equals 1 if program i is sponsored by an institution of type k and equals 0 otherwise. The set of k sponsors includes large U.S. banks (the omitted category), small U.S. banks, non-U.S. banks, and nonbanking institutions. D_t denotes a daily time dummy. Standard errors clustered by program are reported in brackets.

Dependent variable: Overnight spread over fed funds target rate (percentage points)

	Coefficient	June	July	August	September	October	November	December
Program type	Multi seller	-0.015	0.001	-0.036	-0.143*	-0.127**	-0.097**	-0.093
		[0.020]	[0.008]	[0.036]	[0.078]	[0.051]	[0.038]	[0.058]
	Non-mortgage single seller	-0.046	-0.032	-0.026	-0.005	-0.041	-0.026	0.050
		[0.036]	[0.035]	[0.076]	[0.153]	[0.104]	[0.083]	[0.113]
	Mortgage single seller	0.012	0.028**	0.148**	0.341***	1.015***	1.220***	1.412***
		[0.024]	[0.012]	[0.069]	[0.112]	[0.129]	[0.076]	[0.037]
	Securities arbitrage	-0.019	0.000	-0.082	-0.117	-0.049	-0.048	0.014
		[0.021]	[0.009]	[0.065]	[0.106]	[0.081]	[0.070]	[0.117]
	Structured invest. vehicle	-0.017	0.003	-0.007	0.005	0.168	0.311***	0.278**
		[0.019]	[0.008]	[0.053]	[0.116]	[0.137]	[0.062]	[0.110]
	CDO	0.008	0.026***	-0.169***	0.120	0.585***	0.000	0.395***
		[0.022]	[0.010]	[0.042]	[0.139]	[0.047]	[0.000]	[0.040]
	Extendibility	0.039***	0.054***	0.247***	0.370***	0.049	0.176	0.224
		[0.012]	[0.010]	[0.082]	[0.134]	[0.096]	[0.130]	[0.139]
	Rating	0.096***	0.086***	0.380***	0.370**	0.361**	0.291***	0.142*
		[0.007]	[0.009]	[0.067]	[0.175]	[0.182]	[0.108]	[0.072]
Sponsor type	Small U.S. bank	0.050***	0.041***	0.278***	0.545***	0.325***	0.290***	0.370***
		[0.015]	[0.012]	[0.055]	[0.093]	[0.075]	[0.032]	[0.077]
	Non-U.S. bank	0.017**	0.011**	0.133**	0.204*	0.109	0.084	0.134
		[0.008]	[0.005]	[0.054]	[0.107]	[0.067]	[0.051]	[0.086]
	Nonbanking Institution	0.026***	0.023***	0.135***	0.217***	0.094**	0.113***	0.182***
		[0.008]	[0.006]	[0.044]	[0.077]	[0.044]	[0.038]	[0.061]
	Constant	0.009	0.004	0.567***	0.520***	0.174***	0.458***	0.291***
		[0.018]	[0.009]	[0.111]	[0.093]	[0.056]	[0.050]	[0.071]
	Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	2208	2261	2429	1884	2025	1775	1608
	R-squared	0.052	0.351	0.416	0.271	0.404	0.486	0.359
	F test Time dummies = 0, p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1