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

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The U.S. asset-backed commercial paper (ABCP) market arguably played a pivotal role in the global financial market turmoil in the summer of 2007. A narrative of the turmoil begins with mounting delinquencies of subprime mortgages triggering a decline in confidence, particularly with respect to the credit ratings assigned to structured products.[1] Apparently reflecting these concerns, investors became reluctant to purchase commercial paper, yields on ABCP and lower-rated unsecured paper soared, and ABCP outstandings fell almost by a staggering $400 billion by the end of the year (see Figures 1 and 2). These problems, in turn, sparked concerns about balance sheet exposures of banking institutions to the ABCP market through explicit back-up liquidity facilities and implicit support for own-sponsored programs. As a result, banking institutions became protective of their liquidity and concerned about counterparty credit risk in term funding markets—as evidenced by sharply widening LIBOR spreads.

An important question about the summer's events with implications for financial stability is whether ABCP programs experienced panic-driven runs during which they were unable, or found it prohibitively costly to roll maturing paper. A pure panic-driven run can be thought of as an equilibrium in which investors refuse to purchase a program's paper only because they believe other investors will do the same and force the program to sell illiquid assets at a discount. If sufficiently widespread, panic-driven runs in the roughly $1 trillion ABCP market could create macro-level financial volatility. In addition, widespread runs could impair the liquidity of the financial institutions that sponsor or provide liquidity support to the programs. When runs occur, draws by issuers on liquidity and credit supports can lead to a forced and potentially costly expansion of assets at liquidity providers, often commercial banks. Sponsors and ABCP programs could also sell assets, but 'fire sales' can lead to even further declines in asset prices. These effects create the potential for disruptions in the ABCP market to affect other markets. Banks forced to meet liquidity draws may have to pullback on other forms of lending or raise capital, and asset price declines could force some leveraged investors to sell other assets, forcing down those prices.

[1] See, for example, Ben S. Bernanke, "The Recent Financial Turmoil and its Economic and Policy Consequences," Speech at the Economic Club of New York, October 15, 2007.

The possibility that the ABCP market is prone to panic-driven runs is suggested by the similarities between ABCP programs and banks. Both entities tend to issue liquid short-term debt to finance illiquid and long-term assets. 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 both appear to require some form of liquidity support to issue short-term debt suggests that they are subject to runs.[2] Of course, ABCP programs, like banks, may also be subject to fundamentals-driven runs, whereby investors quickly flee from potentially insolvent programs.[3]

In this paper, we measure and analyze runs in the ABCP market during the financial turmoil of 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."

In addition, a number of studies have analyzed the nature of bank runs. Calomiris and Mason (2003) find that panic-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 panic.

[2] To be more precise, the need for liquidity support is suggestive of runs, while the existence of liquidity support should help to mitigate runs.
[3] Diamond and Dybvig (1983) are the first to make the distinction between panic- and fundamentals-driven runs.

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 general understanding of runs using a rich issue-level data set of ABCP transactions, where a run is defined as no issuance at a program with a substantial amount of maturing paper. Our data set contains proprietary information from the Depository Trust Corporation (DTC) on the prices and quantities of all commercial paper transactions in the U.S. commercial paper market, as well as weekly information on outstandings at all commercial paper programs. In addition to identifying runs on ABCP programs, we follow the literature on bank runs and attempt to disentangle runs driven by panics from runs driven by deteriorating fundamentals. Our analysis uses a rich cross section of data to link runs to a number of fundamentals, including program and sponsor types, ratings, and contract characteristics. Our approach is to attribute increases in the likelihood of runs across all programs, after controlling for fundamentals, to panic. A key advantage of our analysis over prior studies of runs is the high frequency of our data, which we use to identify panics and to study the weekly evolution of runs and their determinants through and after the crisis. We also use information on pricing 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.[4]

Our analysis yields substantial evidence of runs in the ABCP market. Indeed, we find that nearly 40 percent of programs were in a run at the end of 2007. We also find that runs in the first few weeks of the crisis were widespread, even after controlling for fundamentals, consistent with the runs being driven by panic. However, after a few weeks, the runs mostly plagued programs with apparent exposures to mortgage-related assets, and with sponsors that were foreign banks, non-banks, and small-domestic-bank sponsors, that might not be able to provide adequate liquidity support. In our analysis of ABCP pricing we find a similar pattern, with yield spreads ballooning for most programs in the first several weeks of the crisis, but subsequently tiering for the most part on the types of programs identified as subject to runs.

[4] The notion that the risk of a run can be priced is shown in Goldstein and Pauzner's 2005 theoretical model of bank runs.

These results suggest a more nuanced view of runs than the one presented in the literature to date. In particular, our results suggest that the nature of runs evolves rapidly through a crisis, with widespread runs taking place during the first weeks of the turmoil, but with runs later on centered on fundamentally impaired programs. Similarly, Martinez and Schmukler (2001) find that deposit levels and interest rates in three countries during their respective banking crises in the late 1990s depended on bank fundamentals only in the wake of each crisis. Our contributions relative to their paper are: first, to show that this dynamic holds during an ABCP crisis; second, to link the dynamic explicitly to runs; and, third to trace out the evolution of investor behavior during a crisis at a relatively high frequency.

The remainder of this paper proceeds as follows. In Section I we discuss why one might expect ABCP programs to be subject to runs, types of ABCP programs, data, and summary statistics on outstandings and spreads that are suggestive of runs. Section II displays our methodology for estimating and analyzing runs, and our empirical results follow in Section III. We conclude in Section IV with a discussion of policy implications.

I. Background on the ABCP Market and Data

i. ABCP programs are like banks

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 are longer term and more illiquid than its debt. 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 has maturities of 1-4 days. ABCP is thought to be liquid because positions are liquidated, mostly the next business 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 and avoid

"breaking the buck" (when the net asset value falls below $1).[5] An important feature of ABCP programs is the form of liquidity support, and traditionally most programs had liquidity support provided explicitly by a line or letter of credit from the sponsor. The heightened 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).

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. ABCP programs employ various credit support mechanisms and have credit ratings from the major rating agencies, but specific assets in the pools 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.

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.

[5] 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.

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. As of January 2007, there were 92 separate multi-seller programs in the U.S. ABCP market with ABCP outstanding of $455 billion, about 45 percent of total 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 extendable 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 January 2007, there were 48 single-seller programs, about 14 percent of the U.S. ABCP market.

Notably, about 11 of the 48 single-seller conduits primarily funded mortgages. This *single-seller mortgage* subcategory essentially warehoused mortgages prior to their securitization.

Even more similar to a bank 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 on balance sheet. The sponsor banks provide full liquidity support. By using off-balance-sheet funding, commercial banks exploit regulatory capital arbitrage opportunities. In January 2007, these programs 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.

Before the financial turmoil caused SIVs to change their practices (and ultimately disappear), most SIVs issued a combination of senior liabilities with longer maturity than commercial paper (i.e., medium-term notes) to attenuate liquidity risks. In addition, SIVs also issued junior liabilities to absorb the first credit losses to attenuate credit risks to ABCP investors. In addition, many SIVs followed mark-to-market accounting, and this mark-to-market 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. At their peak in July 2007, SIVs represented 7 percent of the U.S. ABCP market.

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 partial liquidity support. There were 32 ABCP CDO programs in January 2007, and their paper represented about 4 percent of the market.

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 the recent market turmoil was expected losses on subprime mortgage-related assets 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, investors can be more confident about programs for which they understand asset holdings and liquidity support. However, while investors can 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 had the clearest insight, perhaps, into single-seller mortgage conduits, because their assets were mortgages originated by the lender, and liquidity was often also supported by that lender. In contrast, securities arbitrage, SIVs, and CDOs held subprime-related assets, but

predominantly in their structured forms and the underlying mortgages were originated by many different lenders. Moreover, some of these programs, notably SIVs, would not widely disclose their proprietary investment strategies. A Moody's report (2007a) documented that about one-quarter of SIV and CDO ABCP assets were in highly-rated mortgage-backed securities. In a separate report, Moody's (2007b) reports that securities arbitrage programs, like SIVs, had about 27 percent of its assets in highly-rated mortgage-backed securities, suggesting both types of programs had substantial subprime mortgage exposures and were opaque about asset holdings. An important distinction between securities arbitrage and SIVs, however, is that the latter lacked explicit full liquidity support, which we show below helps to explain why investors ran on SIVs but not securities arbitrage.

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, most 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 a provision that allowed it to extend the maturity of its paper. When the paper was due, the program had the option to extend for some period of time at a pre-set rate. Most single-seller programs contained an extendible feature. Indeed, American Home Mortgage 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 and if exercised by firms that were downgraded or that failed.

Programs also vary by type of sponsor. Large U.S. banks have long sponsored ABCP programs. Some smaller U.S. banks, such as Zions First National Bank and PNC Bank, have also sponsored some conduits, but represent a very modest share of the market. Foreign banks have substantially increased their market share of sponsored ABCP programs in the U.S. market over the past few years. For example, with the salient exception of Citigroup, no other U.S. institutions were substantially involved in the SIV segment of the market. Nonbanks, including

finance companies or asset managers, also serve as sponsors, but these firms would more likely turn to a bank to provide liquidity support. 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 this data, we calculate implicit yields on new overnight paper (maturity of 1-4 days) paid by issuers using standard money market conventions. [6] 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 287 of the 353 programs in the raw data.

Market and program-level levels of ABCP outstanding in our raw data are summarized in Table 2. Total outstanding ABCP grew slightly over the first half of the year, from $1,061 billion in January to $1,163 billion by the end of July. However, the level of outstandings plunged by roughly $200 billion in August, and then fell another $180 billion over the remaining months of the year. Taken together, the market at year-end was nearly 30 percent less than at mid-year. Some program types fared better than others. Outstandings at multi-seller programs actually increased a bit, from about $455 billion at the end of January to about $469 billion at the end of December. But outstandings in all the other program categories -- non-mortgage single seller, mortgage single seller, SIVs, CDOs, and other -- declined, some by significant amounts. Notably, outstandings at mortgage single-seller programs fell from $23 billion to $2 billion and

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

SIVs fell from $84 billion to $15 billion during July to December 2007, as nearly all of these programs were unable to issue new paper as paper matured.

Summary statistics on overnight ABCP yield spreads over the fed funds target rate are shown in Table 3 and Figure 4. 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. In August, spreads averaged 47 basis points, remained elevated for several months, and then bumped up to an average of 53 basis points in December as strains in the market were likely compounded by typical year-end pressures.[7] As shown in Figure 4, the jump in spreads in August was evident across all program types. However, in the last four months of the year, spreads on ABCP issued by multi-seller programs were substantially lower than in all other program categories.

These patterns in our data are suggestive of runs in 2007, as outstandings dropped and programs appeared to be under substantial pricing pressure. Moreover, the relatively strong performance of multi-sellers after August suggests some tiering in the market along fundamentals, and so is less suggestive of panic-driven runs during that 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.

II. Methodology

In traditional bank runs, depositors withdraw demand deposits from commercial banks. We define a run on a commercial paper program analogously as occurring if 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.[8] The program is

[7] See Downing and Oliner (2006), and Downing and Covitz (2007) for discussions of year-end effects in the commercial paper market.

[8] 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.

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. We want to measure runs at the highest possible frequency to help uncover changing run dynamics through the period of financial turmoil. However, we cannot construct the run measure at a daily frequency, as our data on program outstandings are weekly. 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 no-issuance condition makes our definition of runs conservative in the sense that even programs with at least some issuance are not classified as having experienced a run, even if the amount issued is small relative to the amount of maturing paper.

Notably, our run measure can not distinguish between issuers being shut out or finding it too costly to issue ABCP. However, in either case, the program identified as experiencing a run by our measure will be contracting and putting pressure on sponsors, a key policy concern that motivates our analysis. Another potential difficulty with our definition is that it allows for the possibility that programs can be in a run, exit a run, and then start a new run. This type of cycling in and out of runs seems inconsistent with the intuitive notion that a run is an absorbing state. However, we estimate unconditional hazard rates over time of the probability of leaving the run state, and find it to be near zero during the financial turmoil. In other words, the runs we identify do appear to be absorbing states during the financial crisis.

One additional 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 triggered by panic.

In our primary specification, to proxy for "fundamentals" we use program, sponsor, and contract information, which are mostly constant over time within a particular program—the exception being the program's rating. The presumption is that concern about the exposure of some program types to mortgage-related assets was the fundamental that triggered runs. To capture panic, we use time dummies. Of course, it is possible that panic could be triggered by program fundamentals. As a result, even if fundamentals are important for explaining runs, panic may still play a role (Gorton, 1988, and Demirgüç-Kunt and Detragiache, 1998, make similar points). However, a finding that time dummies are important for explaining runs 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 across 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.

We also 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.[9] Exposure to subprime mortgages and expected performance of these assets were a major source of uncertainty about asset quality of ABCP programs. One measure of expected performance on such assets is the ABX index. This index is traded daily and was a harbinger of the losses realized on these assets. For a program with known mortgage exposure, the coefficient on the interaction between the program type and the index return is expected to be negative–such programs are more likely to suffer a run, but the likelihood is reduced 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

[9] 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 originated in the first half of 2006.

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. In addition, spreads provide a higher frequency measure (i.e., daily) of the dynamics of investor behavior through the financial turmoil.

III. Empirical Analysis of Runs

a. Runs during financial turmoil were fully absorbing

The percent of ABCP programs experiencing a run each week based on our definition was quite low from January to July of 2007, but then shot up in August as the financial market turmoil erupted (see Figure 3). Before August, the share of programs experiencing a 'run' was less than 5 percent each week. Starting in August, the percent of ABCP programs experiencing a run each week was substantial, rising 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, according to our definition, were in a run.

To evaluate our identification of runs, we estimate an unconditional hazard rate for programs in a run—that is, the unconditional likelihood that a program exits a run. As already discussed in the methodology section, a run should be an absorbing state in which a program is essentially shut out of the market. However, as shown by the dotted line in Figure 3, in the first seven months of the year, the hazard rate was high, ranging from 20 to 50 percent, calling into question whether the few programs identified as having been in a run during this period were indeed in runs. In contrast, the estimated hazard rate fell to less than 10 percent on average in early August, and then declined to near zero by the end of the year, confirmation that the mounting number of programs identified as having been in runs during this period were indeed subject to runs.

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 relatively confident that our measure accurately identified runs. The results from this baseline regression are shown in Table 4.

Several results suggest that fundamentals helped trigger runs. First, the p-values for the entire set of program variables (i.e., all variables but the time dummies) in each month are all significant. Moreover, the coefficients on *extendibility* and *lower rating* are positive, significant, and large. The positive coefficients on *extendibility* likely reflect the importance of liquidity to investors. If programs have the option to extend, then ABCP investors, such as money funds, may not receive funds on demand, a feature that is especially costly if money funds are facing redemptions. The positive coefficient on *lower rating* indicates that programs with greater credit and liquidity risk were more subject to runs than fundamentally stronger programs. We also find evidence that investors were more likely to run from programs with exposure to mortgages. The omitted category in each regression, *hybrid and unclassified*, had roughly an average propensity to experience a run. The coefficients on *mortgage single seller* were generally positive, significant, and large, as were the coefficients on *structured investment vehicle*. All of these

programs were known at the time to have substantial exposures to mortgage-related assets.[10] Moreover, investors may have run from structured investment vehicles, in part, because they lacked liquidity support, a possibility suggested by the fact that the coefficients on *securities arbitrage* were mostly insignificant despite such programs likely having exposures to subprime mortgages. The importance of liquidity support is also suggested by the positive and significant coefficients on *nonbanking Institutions* beginning in October, as nonbanks do not have 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, the results in Table 4 suggest that panic also played a role in generating runs. In particular, the coefficients on the weekly time dummies are positive and significant starting in the third week of August through the last week of September, with point estimates of the marginal effects ranging from 6 to 14 percent. The possibility of panic is plausible given the major liquidity and credit events in money markets that took place during that period. For instance, on Thursday August 9 BNP Paribas, a French bank, halted redemptions from its money market mutual funds and the ECB announced they would supply a huge amount of reserves to promote stability.[11] The Federal Reserve on Friday August 10 also announced they would supply funds but overnight ABCP rates still jumped to over 6 percent (from a bit above 5), where it had hovered for many months. The following Tuesday, the ABCP market in Canada was severely disrupted and banks refused to provide emergency funding. The calendar of events (Table 5) indicates that the market continued to be roiled in the following weeks by credit and liquidity events.

Under the interpretation that, after controlling for observable fundamentals, aggregate time effects capture the extent to which panic explains runs, our analysis suggests that periods when panics are relevant drivers of runs in the ABCP market are short. Indeed, after August and September, when time effects contribute to explain the variation in our measure of runs, the magnitude and statistical significance of the aggregate time effects drop substantially in Table 4. Furthermore, starting in October, only program-level variables, our proxies for fundamentals, are relevant to explain the variation in our measure of runs. The marginal effects associated with

[10] See Moody's 2007a and 2007b.
[11] Because our data on CP outstandings are available for weeks ending Wednesday, week 3 of August starts on August 9.

single-seller mortgage programs and structured investment vehicles become large and statistically significant a few weeks after our aggregate measure of runs jumps in Figure 3. This finding suggests that investors avoided exposures to mortgages by not purchasing paper from programs with significant exposures to structured mortgages or that warehoused mortgages. Similarly, investors also avoided programs whose sponsors were not perceived as strong enough to be able to provide liquidity to the conduit, as the marginal effect on nonbanking institutions becomes statistically significant and large after September. In short, our results suggest that panics are short-lived phenomena in the ABCP market.

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

The results from the secondary analysis, which augments the primary regressions with interactions between program dummies and the weekly return on the ABX, are shown in Table 6. The coefficients on the time dummies in September and August remain significant, and are similar in magnitude to the coefficients from the baseline regressions. In addition, the coefficients on the interactions between the ABX return and program type dummies are mostly insignificant, an indication that investors were not modulating their propensity to run from ABCP programs with weekly changes in expectations about subprime mortgages.

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. To preview, we find that rate spreads for all programs were very high after the financial turmoil erupted in the summer of 2007, suggesting that programs were not eager to issue and investors were not anxious to buy. In addition, lack of distinction in pricing across programs in the first few weeks of the turmoil supports the panic hypothesis.

As shown earlier in Figure 4 and Table 2, daily spreads on overnight paper for ABCP programs were very low, averaging about 3 to 6 basis points above the target federal funds rate,

before disruptions in August 2007. The results, which are displayed in Table 7, show only very modest differences in spreads across program types before August. Only the coefficient on *CDOs* is generally significant, and suggests only 1 to 1-1/2 basis points more than multi-seller. But, lower-rated programs consistently paid about 6 to 8 basis points more, extendible programs paid about 4 basis points, and programs with sponsors that were not large US banks generally paid about 1 to 5 basis points more for issuing.

In contrast, spreads averaged a substantial 47 basis points in August. In addition, ABCP features that were important before the disruptions became much more important after. The coefficient on extendibility increased to 25 basis points in August; the coefficient on rating rose to 38 basis points. Spreads on sponsors that were not *large US banks* also became large and significant in August. Spreads remained elevated through the remainder of the year for all program types, and distinctions among features remained strong. As in Martinez-Peria and Schmuckler (2001), higher premiums were required for risk characteristics after the onset of troubles. As we found for program runs, coefficients on *single-seller mortgages*, *SIVs*, and *CDOs* became consistently statistically significant after August. These programs were likely to experience runs; those able to issue paid substantially higher spreads. For example, as *mortgage single-seller* outstandings fell from $23 billion in July to $2 billion in December, spreads required on new issues were 150 basis points higher than the elevated spreads required for other ABCP issues. *Multi-sellers* were issuing at about a 10 to 15 basis point discount to other programs.

Despite the increased role played by program characteristics when financial turmoil ensued, however, such characteristics generally explained only a small part of the overall variation in ABCP spreads. As shown in Figure 5, in July and August, the majority of the explanatory power came from the time dummies, not the program fundamentals. This result is strongly suggestive of a panic in the early weeks of the turmoil when investors did not make meaningful distinctions among types of programs, and instead chose to charge a higher price for all programs. Within weeks, however, the time dummy variables lost their explanatory power, while fundamentals explained a greater share of the variation. These results corroborate those predicting program runs, in which many investors initially refused to roll over paper across all types of programs, but within weeks became more selective based on program fundamentals.

IV. Conclusion

One implication of our results concerns the design of ABCP programs. In particular, our results suggest that some forms of liquidity support prevent runs better than others. In particular, all structures that employed "dynamic liquidity management" or extendable commercial paper rather than full liquidity support were literally run out of the market by the end of 2007. Another 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.[12] A corollary to this is that the federal government may be exposed to runs from unregulated entities (i.e., ABCP conduits sponsored by banks).

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

Figure 1: Commercial paper outstanding

The solid line plots the weekly (Wednesday) 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.

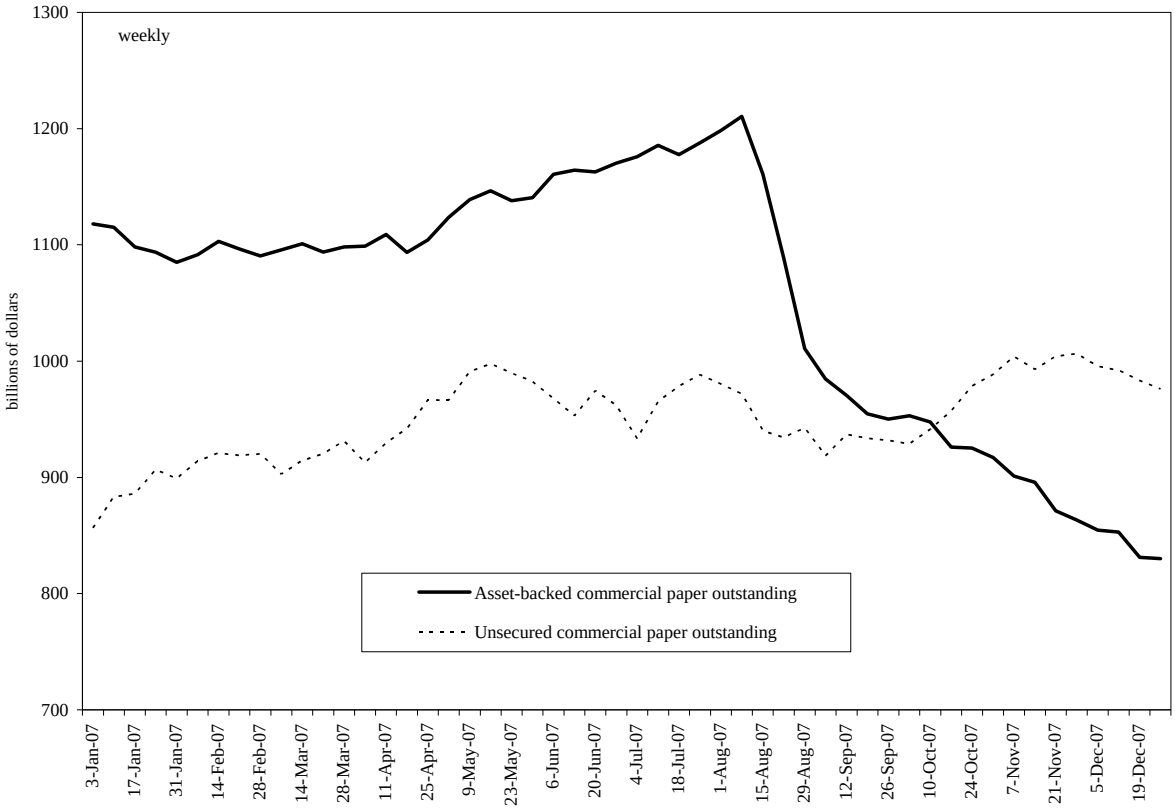

Figure 2: Overnight commercial paper spreads

The solid line plots the daily 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.

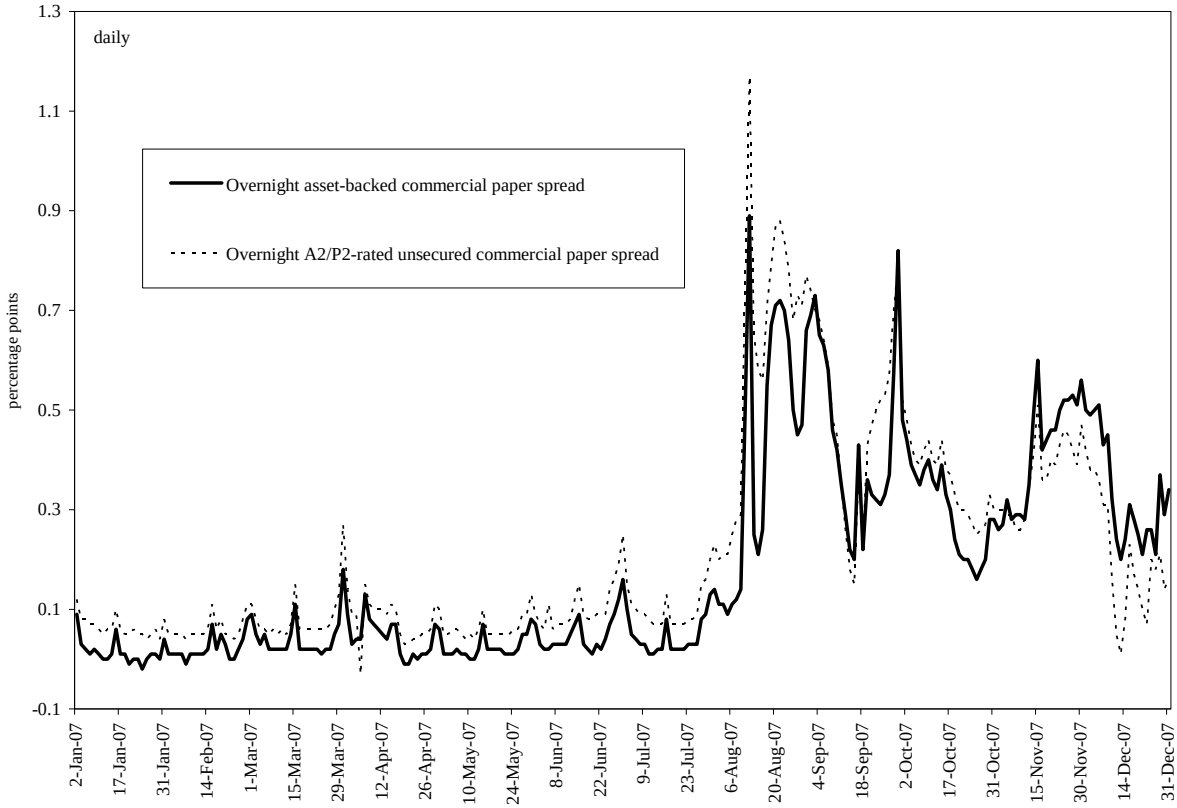

Figure 3: Programs experiencing runs

The solid line plots the weekly fraction 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 asset-backed commercial paper (ABCP) programs in 2007.

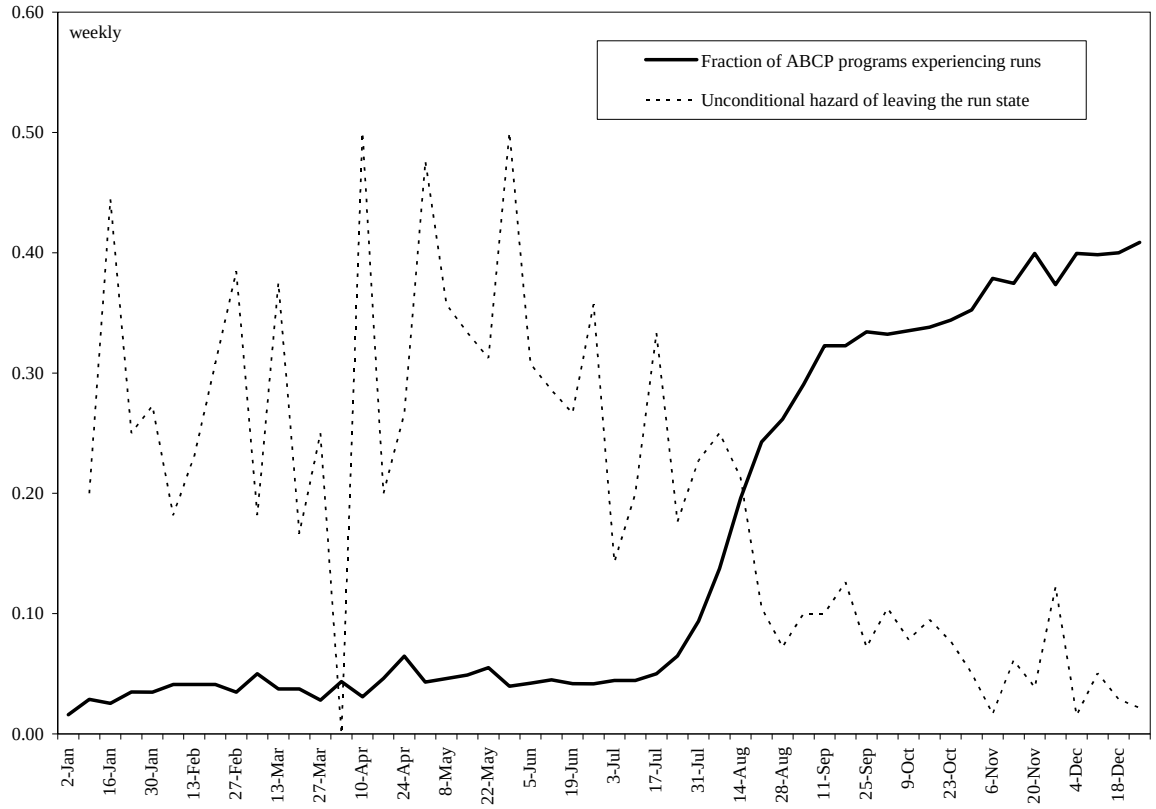

Figure 4: Overnight commercial paper spreads by program type

The solid line plots the daily 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.

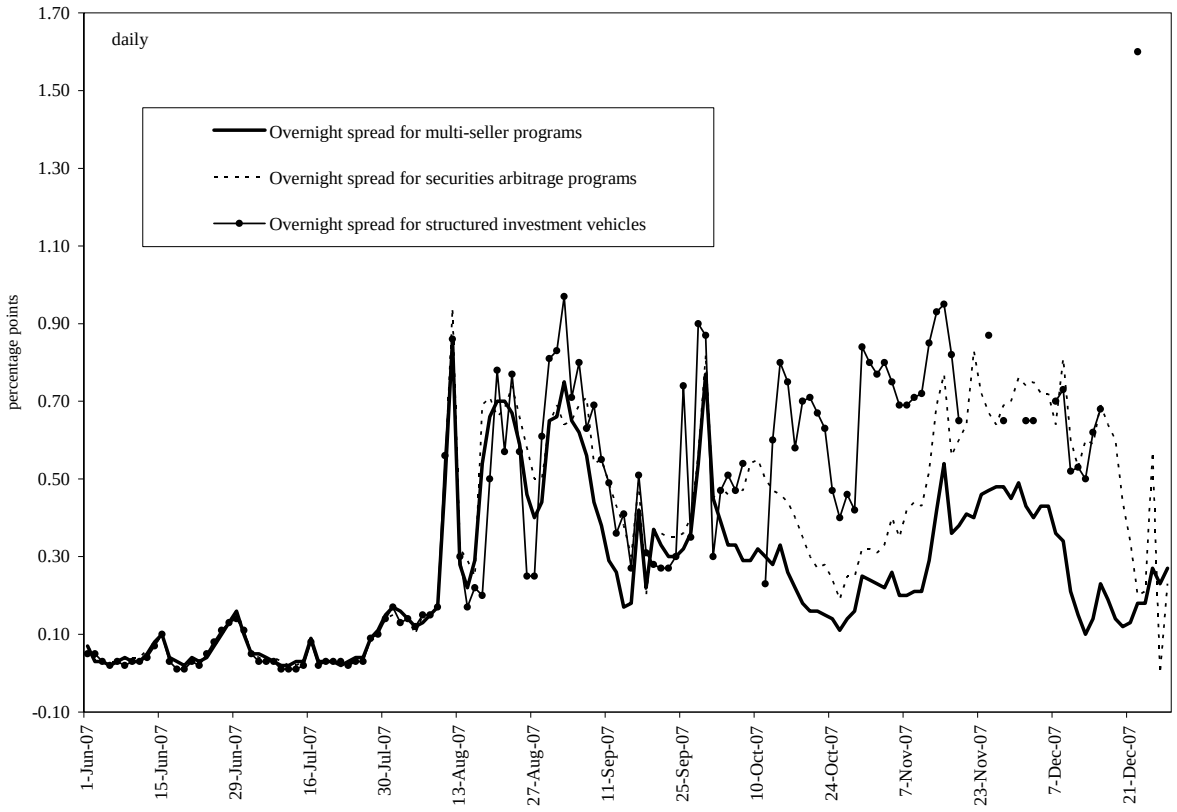

Figure 5: Explanatory power of time effects and program characteristics for spread regressions

The solid line plots the adjusted R-squared from running equation (3) from the text without day-fixed effects, i.e., the explanatory power of program characteristics for overnight spreads. Program characteristics are: (i) program type dummies (for multi seller, non-mortgage single seller, mortgage single seller, securities arbitrage, structured investment vehicles, and CDO programs, while omitting "hybrid and other" programs); (ii) a dummy variable for programs that issue extendible paper; (iii) an indicator variable for programs rated P2 or P3 by Moody's Investors Service; and (iv) sponsor type dummies (for small U.S. banks, non-U.S. banks, and nonbanking institutions, while omitting programs sponsored by large U.S. banks). The dotted line plots the adjusted R-squared from running equation (3) from the text with time-fixed effects only. The regressions are monthly panels of daily observations for all months in 2007.

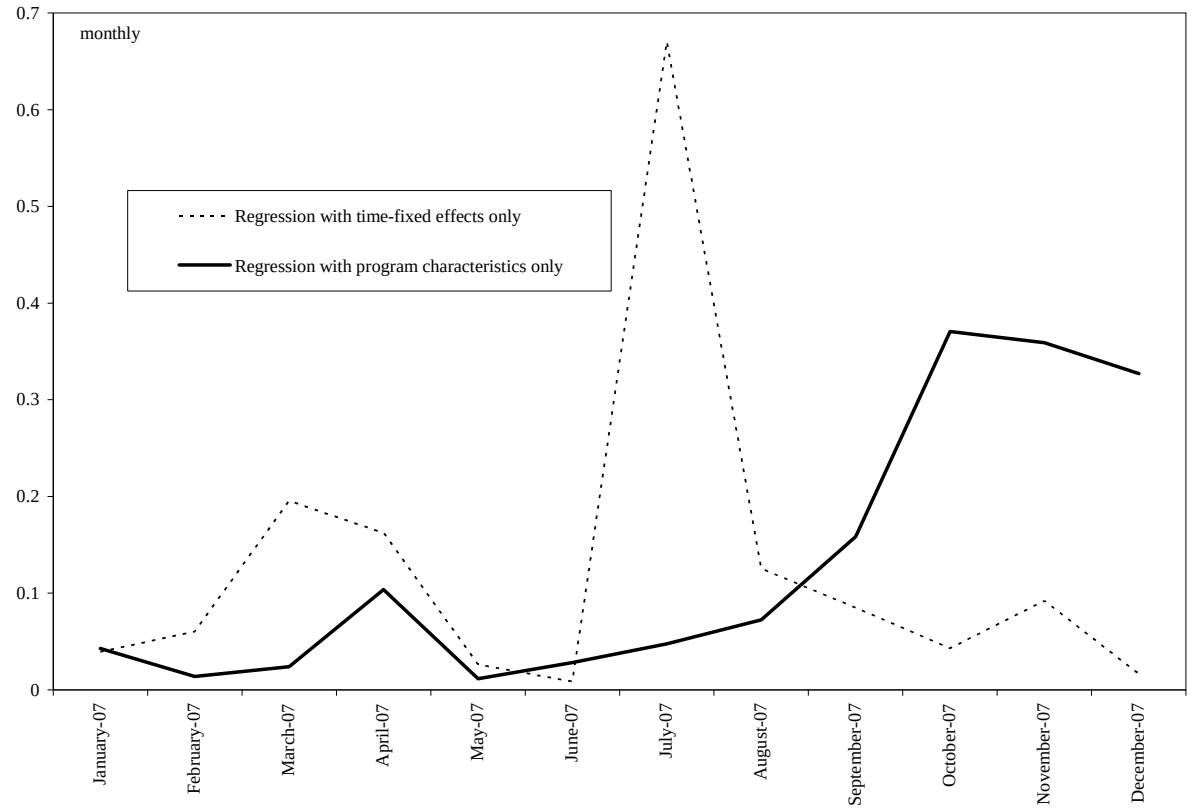

Table 1: Asset-backed commercial paper program types

Program Type	Assets	Liquidity Support	Number of Programs	Percent of Outstandings
Multi Seller	Receivables and loans	Full	92	42.9
Non-Mortgage Single Seller	Credit card receivables and auto loans	Implicit by originator	37	11.4
Mortgage Single Seller	Mortgages and mortgage-backed securities	Implicit by originator	11	3.0
Securities Arbitrage	Highly-rated long-term securities	Full	33	15.0
Structured Investment Vehicle	Highly-rated long-term securities	None	29	5.9
CDO	Highly-rated long-term securities	Partial	32	3.9
Hybrid and Other	n.a.	n.a.	77	17.9

Notes. Number of programs and percent of market outstandings are based on data as of January 2007.

Table 2: Asset-backed commercial paper outstanding and number of programs

Panel A 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. Panel B reports the number of programs per type at the end month. Data on paper outstanding are from DTC and program type classification is from Moody's Investors Service.

Panel A

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

Panel B

number of programs, 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	316	95	38	11	33	29	32	78
Feb	316	95	38	11	33	29	32	78
Mar	320	96	39	11	33	29	33	79
Apr	324	97	39	11	34	30	34	79
May	327	97	40	11	34	30	35	80
Jun	336	98	40	11	35	34	36	82
Jul	339	98	40	11	35	35	36	84
Aug	343	99	40	11	36	35	36	86
Sep	343	99	40	11	36	35	36	86
Oct	345	99	40	11	36	35	36	88
Nov	347	99	40	11	36	35	36	90
Dec	349	99	40	11	36	35	36	92

Table 3: Asset-backed commercial paper spreads

This table reports the spread over the fed funds target rate paid by different asset-backed commercial paper (ABCP) program types to issue overnight paper in the U.S. market. Data on ABCP transactions are from DTC and program type classification is from Moody's Investors Service. Spreads are weighted averages of individual transaction spreads 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 on 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	-0.101	-0.067	-0.102	-0.104
		[0.048]	[0.068]	[0.071]	[0.076]	[0.080]
	Non-mortgage single seller	0.059	0.005	0.065	-0.012	-0.045
		[0.075]	[0.091]	[0.105]	[0.107]	[0.110]
	Mortgage single seller	0.266*	0.404**	0.362*	0.428***	0.459***
		[0.151]	[0.187]	[0.187]	[0.159]	[0.173]
	Securities arbitrage	0.025	-0.127*	-0.107	-0.113	-0.060
		[0.074]	[0.075]	[0.082]	[0.093]	[0.106]
	Structured invest. vehicle	0.069	0.161*	0.324***	0.427***	0.397***
		[0.071]	[0.093]	[0.094]	[0.095]	[0.097]
	CDO	0.104	0.078	0.090	0.051	0.081
		[0.097]	[0.103]	[0.111]	[0.115]	[0.114]
	Extendibility	0.238***	0.338***	0.372***	0.437***	0.494***
		[0.066]	[0.081]	[0.077]	[0.076]	[0.074]
	Lower Rating	0.440***	0.475***	0.302**	0.233	0.445***
		[0.146]	[0.130]	[0.153]	[0.198]	[0.131]
Sponsor type	Small U.S. bank	0.054	0.110	0.272	0.163	0.199
		[0.094]	[0.153]	[0.186]	[0.209]	[0.201]
	Non-U.S. bank	0.038	0.120	0.140	0.198	0.246**
		[0.075]	[0.109]	[0.117]	[0.124]	[0.124]
	Nonbanking Institution	-0.017	0.067	0.132*	0.176**	0.172*
		[0.066]	[0.079]	[0.078]	[0.088]	[0.093]
	Week 1 dummy	-	-	-	-	-
	Week 2 dummy	0.032	0.061**	0.001	0.009	0.015
		[0.024]	[0.024]	[0.018]	[0.017]	[0.017]
	Week 3 dummy	0.089***	0.065***	0.008	0.030	0.013
		[0.031]	[0.025]	[0.022]	[0.019]	[0.017]
	Week 4 dummy	0.141***	0.066**	0.007	0.009	0.034*
		[0.036]	[0.027]	[0.023]	[0.021]	[0.020]
	Week 5 dummy	0.160***	-	0.012	-	-
		[0.035]		[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 SIBs. (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 on the probability of experiencing a run: Interactions with the ABX index

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 growth rate of the ABX.HE index for AAA-rated bonds issued in the first half of 2006. 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 on commercial paper spreads

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	April	May	June	July	August	September	October	November	December
Program type	Multi seller	0.006	0.007*	-0.015	0.001	-0.036	-0.143*	-0.127**	-0.097**	-0.093
		[0.007]	[0.004]	[0.020]	[0.008]	[0.036]	[0.078]	[0.051]	[0.038]	[0.058]
	Non-mortgage single seller	-0.029	-0.035	-0.046	-0.032	-0.026	-0.005	-0.041	-0.026	0.050
		[0.033]	[0.041]	[0.036]	[0.035]	[0.076]	[0.153]	[0.104]	[0.083]	[0.113]
	Mortgage single seller	0.028**	0.043***	0.012	0.028**	0.148**	0.341***	1.015***	1.220***	1.412***
		[0.013]	[0.016]	[0.024]	[0.012]	[0.069]	[0.112]	[0.129]	[0.076]	[0.037]
	Securities arbitrage	0.001	0.004	-0.019	0.000	-0.082	-0.117	-0.049	-0.048	0.014
		[0.008]	[0.006]	[0.021]	[0.009]	[0.065]	[0.106]	[0.081]	[0.070]	[0.117]
	Structured invest. vehicle	0.005	0.009*	-0.017	0.003	-0.007	0.005	0.168	0.311***	0.278**
		[0.006]	[0.005]	[0.019]	[0.008]	[0.053]	[0.116]	[0.137]	[0.062]	[0.110]
	CDO	0.022***	0.027***	0.008	0.026***	-0.169***	0.120	0.585***	0.000	0.395***
		[0.005]	[0.003]	[0.022]	[0.010]	[0.042]	[0.139]	[0.047]	[0.000]	[0.040]
	Extendibility	0.032***	0.029**	0.039***	0.054***	0.247***	0.370***	0.049	0.176	0.224
		[0.010]	[0.011]	[0.012]	[0.010]	[0.082]	[0.134]	[0.096]	[0.130]	[0.139]
	Rating	0.083***	0.084***	0.096***	0.086***	0.380***	0.370**	0.361**	0.291***	0.142*
		[0.007]	[0.003]	[0.007]	[0.009]	[0.067]	[0.175]	[0.182]	[0.108]	[0.072]
Sponsor type	Small U.S. bank	0.034*	0.030***	0.050***	0.041***	0.278***	0.545***	0.325***	0.290***	0.370***
		[0.019]	[0.011]	[0.015]	[0.012]	[0.055]	[0.093]	[0.075]	[0.032]	[0.077]
	Non-U.S. bank	0.007	0.009*	0.017**	0.011**	0.133**	0.204*	0.109	0.084	0.134
		[0.012]	[0.005]	[0.008]	[0.005]	[0.054]	[0.107]	[0.067]	[0.051]	[0.086]
	Nonbanking Institution	0.008	0.017***	0.026***	0.023***	0.135***	0.217***	0.094**	0.113***	0.182***
		[0.012]	[0.006]	[0.008]	[0.006]	[0.044]	[0.077]	[0.044]	[0.038]	[0.061]
	Constant	0.024**	-0.003	0.009	0.004	0.567***	0.520***	0.174***	0.458***	0.291***
		[0.012]	[0.005]	[0.018]	[0.009]	[0.111]	[0.093]	[0.056]	[0.050]	[0.071]
	Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Observations	1766	1912	2208	2261	2429	1884	2025	1775	1608
	R-squared	0.156	0.324	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	0.000	0.000

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

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