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Securitization without risk transfer ☆

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ABSTRACT

We analyze asset-backed commercial paper conduits, which experienced a shadow-banking run and played a central role in the early phase of the financial crisis of 2007–2009. We document that commercial banks set up conduits to securitize assets worth $1.3 trillion while insuring the newly securitized assets using explicit guarantees. We show that regulatory arbitrage was an important motive behind setting up conduits. In particular, the guarantees were structured so as to reduce regulatory capital requirements, more so by banks with less capital, and while still providing recourse to bank balance sheets for outside investors. Consistent with such recourse, we find that conduits provided little risk transfer during the run, as losses from conduits remained with banks instead of outside investors and banks with more exposure to conduits had lower stock returns.

1. Introduction

Securitization was traditionally meant to transfer risks from the banking sector to outside investors and thereby disperse financial risks across the economy. Because the risks were meant to be transferred, securitization allowed banks to reduce regulatory capital. However, in the period leading up to the financial crisis of 2007–2009, banks increasingly devised securitization methods that allowed them to retain risks on their balance sheets and yet receive a reduction in

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regulatory capital, a practice that eventually contributed to the largest banking crisis since the Great Depression. In this paper, we analyze one form of securitization, namely, asset-backed commercial paper (ABCP) conduits (henceforth, conduits), as an example of how banks exposed themselves to such risks.

Conduits are special purpose vehicles managed by large commercial banks. Conduits purchase medium- to long-term assets, which they finance by issuing short-term asset-backed commercial paper. Given this structure, conduits are similar to regular banks in many ways and form an integral part of financial intermediation that has over time come to be called "shadow banking." Put simply, shadow banking is that part of the intermediation sector that performs several functions that traditionally are associated with commercial and investment banks but runs in the shadow of the regulated banks, in the sense that it is off-balance sheet and less regulated.[1]

As shown in Panel A of Fig. 1, ABCP outstanding grew from $650 billion in January 2004 to $1.3 trillion in July 2007. [2] At that time, ABCP was the largest money market instrument in the United States. For comparison, the second largest instrument was Treasury bills with about $940 billion outstanding. However, the rise in ABCP came to an abrupt end in August 2007. On August 9, 2007, the French bank BNP Paribas halted withdrawals from three funds invested in mortgage-backed securities and suspended calculation of net asset values. Even though defaults on mortgages had been rising throughout 2007, the suspension of withdrawals by BNP Paribas had a profound effect on the market.[3]

As shown in Panel B of Fig. 1, the interest rate spread of overnight ABCP over the federal funds rate increased from 10 basis points to 150 basis points within one day of the BNP Paribas announcement. Subsequently, the market experienced the modern-day equivalent of a bank run that originated in shadow banking, and ABCP outstanding dropped from $1.3 trillion in July 2007 to $833 billion in December 2007.[4] Apparently, investors in ABCP, primarily money market funds, became concerned about the credit quality and liquidation values of collateral backing ABCP and stopped refinancing maturing ABCP.

Our main conclusion in this paper is that, somewhat surprisingly, this crisis in the ABCP market did not result (for the most part) in losses incurred by those actually invested in ABCP. Instead, the crisis had a profoundly negative effect on commercial banks because banks had (in large part) insured outside investors in ABCP by providing explicit guarantees to conduits, which required banks to pay off maturing ABCP at par. Effectively, banks had used conduits to securitize assets without transferring the risks to outside investors, contrary to the common understanding of securitization as a method for risk transfer. We argue that banks instead used conduits for regulatory arbitrage.

We first show and describe the structure of the guarantees that effectively created recourse from conduits back to bank balance sheets. For the most part, these guarantees were explicit legal commitments to repurchase maturing ABCP in the event that conduits could not roll over their paper, not a voluntary form of implicit recourse. The guarantees could be structured as liquidity guarantees, a contract design that would reduce their regulatory capital requirements to at most a tenth of the capital required to back on-balance sheet assets (especially after this regulation was confirmed as a permanent exemption by regulators in the United States in July 2004; see Fig. 2). Such liquidity guarantees would cover most assets' credit and liquidity risks and effectively absorb all losses of outside investors. For comparison, banks also had the option to use weaker guarantees that did not cover all of the assets' liquidity and credit risks or use stronger guarantees that had strict capital requirements.

We test for regulatory arbitrage using a novel panel data set on the universe of conduits from January 2001 to December 2009. First, we analyze guarantees provided by, and the type of, financial institutions that manage ("sponsor") conduits. We find that the majority of guarantees were structured as capital-reducing liquidity guarantees and that the majority of conduits were sponsored by commercial banks (which among financial institutions are subject to the most stringent capital requirements). Also, the growth of ABCP stalled in 2001 after regulators considered increasing capital requirements for conduit guarantees (following the failure of Enron, which had employed conduit-style structures to create off-balance sheet leverage) (Wall Street Journal, 2001) and picked up again, especially the issuance of liquidity-guaranteed paper by commercial banks, after a decision against a significant increase was made in 2004 (see Fig. 2).[5]

Second, we examine whether more capital-constrained commercial banks were more likely to set up conduits. Using the sample of commercial banks with more than $50 billion in assets from 2001 to 2006, we find that liquidity-guaranteed ABCP was issued more frequently by commercial

[1] Adrian, Ashcraft, Boesky, and Pozsar (2010) show that shadow banking assets grew from an amount close to zero in 1980 to somewhere between $15 trillion and $20 trillion by 2008. In 2007, conduits represented about 25% of total assets newly transferred to shadow banking. In terms of the stock of assets, as of July 2007, conduits held more than $1.3 trillion, compared with securities lending of $0.6 trillion, broker-dealer repo of $2.5 trillion, and financial commercial paper of $0.8 trillion.

[2] ABCP outstanding is a good measure of the size of conduits because most conduits do not issue other liabilities. The only exceptions are structured investment vehicles, which also issue medium-term notes and capital notes. In July 2007, medium-term notes and capital notes accounted for about $400 billion.

[3] The announcement read: "[*T*]he complete evaporation of liquidity in certain market segments of the US securitization market has made it impossible to value certain assets fairly regardless of their quality or credit rating.... Asset-backed securities, mortgage loans, especially subprime loans, don't have any buyers.... Traders are reluctant to bid on securities backed by risky mortgages because they are difficult to sell.... The situation is such that it is no longer possible to value fairly the underlying US ABS assets in the three above-mentioned funds" (Bloomberg.com, 2007).

[4] Further, average maturity of asset-backed commercial paper outstanding declined from 32 days to 15 days over the same period.

[5] Consistent with the importance of capital requirements, banks based in countries such as Spain and Portugal that did not allow such capital-reducing liquidity guarantees did not sponsor conduits.

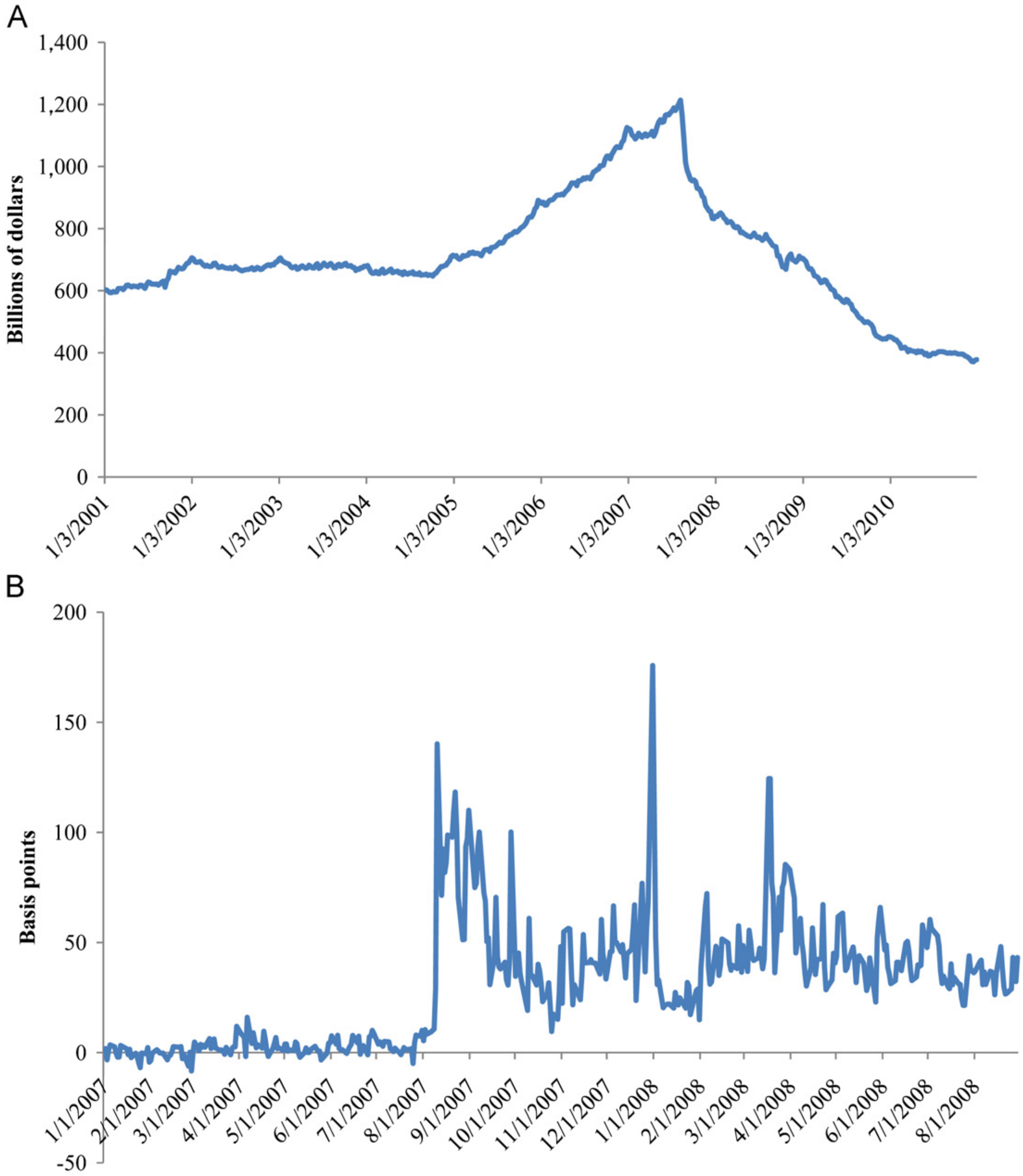

Fig. 1. Asset-backed commercial paper (ABCP) outstanding and spreads. Panel A plots weekly total ABCP outstanding in the US market from January 2001 to April 2010. Panel B shows the daily spread of overnight ABCP over the federal funds rate from January 2007 to August 2008. The figures are based on data published by the Federal Reserve Board.

banks with low economic capital, measured by their book value of equity relative to assets. We use panel regressions to confirm that this result is robust to controlling for time trends, bank characteristics, and bank fixed effects. Interestingly, we find a much weaker relation between the issuance of liquidity-guaranteed ABCP and the bank's regulatory capital, measured as the Tier 1 regulatory capital relative to risk-weighted assets. And, we find no relationship between a bank's capital position and the issuance of nonliquidity guaranteed ABCP, which had no associated relief from a regulatory capital standpoint. These results are highly suggestive of regulatory arbitrage. In particular, the use of liquidity-guaranteed conduits allowed banks to reduce their economic capital ratio, while maintaining a stable regulatory capital ratio.

Third, we examine the effect of guarantees on conduits' ability to roll over maturing ABCP during the shadow-banking run. The regulatory arbitrage hypothesis suggests that banks did not transfer risks to outside investors. We test for risk transfer using variation in the strength of guarantees and examine whether conduits with weaker guarantees had higher spreads, and were less likely to roll over ABCP, once the run took hold in August 2007. Using conduit-level data on daily spreads and weekly issuances, we find that, starting on August 9, 2007 conduits with weaker guarantees (namely, conduits with extendible notes and structured investment

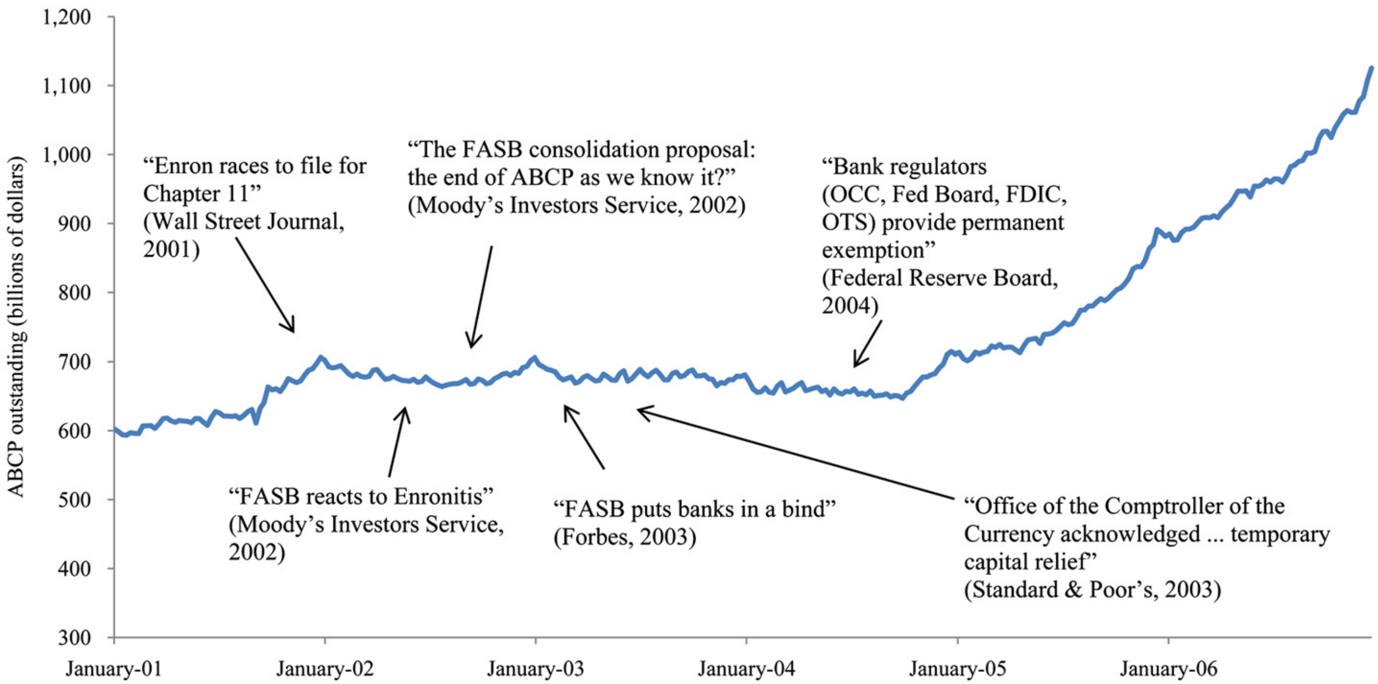

Fig. 2. Asset-backed commercial paper (ABCP) outstanding and capital regulation. This figure shows total weekly ABCP outstanding from January 2001 to December 2006. The figure also shows the timeline of regulatory decisions on regulatory capital required for guarantees provided to conduits.

vehicles or SIVs) experienced a substantial decrease in their ability to roll over maturing ABCP and a significant widening of spreads. Consistent with the lack of risk transfer, we find that conduits with stronger guarantees (namely, liquidity guarantees and credit guarantees) experienced a smaller decrease in issuances and a smaller rise in spreads.

Fourth, we analyze the extent of realized risk transfer by taking the perspective of an investor that was holding ABCP at the start of the run and studying whether the investor suffered losses by not rolling over maturing ABCP. The regulatory arbitrage hypothesis suggests that losses primarily remained with the sponsoring financial institution (henceforth, sponsor), not with outside investors. Using hand-collected data from Moody's Investors Service press releases, we identify all conduits that defaulted on ABCP in the period from January 2007 to December 2008. We find that all outside investors covered by liquidity guarantees were repaid in full. We find that investors in conduits with weaker guarantees suffered small losses. In total, only 2.5% of ABCP outstanding as of July 2007 entered default in the period from July 2007 to December 2008. Hence, most losses on conduit assets remained with the sponsoring banks. Assuming loss rates of 5–15%, we estimate that commercial banks suffered losses of $68 billion to $204 billion on conduit assets.

Finally, we examine the impact of a bank's exposure to conduits on bank stock returns. The regulatory arbitrage hypothesis suggests that banks were negatively affected by the run because they had insured conduits against losses. We focus our analysis on the narrow event window around the start of the financial crisis on August 9, 2007 to identify conduit exposure separately from the impact of other bank observables. We find that an increase in conduit exposure (measured as the ratio of ABCP to bank equity) from 0% to 100% (e.g., comparing Wells Fargo and Citibank) reduced the cumulative equity return by 1.1% during a 3-day window. The estimate increases to 2.3% when we expand the event window to one month. The result is robust to controlling for a large set of observable bank characteristics, and we find no effects prior to the run.

In summary, our results show that commercial banks used conduits to invest in long-term assets without holding capital against these assets. This evidence suggests that banks' investment decisions are at least partly motivated by activity aimed at circumventing regulatory constraints. Moreover, because these investments reflect significant maturity mismatch and default only in a severe economic downturn, banks are taking on rollover risk that is highly correlated within the financial sector. Hence, our analysis shows that regulatory arbitrage activity, if successful, can create significant concentrations of systemic risk in the financial sector. Regulatory arbitrage activity could result in a shadow banking sector that is intimately tied to the regulated banking sector, instead of transferring risks away from the latter.

The remainder of this paper is organized as follows. Section 2 discusses the institutional background. Section 3 presents our theoretical framework. Section 4 describes the data and discusses our empirical results. Section 5 analyzes the incentives of banks to set up conduits. Section 6 reviews the related literature. Section 7 concludes.

2. Institutional background

This section describes the basic structure of ABCP conduits and their connection with sponsoring financial institutions through guarantees. In addition, this section explains the different types of guarantees.

2.1. Conduit structure

A conduit is a special purpose vehicle set up by a sponsoring financial institution. The sole purpose of a conduit is to purchase and hold financial assets from a variety of asset sellers. The conduit finances the assets by selling ABCP to outside investors. The outside investors are primarily money market funds and other investors that prefer safe assets.

Most conduits exhibit a significant maturity mismatch. They purchase medium- to long-term assets with maturities of 3–5 years and hold them to maturity. They finance these assets primarily by issuing ABCP with a maturity of 30 days or less. Conduits regularly roll over their liabilities and use proceeds from new issuances of ABCP to pay off maturing ABCP.

Conduits minimize their credit risk by holding a diversified portfolio of high-quality assets. Typically, they are restricted to purchasing AAA-rated assets or unrated assets of similar quality. Some conduits exclusively purchase unrated assets originated by their sponsoring financial institutions. Other conduits exclusively purchase securitized assets originated by other financial institutions. Many conduits combine the two strategies by purchasing both securitized and unsecuritized assets from more than one financial institution.

Almost all sponsors provide guarantees to outside investors in ABCP. The guarantees are structured to ensure that ABCP is paid off even if the conduit's cash flow is insufficient to satisfy investor claims. Outside investors consider ABCP a safe investment because of these guarantees. Moreover, ABCP is very short term, so that investors can liquidate their investment quickly by not rolling over maturing ABCP.

Conduits generate significant risks for the sponsor. The sponsor's guarantee typically covers the conduit's rollover risk, which is the risk that the cash flows generated by the conduit cannot refinance maturing commercial paper, possibly because of a deterioration of conduit asset values. In that case, the sponsor has to assume the losses from lower asset values, because under the guarantee sponsors are required to repurchase assets at par. In exchange for assuming this risk, the sponsor could retain a residual interest in the conduit (and receive its profits) or charge a fee for providing the guarantees.[6]

[6] The guarantees are also important from a regulatory perspective because they ensure that ABCP qualifies for the highest available rating from accredited national rating agencies. Credit ratings are important because the main purchasers of ABCP are money market funds, which are legally restricted to invest in securities with such ratings (Kacperczyk and Schnabl, 2010a).

2.2. Guarantee structure

Conduit sponsors use four different types of guarantees that provide different levels of insurance to outside investors. The four types of guarantees, ranked from strongest to weakest, are credit guarantees ("credit"), liquidity guarantees ("liquidity"), extendible notes guarantees ("extendible notes"), and guarantees arranged via structured investment vehicles ("SIV").

Credit guarantees are guarantees that require the sponsor to pay off maturing ABCP independent of the conduit's asset values. From a regulatory perspective, credit guarantees are considered equivalent to on-balance sheet financing because they expose banks to the same risks as assets on the balance sheet. In practice, these guarantees are infrequently used by financial institutions that have to satisfy bank capital requirements but are more common among financial institutions that follow other forms of capital regulation.

Liquidity guarantees are similar to credit guarantees with the main difference being that the sponsor needs to pay off maturing ABCP only if the conduit assets are not in default. Hence, liquidity guarantees might not cover credit defaults, but in practice liquidity guarantees are structured to prevent this from happening. In most cases, asset default is defined as a discontinuous function of a slow-moving variable such as a delinquency rate. This definition of default ensures that ABCP almost always matures before the assets are declared in default. In fact, throughout the entire run, no outside investors in ABCP suffered a default under a liquidity guarantee. In practice, these guarantees are used primarily by commercial banks.

Extendible notes guarantees are similar to liquidity guarantees with the main difference being that the conduit issuer has the discretion to extend maturing commercial paper for a limited period of time (usually 60 days or less). By extending the maturity of the commercial paper, it is more likely that the conduit's assets are in default before the commercial paper matures. From the viewpoint of an outside investor, extendible notes guarantees are, therefore, riskier than liquidity guarantees. In practice, these guarantees are mostly used by financial institutions other than commercial banks.

SIV guarantees are similar to liquidity guarantees with the main difference being that, in addition to ABCP, conduits issue longer-maturity, uninsured debt. We consider SIV guarantees as providing weaker insurance to outside investors because of the presence of uninsured debt. In practice, these guarantees are used primarily by commercial banks and structured finance groups.

3. Theoretical framework

The economic rationale for imposing capital requirements on banks comes from the premise that individual banks do not internalize the costs their risk taking imposes on other parts of the economy, in particular, other banks and the nonfinancial sector. For example, Diamond and Rajan (2000) explain why the market discipline provided by demandable debt may have to be counteracted with bank capital when bank assets contain aggregate risk. Acharya (2001) focuses on collective risk shifting by banks in the form of herding to exploit their limited liability options. Higher capital requirements on aggregate risky assets can serve as a way to counteract this incentive. Gordy (2003) provides the foundation for the Basel I capital requirement framework based on the assumption that each bank is holding a diversified portfolio of economy-wide loans, thereby holding aggregate risk, and the job of the Basel I capital weights is to ensure that the resulting aggregate risk does not erode bank capital beyond a desired likelihood.

In effect, capital requirements increase bank owners' cost of capital with the intention of preventing them from undertaking certain risks that would otherwise seem privately attractive to banks. For instance, banks inherently perform maturity transformation, which is to borrow short and lend long. However, both on their (uninsured) liabilities and asset side, they are typically exposed to aggregate risk. To the extent that banks make profits by earning interest margins on the asset side, over and above their cost of financing, but the costs in aggregate risk states (such as credit crunch or more generally loss of intermediation) are not entirely borne by them, banks have a private incentive to raise leverage beyond the socially efficient level. The presence of explicit or implicit government guarantees in aggregate risk states would serve only to strengthen this incentive. Thus, in a world with imperfectly imposed capital requirements, banks would thus have incentives to arbitrage regulation and devise ways of synthesizing leveraged exposures to aggregate risks. In this paper, we examine this regulatory arbitrage hypothesis to explain the structure and performance of conduits. We test three hypotheses.

The first hypothesis is that commercial banks set up conduits to minimize regulatory capital requirements. In particular, capital-constrained commercial banks set up more conduits than other financial institutions, and more so, with guarantees that circumvent capital requirements. This is because banks taking deposits could have a natural advantage in providing guarantees (e.g., lines of credit), as argued by Kashyap, Rajan, and Stein (2002), or because commercial banks have access to federal deposit insurance, which causes economy's savings to move into bank deposits during times of aggregate stress, as found by Gatev and Strahan (2006) and Pennacchi (2006); and commercial banks are subject to the strictest capital requirements in the financial sector and thus have greater benefits from regulatory arbitrage.[7]

[7] From an incentive perspective, the use of guarantees to align risks and rewards within the sponsor is consistent with the optimal allocation of control rights under asymmetric information. Sponsors often use conduits to purchase assets originated by their customers, their own origination department, or other close parties and could be better informed about asset quality than outside investors. Guarantees thus ensure that sponsors have strong incentives to carefully screen the conduit's asset purchases (e.g., see Ramakrishnan and Thakor, 1984; Calomiris and Mason, 2004; Keys, Mukherjee, Seru, and Vig, 2010). However, the lack of any risk transfer, as in the case of credit and liquidity guarantees, is at odds with security design models unless the underlying assets are mostly all of low quality, an unlikely scenario especially when these conduits were set up.

Further, if conduits are set up to primarily maintain regulatory capital ratios, banks with lower economic capital ratios would be more likely to be associated with setting up of conduits that relax regulatory capital requirements but not other types of conduits. And, the association with conduits that relax capital requirements should be weaker for regulatory ratios as the latter are being arbitraged through conduit activity in the first place.

The second hypothesis is that, ex post, when asset quality deteriorates and there is credit and liquidation risk to assets, conduits experience a run from their short-term credit providers, leading to less ABCP issuance and higher spreads. The cost of redeeming debt that cannot be rolled over and the cost of higher spreads on new issuances are borne by the sponsors. This impact of asset quality deterioration should be larger for weaker guarantees.

The third hypothesis is that no realized losses are passed on to creditors of conduits that are fully guaranteed, with some losses passed on to creditors of conduits with weaker guarantees. In turn, banks with greater exposure to conduits (relative to their size) experience worse stock returns once the run on conduits is initiated because they have to absorb the losses on conduit assets.

Put together, these hypotheses amount to establishing that a significant part of the conduit activity is a form of securitization without risk transfer, that is, a way for banks to concentrate aggregate risks instead of dispersing them, and do so without necessarily holding much capital against these risks.

4. Empirical analysis

This section introduces three types of results. First, we study the relation between the incentives to set up conduits and bank capital. Second, we analyze the performance of different types of conduit guarantees during the financial crisis. Finally, we estimate the losses incurred by investors in conduits and the sponsoring financial institutions that provided guarantees to the conduits.

4.1. Data and summary statistics

We use several different data sources for the analysis in this paper. We collect ratings reports for all 938 conduits rated by Moody's Investors Service from January 2001 to December 2009. Most reports are three to five pages and contain information on conduit sponsor, conduit type, conduit assets, and guarantees. Moody's publishes the first report when it starts rating a conduit and subsequently updates the reports annually. For some larger conduits, Moody's also publishes monthly reports that provide information on conduit size, guarantees, and conduit assets. In addition, Moody's publishes a quarterly spreadsheet that summarizes basic information on all conduits.

We construct our main data set based on Moody's quarterly spreadsheets. We confirm with market participants that the data effectively represent the universe of conduits. We augment the data with information on asset types from ratings reports. We merge conduit observations with the same underlying portfolio but two separate funding operations (in most cases, separate funding operations in US dollars and the euro). We drop ABCP issued by collateralized debt obligations because their guarantees are not comparable to the rest of the sample (292 out of 9,536 observations).

We merge our data with a proprietary data set on all ABCP transactions conducted in the United States from January 2007 to February 2008. The data set contains 777,758 primary market transactions by 349 conduits over 292 trading days. The data are provided by the Depository Trust and Clearing Corporation (DTCC), the agent that electronically clears and settles directly and dealer-placed commercial paper. 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. We use DTCC data to compute ABCP issuances. We compute ABCP overnight spreads as the annualized yield on ABCP minus the federal funds target rate.

We use rating reports to identify the sponsoring institution that is providing guarantees to the conduit. We first identify the type of sponsor (e.g., commercial bank, mortgage originator, structured finance group, etc.). If the sponsoring institution is a commercial bank, we search for the sponsor in the Bankscope database. If we cannot identify a sponsor in Bankscope, we conduct an Internet search. We match the sponsor to the consolidated financial company.

We use Bankscope to construct a data set of all commercial banks based in the United States and Europe, with more than \$50 billion in assets in the years 2000–2006. If the consolidated company and its subsidiaries have more than one entry in Bankscope, we keep only the consolidated company. We collect data on all banks in our data set for the fiscal years ending in the period from July 1, 1999 to June 30, 2007 (the last filing date prior to the shadow-banking run). We assign the filing year based on the fiscal year. Therefore, we capture the fiscal years 2000–2006. We drop banks that have fewer than six observations during the analysis period (54 observations). We drop banks that do no report data on Tier 1 ratios (137 observations). If a bank is missing only one observation on Tier 1 ratios, we interpolate the missing Tier 1 ratio (14 observations). We use the International Securities Identification Number (ISIN) identifier provided in Bankscope to match bank characteristics to share price information in Datastream (88 banks). If a bank does not have an ISIN identifier, we verify with the bank's website that the bank has no publicly traded equity.

We use Moody's *Weekly Announcement Reports* of rating downgrades from January 2007 to December 2008 to identify all conduits that were downgraded or withdrawn during this period. For all such conduits, we search for an affirmative statement by Moody's that all outside investors were repaid prior to the downgrade or withdrawal. If there is no such affirmative statement, we use announcements by the sponsor or other rating agencies to determine whether investors were repaid. If we do not find an affirmative statement that all investors were repaid, we assume that the conduit entered default. This coding procedure could overestimate the extent of investor liquidation because investors could have been repaid without an affirmative announcement by either the sponsor or the rating agencies.

Panel A of Table 1 provides an overview of the ten largest conduits as of January 1, 2007. Most conduits hold highly

Table 1
Conduits and sponsors.

This table shows the ten largest conduits and sponsors as of January 1, 2007. The sample is restricted to bank-sponsored conduits. The information is collected from Moody's Rating Reports and Bankscope. "ABCP (billion)" denotes asset-backed commercial paper (ABCP) outstanding per conduit (Panel A) and sponsor (Panel B). "Asset origin," "Asset rating," and "Asset type" denote characteristics of the main asset class owned by a conduit; CDO/CLO represents combinations of collateralized debt obligations and collateralized loan obligations.

Panel A: Ten largest conduits

Program name	Sponsor	ABCP (billion)	Guarantee	Asset origin	Asset rating	Asset type (share)
Grampian Funding	HBOS	37.9	Liquidity	United States	AAA	Residential mortgages (36%)
Amstel Funding	ABN Amro	30.7	Liquidity	Netherlands	AAA	CDO/CLO (84%)
Scaldis Capital	Fortis Bank	22.6	Liquidity	United States	AAA	Asset-backed securities (77%)
Sheffield Receivables	Barclays	21.4	Liquidity	n.a.	NR	Mortgages (43%)
Morrigan TRR	Hypo Public	18.9	Credit	n.a.	n.a.	Bonds (51%)
Cancara Asset	Lloyds	18.8	Liquidity	Great Britain	AAA	Residential mortgages (43%)
Solitaire Funding	HSBC	18.5	Liquidity	United States	AAA	Residential mortgages (45%)
Rhineland Funding	IKB	16.7	Liquidity	United States	AAA	CDO/CLO (95%)
Mane Funding	ING	13.7	Liquidity	n.a.	AAA	Asset-backed securities (91%)
Atlantis One	Rabobank	13.5	Liquidity	United States	NR	Commercial loans (100%)

Panel B: Ten largest sponsors

Sponsor	Country	ABCP (billion)	Assets (billion)	Tier 1 capital (billion)	ABCP/Tier 1 (percent)	Tier 1 ratio (percent)
Citigroup	United States	92.7	1,884.3	90.9	102.0	8.6
ABN Amro	Netherlands	68.6	1,300.0	31.2	219.5	8.5
Bank of America	United States	45.7	1,459.7	91.1	50.2	8.6
HBOS Plc	Great Britain	43.9	1,161.7	44.0	99.7	8.1
JP Morgan	United States	42.7	1,351.5	81.1	52.7	8.7
HSBC	Great Britain	39.4	1,860.8	87.8	44.9	9.4
Deutsche Bank AG	Germany	38.7	2,070.0	31.0	125.0	8.5
Société Générale	France	38.6	1,260.2	29.4	131.3	7.8
Barclays Plc	Great Britain	33.1	1,956.7	45.2	73.2	7.7
Rabobank	Netherlands	30.7	732.9	34.8	88.3	10.7

rated assets originated in the United States or the United Kingdom. The main asset classes are residential mortgages and asset-backed securities. Panel B of Table 1 provides an overview of the ten largest conduit sponsors as of January 1, 2007. In the United States, the largest sponsor was Citigroup with conduit assets of $93 billion. For comparison, this is about the same size as Citigroup's regulatory capital (Tier 1) of $91 billion. In Europe, the largest sponsor was ABN Amro with $69 billion of conduits assets. ABN Amro's regulatory capital was $31 billion. (ABN Amro later merged with Royal Bank of Scotland.) Most sponsors are large commercial banks based in the United States and Europe.

Panel A of Table 2 provides summary statistics for all conduits authorized to issue ABCP as of January 1, 2007. Panel A shows that there are 301 conduits with total ABCP of $1,236 billion. The average conduit size is $4.1 billion with a standard deviation of $5.1 billion. About 61% of ABCP (or $753 billion) is covered by liquidity guarantees, 13% is covered by credit guarantees, 19% is covered by extendible notes guarantees, and 7% is covered by SIV guarantees.[8]

Panel B of Table 2 presents summary statistics for all sponsors as of January 1, 2007. There are 127 sponsors, each of which, on average, sponsors $9.7 billion of ABCP. The largest sponsor type is commercial banks, which sponsor about 74% (or $911 billion) of ABCP. The second largest type is structured finance groups, which sponsor about 13% (or $156 billion) of ABCP. Contrary to commercial banks, structured finance groups usually do not have the financial resources to provide guarantees directly but purchase them from other financial institutions.[9] Other large sponsor types are mortgage lenders (6.1% or $76 billion), investment managers (1.4% or $18 billion), and investment banks (0.9% or $11 billion).

4.2. Conduits and capital requirements

This section recounts the regulatory framework for conduits in historical perspective and presents results on the relation between bank capital and their incentive to set up conduits.

4.2.1. History of capital requirements for conduits

Bank regulation requires banks to hold a certain amount of capital against its investments. One way for a

[8] Moody's rating reports suggest that almost all conduits are hedged against currency and interest rate exposure. The most common way for conduits to hedge their currency exposure is by matching the currency of the assets with the currency of the liabilities. Consistent with our earlier observation that most assets are originated in the United States, we find that 75% of ABCP is issued in US dollars. About 18% is issued in euros and the remainder is issued in yen, Australian dollars, and New Zealand dollars.

[9] Some industry reports indicate that the main providers were large US investment banks, which used internal rating models for computing capital charges (Nadauld and Sherlund, 2008). Internal rating models made less distinction between credit and liquidity guarantees in terms of capital requirements.

Table 2
Conduit and sponsor statistics.

This table includes all conduits rated by Moody's Investors Service as of January 1, 2007. Panel A shows summary statistics by conduit. "Risk transfer" refers to the sponsor guarantee. "Assets" is the conduit's main asset type. "Currency" is the conduit's issuing currency. Panel B aggregates conduits by sponsor. "Sponsor type" is the sponsor type. "Country of origin" denotes the sponsor's headquarters.

Panel A: Conduits	Total		Size	
	Number of conduits	Size (billion)	Mean	Standard deviation
All conduits	301	1,236.2	4.1	(5.1)
Risk transfer				
Liquidity	163	752.9	4.6	(5.7)
Credit	55	159.9	2.9	(4.6)
Extendible notes	55	230.9	4.2	(4.5)
Structured investment vehicle	28	92.6	3.3	(3.4)
Assets				
Asset-backed securities	91	387.4	4.2	(5.9)
Loans	39	65.3	1.6	(2.4)
Receivables	88	436.7	3.5	(4.9)
Mixed asset categories	59	272.9	4.6	(5.3)
Other	24	74.0	4.9	(4.7)
Currency				
US dollar	233	973.0	4.2	(4.6)
Euro	33	220.0	6.7	(8.4)
Other	35	43.2	1.2	(1.6)

Panel B: Sponsors	Total		Size	
	Number of sponsors	Size (billion)	Mean	Standard deviation
All programs	127	1,236.2	9.7	(14.7)
Sponsor type				
Commercial banks	67	911.4	13.6	(17.6)
Structured finance	19	155.8	8.2	(13.7)
Mortgage lender	18	75.5	4.2	(5.8)
Investment manager	5	17.6	3.5	(3.3)
Investment banks	4	11.0	2.7	(2.2)
Other	14	64.8	4.6	(6.2)
Country of origin				
United States	67	491.8	7.3	(14.7)
Germany	15	204.1	13.6	(11.6)
United Kingdom	10	195.7	19.6	(17.0)
Other	35	344.5	9.8	(14.4)

bank to reduce its capital requirements is to transfer the risks of investments to outside investors. Over the last two decades, securitization has emerged as one of the main risk transfer mechanisms for banks. Bank regulators have recognized such risk transfer and modified bank capital regulation to reduce capital requirements accordingly. However, our analysis suggests that banks used conduits for securitization without transferring risks to outside investors. To explain the mechanics of such securitization, we first describe the history of capital regulation of conduits. Because almost all conduits were sponsored by banks based in the United States and European countries, we focus on bank regulation in these countries.

In the United States, bank regulators historically made a distinction between credit and liquidity guarantees. Credit guarantees were considered to cover credit risk and, thus, were considered equivalent to on-balance sheet financing. Assets covered by credit guarantees, therefore, had the same capital requirements as assets held on the balance sheet. Liquidity guarantees were considered to cover liquidity risk but no credit risk. Regulators required no capital for liquidity risk. Similarly, extendible notes guarantees and SIV guarantees were considered weaker forms of liquidity guarantees and did not require banks to hold any capital. This regulation generated a sharp discontinuity between the capital requirements for credit guarantees and other types of guarantees.

Over time, banks developed guarantees that were classified as liquidity guarantees but effectively covered credit risk. Banks created these guarantees by defining asset default such that ABCP almost always matured before assets were declared in default.[10] A number of

[10] In practice, most sponsors defined asset default as downgrades below investment grade (rated assets) or increases in delinquency rates above prespecified thresholds (unrated assets). Given the requirement that most assets were highly rated, or of similar quality, it was highly unlikely that assets entered default before the ABCP matured. The reason was that rating agencies usually provided ample warnings prior to downgrades (rated assets) and delinquency rates moved only slowly (unrated assets). Moreover, ABCP was very short term with a median maturity at issuance of overnight and a median maturity of outstanding ABCP of 28 days. Hence, even though it was possible that assets entered default prior to the expiration of the ABCP, it was highly unlikely. Instead, outside investors could simply stop rolling over ABCP upon

industry publications describe the benefits of circumventing capital requirements by using liquidity guarantees. For example, a publication by Moody's Investors Service (2003) on the fundamentals of ABCP describes conduits as follows: "If a bank were to provide a direct corporate loan, even one secured with the same assets, it would be obligated to maintain regulatory capital for it. An ABCP program permits the sponsor to offer financing services to its customers without using the sponsor's balance sheet or holding incremental regulatory capital" (p. 15).[11]

In 2001, the Financial Accounting Standards Board (FASB) started a review of guarantees to conduits. FASB initiated this review because of the bankruptcy of the energy company Enron. Enron had used off-balance sheet vehicles for concealing its true leverage and these off-balance sheet vehicles were structured similarly to conduits. The FASB review generated considerable concern in the banking industry. For example, in July 2002, Moody's Investors Service (2002b) reports under the headline "FASB reacts to Enronitis" that FASB is proposing the consolidation of ABCP conduits on bank balance sheets. In October 2002, Moody's published a special report titled "The FASB consolidation proposal: the end of ABCP as we know it?" suggesting that sponsors could face difficulties with consolidation because it would raise regulatory capital requirements and might lead banks to violate their debt covenants (Moody's Investors Service, 2002a).

In January 2003, FASB issued a directive for the consolidation of conduits under Interpretation no. 46 (FIN 46) (Standard & Poor's, 2003). In response, Forbes (2003) published a news report entitled "FASB puts banks in a bind," suggesting that conduit consolidation could negatively affect bank balance sheets. The article quotes the FASB chairman: "If you have risk and reward related to the operation, we thought it was enough to say it ought to be on your books." However, the FASB directive did not adequately specify the circumstances required for consolidation and several large banks requested more guidance from FASB. In December 2003, FASB issued a new directive called FIN 46R ("R" for revision) that clarified how to implement the directive and required commercial banks to consolidate conduits on bank balance sheets.

However, in July 2004, a consortium of bank regulators, namely the Office of the Comptroller of the Currency, the Federal Reserve Board, the Federal Deposit Insurance Corporation, and the Office of Thrift Supervision (henceforth, the agencies), issued a new rule for computing capital requirements for conduits. The official release (Federal Reserve Board, 2004) by the agencies states that "[t]he final rule will permanently permit sponsoring banks, bank holding companies, and thrifts (collectively, sponsoring banking organizations) to exclude from their risk-weighted asset base those assets in ABCP programs that are consolidated onto sponsoring banking organizations' balance sheets as a result of Financial Accounting Standards Board Interpretation No. 46, Consolidation of Variable Interest Entities, as revised (FIN 46-R)." Hence, assets in conduits were not considered assets for the purpose of calculating capital requirements. Instead, bank regulators required banks to hold capital at a conversion factor of 10% against the amount covered by liquidity guarantees. This implied that regulatory charges for conduit assets covered by liquidity guarantees were 90% lower than regulatory charges for on-balance sheet financing (Gilliam, 2005).

Importantly, in addition to risk-weighted capital requirements, U.S. banks also had to satisfy a leverage test, which was based on Tier 1 capital relative to total assets. Conduit assets were only exempted from the leverage test if they were not consolidated under U.S. Generally Accepted Accounting Principles (GAAP). Under FIN 46R banks generally had to consolidate conduit assets for the leverage test but there was an exemption if a conduit's expected loss was sold to a third party. The expected loss was defined as the product of the likelihood of default and the loss conditional on default. Given that default rates based on historical data were very low, the expected loss relative to conduit size was very low. Hence, a bank could move conduits off its balance sheet by selling expected loss notes (ELN) to third parties. However, since the notes as a share of conduits assets were very small, the effective risk (loss conditional on default) remained with the bank.[12]

Not surprisingly, most large U.S. banks issued ELNs to ensure that conduits were off balance sheets. Bens and Monahan (2007) identify 13 banks that reported restructuring conduits to avoid FIN 46 consolidation, which include almost all U.S. banks sponsoring a significant amount of conduits. For example, Citibank (2003) explains in 10-K filings with the Securities and Exchange Commission (SEC) that Citibank restructured two large conduits ($93B billion in ABCP) to deconsolidate under FIN 46, leaving less than $1 billion of conduit assets on its balance sheet. Citibank (2004) confirms that the 2003 non-consolidation continued under FIN-46R. Bank of America (2004) indicates that its largest conduit issued ELNs in October 2003 to deconsolidate $8 billion of assets and that by 2004 Bank of America administered $45.4 billion of unconsolidated conduits and $7.7 billion of consolidated conduits.

In short, U.S. banks were able to satisfy both risk-weighted capital ratios and the leverage test by moving conduit assets off balance sheets and insuring them with liquidity guarantees. The timeline of these changes closely coincides with changes in ABCP outstanding. As shown in Fig. 2, the growth of ABCP conduits stalled in late 2001, around the time when FASB started its review of conduits. From late 2001 to late 2004, ABCP outstanding was flat after several years of significant growth. However, starting in late 2004, at the time bank regulators issued the exemption and banks had restructured their conduits,

(*footnote continued*)
adverse news about the credit or liquidity risk of conduit assets. As a result, liquidity guarantees effectively covered the assets' credit risk without requiring banks to hold the same regulatory capital as that required for assets on the balance sheet.

[11] Even conduits covered with liquidity guarantees typically had some program-wide credit guarantees that covered about 5–10% of assets. Hence, the effective reduction in credit guarantees was 90–95%.

[12] For example, the Counterparty Risk Management Policy Group (2008) estimates that ELNs accounted for only 10 basis points of total conduit assets. For a discussion of deconsolidation under FIN 46, see Credit Suisse First Boston (2003).

growth in ABCP picked up again. This time series evidence is suggestive that lower capital requirements played an important role in the decision to set up conduits.

In Europe, the history of capital requirements for ABCP conduits was slightly different. Before 2004, most European countries had similar capital requirements for guarantees as in the United States. Credit guarantees were considered to cover credit risk and required the same regulatory charges as on-balance sheet financing. Liquidity guarantees were considered to cover liquidity risk and had no capital charges. However, European banks started to adopt International Financial Reporting Standards (IFRS) in the early 2000s. IFRS, contrary to US GAAP, do not recognize asset transfers to conduits as a true sale. European banks were, therefore, required to consolidate conduits on their balance sheets once they adopted IFRS. However, most European bank regulators did not change capital requirements in accordance with IFRS. Hence, for the purpose of computing regulatory requirements and risk-weighted assets, conduits were considered off-balance sheet and European banks did not have to hold regulatory capital against conduit assets. As a result, European banks continued to benefit from lower capital requirements for conduits even after reporting financial statements according to IFRS.

Two European countries, Spain and Portugal, differed in their regulation of capital requirements from other European countries. These countries required sponsors to hold the same amount of regulatory capital for assets on balance sheets and for assets in ABCP conduits. Consistent with the regulatory arbitrage motive, we find that Spanish and Portuguese banks did not sponsor ABCP conduits (Acharya and Schnabl, 2010).

Another difference between the United States and Europe was that European bank regulators were in the process of adopting the Basel II framework in 2007, while US commercial banks were still operating under Basel I. Under the Basel II standardized approach, the capital requirements for conduit assets covered by liquidity guarantees increased from 0% to 20% relative to on-balance sheet financing. Moreover, Basel II assumed lower risk weights for highly rated securities, which reduced the level of regulatory charges for both off-balance sheet and on-balance sheet financing. At the start of the financial crisis, several European banks had adopted Basel II rules, while others were still operating under Basel I. Importantly, both under Basel I and Basel II, there were lower capital requirements for liquidity relative to credit guarantees, albeit the benefit was smaller under the new regulation.

4.2.2. Conduit sponsors and capital

This subsection analyzes whether capital requirements played an important role in the decision to sponsor conduits. The three main sponsor types were commercial banks, structured finance companies, and mortgage originators. The incentives to use liquidity guarantees were particularly strong for commercial banks because they were considered to have the strictest capital regulation of all financial institutions due to their deposit-taking status.

Fig. 3 plots ABCP by sponsor type and type of guarantee from January 2001 to April 2009. Panel A shows that commercial banks were by far the most important sponsors with up to \$900 billion of ABCP. They primarily used liquidity guarantees and the use of such guarantees increased markedly after the capital exemption was confirmed in 2004. Liquidity-guaranteed ABCP increased from \$500 billion in September 2004 to \$900 billion in July 2007. In Panels B and C, we find no such effects for structured finance companies and mortgage originators. These types of sponsors were far less likely to use liquidity guarantees, and there was no change in the use of liquidity guarantees after 2004. These results are suggestive that commercial banks used conduits to circumvent capital regulation.

Next, we examine whether more capital-constrained commercial banks were more likely to sponsor conduits. The main challenge in establishing this relation empirically is that banks choose to engage in regulatory arbitrage to increase (or maintain) their regulatory capital ratio. Therefore, in equilibrium, we expect that capital-constrained banks do not necessarily have low regulatory capital ratios, precisely because they engage in regulatory arbitrage. As a result, we expect that an empirical estimation of the relation between the regulatory capital ratio and conduit activity is downward-biased.[13] Nevertheless, the absence of a relation between the regulatory capital ratio and conduit activity could reflect a rejection of our regulatory arbitrage hypothesis in the data.

We address this issue as follows. We estimate first the relation between the main regulatory ratio (Tier 1 capital) and conduit activity. We perform this estimation because even if the relation is downward-biased, it serves as a useful benchmark for our next step, which is to employ instead of the regulatory ratio the leverage ratio, defined as the ratio of book equity to total assets. The leverage ratio serves as an alternative measure of whether a bank is capital constrained and is likely a better proxy for capital constraints faced by banks precisely because it is not targeted by banks to meet regulatory constraints. Most regulatory arbitrage activities have the characteristic that they reduce risk-weighted assets (and, therefore, regulatory ratios) while maintaining the same level of total assets.[14] This increase in total assets relative to risk-weighted assets is thus captured in the leverage ratio but not in the regulatory ratio.

This interpretation of the leverage ratio as a measure of capital constraints is consistent with empirical evidence from our bank sample. First, if leverage ratios are more informative about capital constraints than Tier 1 ratios, we expect more variation in leverage ratios relative to Tier 1 ratios. Consistent with this hypothesis, we find that the

[13] This can be considered as a consequence of Goodhart's Law (Goodhart, 1975): "Any observed statistical regularity will tend to collapse once pressure is placed upon it for control purposes."

[14] An analogy with the sovereign credit problems in the eurozone of 2009–2010 helps. Sovereign bond holdings on banking books were accorded zero risk weights for regulatory capital purposes. Ex post, sovereign credit risk materialized and affected different banks in various ways based on their exposures to sovereign debt. These risks were reflected in the leverage ratio (because sovereign debt was included in total assets) but not in the Tier 1 capital ratio (because sovereign debt had zero risk weights).

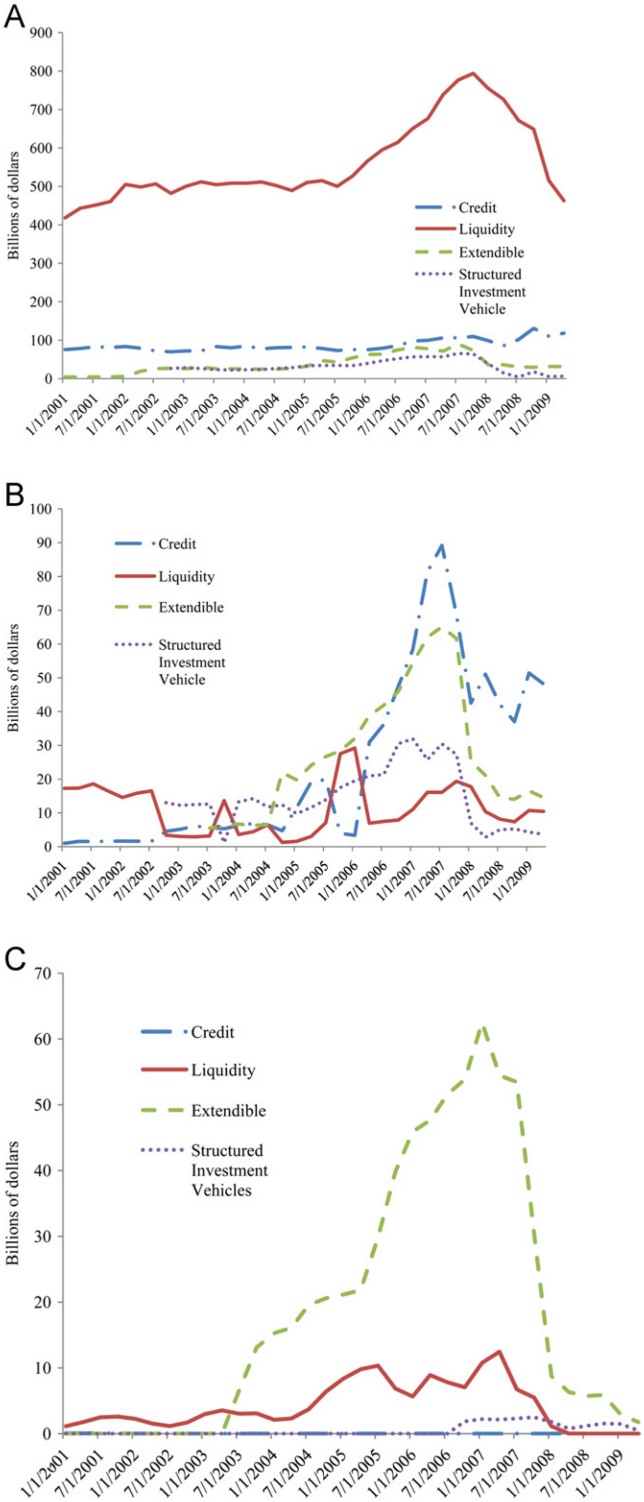

Fig. 3. Asset-backed commercial paper (ABCP) outstanding by sponsor and guarantee. This figure shows quarterly ABCP outstanding by guarantee and sponsor type from January 2001 to April 2009. Panel A plots commercial banks, Panel B shows structured finance companies, and Panel C shows mortgage originators. The figures are based on data provided by Moody's Investors Service.

coefficient of variation in the leverage ratio is 49%, compared with 24% for the Tier 1 ratio. Second, we expect that as conduit (or similar regulatory arbitrage) activity increases, total assets increase relative to risk-weighted assets, and we find in our bank sample that the ratio of total assets to risk-weighted assets increased from 1.8 in 2000 to

Table 3
Commercial banks and conduit activity.

This table shows conduit exposure of commercial banks. Panel A provides summary statistics for commercial banks with more than $50 billion in assets headquartered in Europe or the United States for the fiscal years 2000–2006. "Conduit exposure" is the ratio of asset-backed commercial paper outstanding to total equity. "Leverage ratio" is the ratio of equity to assets. "Tier 1 ratio" is the ratio of Tier 1 to risk-weighted assets. "Assets" and "Log(Assets)" are total assets and the logarithm of total assets, respectively. "Return on assets" is the ratio of net profit to assets. "Share short-term debt," "Share deposits," and "Share loans" are short-term debt, banks deposits, and loans as a share of total assets, respectively. Panel B provides correlations between the main variables.

Panel A: Summary statistics (126 banks)

Variable	Mean	Standard deviation	Median	Minimum	Maximum	N
Conduit exposure (total)	32.20%	81.50%	0.00%	0.00%	999.10%	814
Conduit exposure (liquidity)	25.20%	63.20%	0.00%	0.00%	726.30%	814
Conduit exposure (credit)	1.80%	8.10%	0.00%	0.00%	89.70%	814
Leverage ratio	5.40%	2.60%	4.90%	0.80%	16.90%	814
Tier 1 ratio	8.41%	2.00%	8.00%	4.30%	19.00%	814
Assets (billions of dollars)	260.8	326.4	134.9	9.7	2,070	814
Log(Assets)	4.973	1.086	4.905	2.27	7.635	814
Return on assets	0.80%	0.60%	0.70%	−1.70%	3.10%	814
Share short-term debt	11.70%	9.90%	9.50%	0.00%	51.60%	814
Share deposits	57.60%	13.50%	59.80%	1.80%	86.80%	814
Share loans	54.20%	17.10%	55.90%	4.80%	85.90%	814

Panel B: Correlations ($N=814$)

Variable	Conduit exposure (total)	Conduit exposure (liquidity)	Conduit exposure (credit)	Leverage ratio	Tier 1 ratio	Log Assets	Return on assets
Conduit exposure (total)	1						
Conduit exposure (liquidity)	0.7929	1					
Conduit exposure (credit)	0.2009	0.1445	1				
Leverage ratio	−0.2013	−0.1969	0.0119	1			
Tier 1 ratio	−0.0318	−0.035	−0.0265	0.2582	1		
Log(Assets)	0.2228	0.2542	0.2357	−0.3088	−0.0931	1	
Return on assets	−0.188	−0.2039	−0.0172	0.7243	0.3046	−0.2218	1

2.2 in 2006. Third, we expect that leverage ratios are better predictors of financial distress once the banking sector suffered an aggregate shock. Consistent with this interpretation, Demirguc-Kunt, Detragiache, and Merrouche (2010) find that leverage ratio outperforms risk-weighted ratios in predicting bank stock returns during the financial crisis of 2007–2010.[15] In short, this evidence suggests that the variation in leverage ratio is a sensible way to proxy for the variation in whether banks are capital constrained during the analysis period.

In the tests, we focus our analysis on commercial banks based in the United States and Europe with more than $50 billion in assets in the fiscal years 2000–2006. We compute a bank's conduit exposure as the ratio of ABCP relative to bank equity by type of guarantee.[16]

Panel A of Table 3 provides summary statistics. The average exposure to ABCP is 32.2% of total equity and the average exposure to liquidity-guaranteed ABCP is 25.2%. Panel B of Table 3 reports pair-wise correlations among the main variables. Consistent with the regulatory arbitrage hypothesis, we find a negative correlation of 20.1% between ABCP exposure and the leverage ratio. The correlation with Tier 1 capital is also negative but significantly lower at 3.5%. We also find that larger and less profitable banks were more likely to have high ABCP exposure.

We then use panel regressions to assess the relation between ABCP exposure and bank equity. Our baseline specification is

$$Exposure_{it} = \alpha_i + \delta_t + \beta CapitalRatio_{it} + \gamma X_{it} + \varepsilon_{it}, \quad (1)$$

where $Exposure_{it}$ is ABCP exposure of bank i at time t, $CapitalRatio_{it}$ is the capital ratio of bank i at time t, X_{it} are time-varying control variables, α_i are bank fixed effects, and δ_t are time fixed effects. We use two measures for capital ratio: the *leverage ratio* measured as book equity relative to assets and the *regulatory capital ratio* measured as Tier 1 regulatory capital relative to risk-weighted assets. All regressions include controls for the natural logarithm of banks assets, return on assets, short-term debt as a share of liabilities, deposits as a share of liabilities, and loans as a share of assets. We cluster standard errors at the bank level to allow for correlation of error terms within banks.

Panel A of Table 4 presents the results for the Tier 1 capital ratio and exposures to liquidity-guaranteed ABCP. Our preferred specification includes bank fixed effects to control for cross-sectional variation in banks' capital ratios. As shown in Column 1, we find that more capital-constrained banks have higher ABCP exposure: A 1 standard deviation increase in the Tier 1 ratio reduces conduit exposure by 3.1% (about 12% of mean conduit activity in liquidity-guaranteed ABCP). However, the

[15] Estrella, Park, and Peristiani (2000) also find evidence that leverage ratios are as good as risk-weighted ratios in predicting bank default using a sample from the early 1990s.

[16] We winsorize ABCP exposure at the 1% level to ensure that the results are not driven by outliers. The results are stronger if we do not winsorize ABCP exposure.

Table 4
Bank capital and conduit exposure (liquidity).

This table analyzes the relation between bank capital and exposure to conduits sponsored with liquidity guarantees. The sample includes commercial banks with more than $50 billion in assets based in Europe and the Unites States in the fiscal years 2000–2006. The dependent variable "Conduit exposure (liquidity)" is total outstanding asset-backed commercial paper supported with liquidity guarantees relative to bank equity. In Panel A, the main independent variable is the ratio of Tier 1 capital to risk-weighted assets ("Tier 1 ratio"). In Panel B, the main independent variable is the ratio of book equity to assets ("Leverage ratio"). All regressions include controls for total assets, return on assets, short-term debt share, loan share, deposit share, and year fixed effects. Columns 1, 2, 4, and 5 include bank fixed effects, and Columns 2 to 5 include interactions of country-year fixed effects. Column 4 is estimated in first differences. Column 5 is estimated in first differences with a one-year lag. Standard errors reported in parentheses are clustered at the bank level (126 banks). ***, **, and * represent 1%, 5%, and 10% significance, respectively.

Panel A: Conduit exposure (liquidity)					
Estimation	Fixed effects (1)	Fixed effects (2)	Ordinary least squares (3)	First differences (4)	First differences-lagged (5)
Tier 1 ratio	−1.565	−0.578	−0.016	−0.183	−0.179
	(1.225)	(1.718)	(2.308)	(1.187)	(0.160)
Log(Assets)	0.093	0.120	0.094*	−0.128	0.034**
	(0.075)	(0.095)	(0.048)	(0.100)	(0.017)
Bank fixed effects	Yes	Yes	No	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	No	Yes	Yes	Yes	Yes
Number of banks	126	126	126	126	126
Number of observations	814	814	814	687	564
R-squared	0.850	0.868	0.295	0.145	0.130

Panel B: Conduit exposure (liquidity)					
Estimation	Fixed effects (1)	Fixed effects (2)	Ordinary least squares (3)	Fixed effects (4)	First differences-lagged (5)
Leverage ratio	−4.024**	−4.625**	−5.874**	−4.870***	−2.452**
	(1.903)	(1.944)	(2.709)	(1.389)	(0.970)
Log(Assets)	0.095	0.120	0.095**	−0.124	−0.080
	(0.078)	(0.093)	(0.048)	(0.104)	(0.067)
Bank fixed effects	Yes	Yes	No	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	No	Yes	Yes	Yes	Yes
Number of banks	126	126	126	126	126
Number of observations	814	814	814	687	564
R-squared	0.850	0.868	0.295	0.145	0.130

coefficient is not statistically significant. In Column 2, we add interactions of year and country fixed effects to control for country-specific changes in capital ratios and the coefficient slightly increases. In Column 3, we estimate the main specification without bank fixed effects and the coefficient further increases. In Column 4, we estimate the main specification in first differences and the coefficient is again negative but not statistically significant. In Column 5, we lag the Tier 1 ratio and all control variables by one year and estimate the main specification in first differences and find that the coefficient is roughly unchanged from Column 4. Overall, the coefficient is consistently negative but not statistically significant. This evidence is suggestive of a negative relation between the regulatory capital ratio and conduit activity, but the relation is weak, possibly because of downward bias.

Therefore, we turn to our results using the leverage ratio. Panel B of Table 4 presents the same specifications as in Panel A, but we replace the Tier 1 ratio with the leverage ratio. As shown in Column 1, we find a statistically significant and negative relation between conduit activity and the leverage ratio. The relation is also economically significant: A 1 standard deviation increase in the leverage ratio reduces conduit activity by 10.4% (about 40% of mean conduit activity). As shown in Columns 2 and 3, the relationship is robust to adding interactions of year and country fixed effects and estimating the relationship without bank fixed effects. As shown in Columns 4 and 5, the coefficient remains statistically significant when we estimate our main specification in first differences.

Overall, these results show that banks with higher leverage ratios sponsored less liquidity-guaranteed ABCP. Conversely, if we interpret lower leverage ratios as a proxy for whether a bank is constrained, these results suggest that more capital-constrained banks were more likely to engage in more regulatory arbitrage.

A possible concern with our results could be that we do not observe other time-variant bank characteristics that could affect the incentives to sponsor conduits. For example, banks could use conduits for pure investment purposes and the need for such investment is correlated with banks' leverage ratios. Therefore, we examine bank incentives to set up conduits with credit guarantees. These guarantees are almost identical to full-liquidity guarantees but do not reduce capital requirements.

Table 5 presents the results. We estimate the same regression as in Table 4 but replace the outcome variable with ABCP exposure to credit guarantees. As shown in Panels A and B, we find no association between capital ratios and ABCP exposure to credit guarantees. All coefficients are statistically insignificant and close to zero. Overall, our results suggest that the reduction in capital

Table 5
Bank capital and conduit exposure (credit).

This table analyzes the relation between bank capital and exposure to conduits sponsored with liquidity guarantees. The sample includes commercial banks with more than $50 billion in assets based in Europe and the United States in the fiscal years 2000–2006. The dependent variable "Conduit exposure (liquidity)" is total outstanding asset-backed commercial paper supported with liquidity guarantees relative to bank equity. In Panel A, the main independent variable is the ratio of Tier 1 capital to risk-weighted assets ("Tier 1 ratio"). In Panel B, the main independent variable is the ratio of book equity to assets ("Leverage ratio"). All regressions include controls for total assets, return on assets, short-term debt share, loan share, deposit share, and year fixed effects. Columns 1, 2, 4, and 5 include bank fixed effects, and Columns 2 to 5 include interactions of country-year fixed effects. Column 4 is estimated in first differences. Column 5 is estimated in first differences with a one-year lag. Standard errors reported in parentheses are clustered at the bank level (126 banks). ***, **, and * represent 1%, 5%, and 10% significance, respectively.

Panel A: Conduit exposure (credit)					
Estimation	Fixed effects	Fixed effects	Ordinary least squares	First differences	First differences-lagged
	(1)	(2)	(3)	(4)	(5)
Tier 1 ratio	0.473	0.349	0.082	−0.139	−0.199
	(0.411)	(0.416)	(0.489)	(0.207)	(0.160)
Log(Assets)	0.013	0.009	0.025**	0.018	0.030*
	(0.024)	(0.031)	(0.011)	(0.025)	(0.015)
Bank fixed effects	Yes	Yes	No	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	No	Yes	Yes	Yes	Yes
Number of banks	126	126	126	126	126
Number of observations	814	814	814	687	564
R-squared	0.850	0.868	0.295	0.145	0.130

Panel B: Conduit exposure (credit)					
Estimation	Fixed effects	Fixed effects	Ordinary least squares	First differences	First differences-lagged
	(1)	(2)	(3)	(4)	(5)
Leverage ratio	−0.933	−0.834	0.145	−0.653	−0.179
	(0.591)	(0.652)	(0.464)	(0.402)	(0.160)
Log(Assets)	0.003	0.003	0.024***	0.021	0.034**
	(0.024)	(0.030)	(0.009)	(0.024)	(0.017)
Bank fixed effects	Yes	Yes	No	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes
Country-year fixed effects	No	Yes	Yes	Yes	Yes
Number of banks	126	126	126	126	126
Number of observations	814	814	814	687	564
R-squared	0.679	0.733	0.222	0.228	0.250

requirements was central for banks' incentives to set up conduits with liquidity guarantees.

4.3. *Impact of guarantees on ABCP issuances and spreads*

In this subsection, we examine the effect of guarantees on a conduit's ability to roll over maturing ABCP after the start of the financial crisis. As shown in Panel A of Fig. 1, ABCP declined dramatically after the start of the financial crisis on August 9, 2007. By the end of year, the ABCP market was roughly 30% smaller than it was at its peak in July.

To test for the importance of guarantees in rolling over ABCP after August 9, 2007, we exploit cross-sectional variation in types of guarantees. As discussed in Section 2.2, credit and liquidity guarantees covered almost all risks associated with conduits assets. However, extendible guarantees were weaker, because they allowed conduits to extend commercial paper for a limited period of time, an option that issuers were likely to exercise when there was adverse news about conduit assets. SIV guarantees were also weaker, because SIVs also had other liabilities without guarantees.

To understand the selection of sponsors and assets into guarantees, it is important to understand the sponsor's objective. Most sponsors aimed to put together a conduit structure (consisting of the guarantee, conduit assets, and the sponsor's financial strength) that allowed the sponsor to issue highly rated ABCP at rates similar to the federal funds rate (overnight) or the London Interbank Offered Rate (LIBOR, 30 days). Sponsors traded off various conduit characteristics to achieve this pricing on the ABCP. For example, conduits with lower quality assets were usually required stronger guarantees. Also, sponsors with higher financial strength tended to provide stronger guarantees. Therefore, we control for asset quality and sponsor type in our regressions.

To test the cross-sectional impact of guarantees formally, we compute weekly ABCP outstanding and daily spreads of overnight ABCP. We restrict our sample to the period 4 months before and 4 months after the start of the financial crisis on August 9, 2007. We choose this period because it captures the main decline in ABCP but excludes later events that could confound our analysis (e.g., Bear Stearns merger, Lehman bankruptcy). We find qualitatively and quantitatively similar results if we extend our data set to the period 6 months before and 6 months after August 2007.

We analyze the relation between guarantees and ABCP outcomes using panel regressions. Our baseline specification is

$$y_{it} = \alpha + \beta_j Guarantee_{ij} + \gamma_j After_t * Guarantee_{ij} + \delta After_t + \varepsilon_{it}, \quad (2)$$

where y_{it} is either the natural logarithm of the face value of ABCP outstanding of conduit i in week t or the overnight

(1–4 days of maturity) ABCP spread over the federal funds rate on new issues by conduit i on day t. $Guarantee_{ij}$ is an indicator variable for guarantee of type j of conduit i (with liquidity guarantee as the omitted category). $After_t$ is an indicator variable that equals one after the start of the crisis (after August 9, 2007) and zero before the crisis. We also estimate regressions in which we control for time fixed effects, conduit fixed effects, and sponsor-time fixed effects.

If the financial crisis makes investors more concerned about conduit risks, we expect that the interactions between indicator variables for weak guarantees and the $After_t$ indicator to be more negative than those for strong guarantees. Furthermore, if outside investors perceived that credit and liquidity guarantees provided the same level of protection, we expect that credit and liquidity guarantees perform similarly during the run.

Columns 1–4 of Table 6 present results for commercial paper outstanding. As shown in Column 1, we find that the interaction between the $After_t$ indicator and the dummies for extendible notes and SIVs are negative. This result suggests that ABCP decreased more for conduits with weaker guarantees compared with conduits with liquidity guarantees. The coefficient on the interaction between the $After_t$ indicator and the credit guarantee indicator shows that no statistically significant difference exists between liquidity and credit guarantees. Columns 2 and 3 add time fixed effects and conduit fixed effects, respectively. We find that the coefficients of interest are robust to these control variables. Column 4 adds sponsor-time fixed effects. These fixed effects control for all time-varying changes at the sponsor level, and, thus, the coefficients are identified from the variation across guarantees for the same sponsor. We find that the point estimates are robust to controlling for these fixed effects, but the standard errors are somewhat larger.

Columns 5–8 present results for the overnight ABCP spread. In Column 5, we find positive and statistically significant coefficients on extendible notes and SIVs. We find no statistically significant difference between credit and liquidity guarantees. As shown in Columns 6 and 7, the results are robust to controlling for time and conduit fixed effects. Column 8 controls for sponsor-time fixed effects and, again, the point estimates are robust but the standard errors are larger.

One possible concern with our results is that they reflect differences in asset quality or sponsor types. For example, conduits with weaker guarantees were more likely to hold asset-backed securities. Even though asset-backed securities were perceived of higher quality ex ante, these assets could be of lower quality ex post, which could bias our results. We, therefore, control for asset quality by including indicator variables for asset categories and sponsor types and interactions with the $After_t$ indicator.

Table 7 presents the results. As shown in Columns 1–4, the controls for asset categories have little effect on the coefficients of interest for outstanding ABCP. We confirm our finding that extendible and SIV guarantees have a significantly larger decline in ABCP outstanding relative to liquidity and credit guarantees. As shown in Columns 5–8, the controls reduce the coefficients of interest on the overnight ABCP spread regressions, which suggests that some of the price variation potentially reflects underlying differences in asset and sponsor types. This result could also be due to the fact that, because in a run, the main effect is on the quantity margin, it could be econometrically difficult to discern price effects. Hence, a conservative

Table 6
Effect of guarantee on asset-backed commercial paper (ABCP) outstanding and spreads.

This table shows the effect of guarantees on paper outstanding and spreads from April to December 2007. The dependent variable in Columns 1 to 4 is the weekly log of paper outstanding and in Columns 5 to 8 is the daily overnight spread over the federal funds rate. "Credit," "Extendible," and "SIV" (structured investment vehicle) are indicators for the type of guarantee. "After" is an indicator for dates after August 9, 2007. Columns 2, 3, 6 and 7 include time fixed effects. Columns 3, 4, 7, and 8 include conduit fixed effects. Columns 4 and 8 include sponsor-time fixed effects. Standard errors in parentheses are clustered at the conduit level. ***, **, and * represent 1%, 5%, and 10% significance, respectively.

	Log(Outstanding)				Spread			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit*After	−0.068	−0.062	0.061	−0.005	0.023	0.025	0.041	−0.004
	(0.124)	(0.125)	(0.130)	(0.202)	(0.055)	(0.055)	(0.058)	(0.103)
Extendible*After	−0.725***	−0.748***	−0.880***	−0.681*	0.129**	0.093**	0.135***	0.068
	(0.201)	(0.204)	(0.200)	(0.404)	(0.054)	(0.047)	(0.050)	(0.110)
SIV*After	−0.697***	−0.694***	−0.563***	−0.454	0.316***	0.254***	0.260***	0.315**
	(0.156)	(0.157)	(0.157)	(0.290)	(0.099)	(0.082)	(0.093)	(0.132)
Credit	−0.419	−0.419			0.000	0.001		
	(0.376)	(0.377)			(0.005)	(0.005)		
Extendible	0.132	0.132			0.022**	0.022**		
	(0.204)	(0.204)			(0.009)	(0.009)		
SIV	−0.336**	−0.336**			0.001	0.006		
	(0.167)	(0.167)			(0.006)	(0.005)		
After	−0.213**				0.474***			
	(0.084)				(0.028)			
Number of observations	7,630	7,630	7,630	7,630	14,862	14,862	14,862	14,862
R-squared	0.053	0.057	0.849	0.937	0.444	0.717	0.843	0.952
Time fixed effects	No	Yes	Yes	No	No	Yes	Yes	No
Sponsor-time fixed effects	No	No	No	Yes	No	No	No	Yes
Conduit fixed effects	No	No	Yes	Yes	No	No	Yes	Yes

Table 7
Effect of guarantee on asset-backed commercial paper (ABCP) outstanding and spreads (robustness).

This table shows the effect of guarantees on paper outstanding and spreads from April to December 2007. The dependent variable in Columns 1–4 is the weekly log of paper outstanding and in Columns 5–8 is the daily overnight spread over the federal funds rate. "Credit," "Extendible," and "SIV" (structured investment vehicle) are indicators for the type of credit guarantee. "After" is an indicator for dates after August 9, 2007. Columns 1, 3, 4, 5, 7, and 8 include time fixed effects. Columns 1, 2, 4, 5, 6 and 8 include conduit fixed effects. Columns 2 and 6 include sponsor-time fixed effects. Standard errors in parentheses are clustered at the conduit level. All columns include controls for type of assets and type of sponsor and interaction of the controls with "After." ***, **, and * represent 1%, 5%, and 10% significance, respectively.

	Log(Outstanding)				Spread			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Credit*After	0.065	0.023	0.007	0.073	−0.015	−0.100	−0.039	−0.061
	(0.135)	(0.212)	(0.145)	(0.141)	(0.054)	(0.077)	(0.053)	(0.048)
Extendible*After	−0.818***	−0.683*	−0.621***	−0.623***	0.021	−0.119	−0.069	−0.089
	(0.201)	(0.404)	(0.231)	(0.229)	(0.061)	(0.214)	(0.064)	(0.071)
SIV*After	−0.451**	−0.391	−0.544***	−0.451**	0.166	0.245**	0.171**	0.134
	(0.176)	(0.330)	(0.179)	(0.183)	(0.109)	(0.107)	(0.082)	(0.095)
Receivables*After	0.371**	0.212	0.370**	0.324**	−0.221***	−0.150*	−0.192***	−0.228***
	(0.153)	(0.228)	(0.148)	(0.145)	(0.074)	(0.089)	(0.060)	(0.069)
Loans*After	−0.384	−0.506*	−0.253	0.039	0.066	0.450***	0.158	0.063
	(0.289)	(0.278)	(0.255)	(0.208)	(0.171)	(0.083)	(0.161)	(0.179)
Bank*After			0.051	0.046			−0.148***	−0.185***
			(0.233)	(0.249)			(0.055)	(0.057)
Number of observations	7,630	7,630	7,630	7,630	14,862	14,862	14,862	14,862
R-squared	0.853	0.938	0.189	0.859	0.865	0.96	0.772	0.869
Time fixed effects	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Sponsor-time fixed effects	No	Yes	No	No	No	Yes	No	No
Conduit fixed effects	Yes	Yes	No	Yes	Yes	Yes	No	Yes

Table 8
Estimated losses for sponsors and outside investors.

This table shows the ex post risk transfer by credit guarantee. "Pre-crisis" denotes total asset-backed commercial paper (ABCP) outstanding as of July 1, 2007. Post-crisis denotes the value-weighted share that is "Active" (conduit continues to issue), "Repaid" (conduit closed and repaid investors), and "In default" (conduit closed and investors were not repaid). "Estimated loss" estimates the losses of sponsor and outside investors assuming a recovery rate on conduit assets of 95% and 85%, respectively.

	Pre-crisis	Post-crisis			Estimated loss (billion)			
					Loss rate: 5%		Loss rate 15%	
	ABCP (billion)	Active	Repaid	In default	Sponsor	Investor	Sponsor	Investor
All	1,395.5	76.6%	20.8%	2.5%	68.0	1.7	204.1	5.2
Guarantee					0.0	0.0	0.0	0.0
Liquidity	844	87.9%	12.1%	0.0%	42.2	0.0	126.6	0.0
Credit	204.2	70.9%	29.1%	0.0%	10.2	0.0	30.6	0.0
Extendibles	243.1	47.0%	45.5%	7.4%	11.3	0.9	33.8	2.7
Structured investment vehicle	104.1	65.7%	17.7%	16.6%	4.3	0.9	13.0	2.6
Sponsor type					0.0	0.0	0.0	0.0
Commercial bank	1,035.6	83.0%	16.4%	0.6%	51.5	0.3	154.4	0.9
Structured finance	199.2	58.1%	36.4%	5.5%	9.4	0.5	28.2	1.6
Mortgage lender	60.2	44.5%	40.2%	15.3%	2.5	0.5	7.6	1.4
Other	100.4	63.3%	24.4%	8.9%	4.6	0.4	13.7	1.3

inference is that the ability of conduits to borrow ABCP at pre-crisis spreads fell significantly post-crisis.

Overall, our results show that liquidity guarantees were affected similarly as credit guarantees, and less than extendible and SIV guarantees, during the run. This finding is strongly suggestive of the lack of risk transfer through liquidity guarantees.

4.4. *Losses of outside investors*

This subsection examines the extent of realized risk transfer by analyzing whether outside investors in ABCP were fully repaid after the start of the financial crisis. We take the perspective of an investor that was holding ABCP at the start of the crisis and examine whether the investor suffered losses by not rolling over maturing ABCP. We test the performance of credit guarantees using Moody's Investors Service announcement data from January 2007 to December 2008. Because all conduits are rated, Moody's Investors Service always issues an announcement if a conduit defaults on its obligation to pay off maturing ABCP.

Table 8 presents the results on the ex post risk transfer. Column 1 reports ABCP outstanding per credit guarantee in July 2007. Columns 2–4 show the value-weighted percentage of outstanding in three categories: (1) conduits that were closed down and repaid all maturing ABCP before December 2008, (2) conduits that remained active and repaid all maturing commercial paper up to December 2008, and (3) conduits that failed to repay maturing ABCP and entered default by December 2008.

We find that not a single conduit using credit or liquidity guarantees defaulted by December 2008. In contrast, 7.4% of ABCP covered by extendible notes guarantees and 16.6% of ABCP covered by SIV guarantees entered default by December 2008, respectively. Regarding the sponsor type, we find that conduits sponsored by structured finance firms and mortgage companies were significantly more likely to enter default than conduits sponsored by commercial banks. Overall, we find that 97.5% of outside investors in ABCP were fully repaid.

The total amount of conduit losses depends on the loss rate of conduit assets and, unfortunately, no information is publicly available with respect to such rates. However, we can use different pieces of publicly available information to form an estimate. For example, State Street (2009) announced an after-tax loss of $3.7 billion on conduit assets of $21.8 billion, which amounts to a loss rate of 22.6% (assuming a tax rate of 25%). Consistent with this estimate, the AAA-tranche of the ABX-index suggests that the value of collateralized mortgage obligations backed by subprime mortgages dropped by up to 60% over the same period. The losses on conduit assets are likely to be smaller because many conduits hold both mortgage and non-mortgage assets. In the case of mortgage assets, conduits usually hold prime mortgages instead of subprime mortgages. We, therefore, assume more conservative loss rates of 5% and 15%. Under these assumptions, we estimate total losses on conduit assets of $68 billion and $204 billion, respectively. The estimated losses for outside investors are $1.8 billion and $5.2 billion, respectively. Consistent with the lack of risk transfer, this analysis shows that most of the losses were borne by sponsors, not transferred to outside investors. However, the level of the estimated losses is only suggestive because we lack the data to compute actual losses.

4.5. Effect of conduit exposure on sponsor stock returns

As our final piece of evidence, this subsection analyzes whether banks with higher conduit exposure experienced lower stock returns during the financial crisis. The difficulty in testing this hypothesis is that the financial crisis also affected banks in other ways, some of which could be correlated with conduit exposure. Hence, if we observe that banks with higher conduit exposure have lower returns, then this result could be driven by other bank activities that negatively affected stock prices and were correlated with conduit exposure.

To address this identification issue, we focus on the start of the crisis in the ABCP market on August 9, 2007. We believe this provides a good setting to identify the impact of conduit exposure for two reasons. First, the financial crisis arguably started with the announcement of difficulties in the mortgage market. As shown in Panel B of Fig. 1, starting on August 9, 2007, investors drastically reduced refinancing of maturing ABCP and, as a result, overnight spreads jumped from about 10 basis points to 150 basis points. Hence, it is unlikely that the event study is confounded by other events that happened just prior to August 9, 2007. Second, our analysis focuses on the narrow 3-day window around August 9, 2007. This short event window reduces the likelihood that the results could be confounded by other events that happen around the same time.

Our sample is the group of commercial banks based in the United States and Europe with at least $50 billion in assets as of January 2007. We restrict the sample to banks that have publicly listed equity. To control for differences in observable characteristics, we estimate the baseline specification

$$R_i = \alpha + \beta ConduitExposure_i + \gamma X_i + \varepsilon_i, \quad (3)$$

where R_i is the cumulative equity return of bank i computed over the 3-day period from August 8 to 10, 2007; $ConduitExposure_i$ is bank i's conduit exposure (all guarantees) relative to equity as of January 2007; X_i are bank i's observable characteristics as of January 1, 2007; and ε_i is a bank-specific error term. We estimate the baseline specification using heteroskedasticity-consistent standard errors.

Table 9 presents the results. Column 1 shows that an increase in conduit exposure from 0% to 100% (e.g., Wells Fargo to Citibank) reduces the stock return during the 3-day event window by 1.4 percentage points. Column 2 controls for bank characteristics such as bank size, leverage ratio, share of assets funded with deposits, share of assets funded with short-term and nondeposit debt, and indicator variables for the country of the sponsoring institution's headquarters. The coefficient of conduit exposure decreases to 1.1 percentage points but remains statistically significant at the 5% level.

We interpret these results as evidence that banks with higher conduit exposure were more negatively affected by the crisis in the ABCP market. The coefficient is probably a lower bound of the impact, because investors could have underestimated at first the severity of the downturn or might not have been fully aware of the (relatively opaque) credit guarantees provided to conduits. Also, investors could have anticipated some of the losses because of prior announcements about losses on subprime assets.

To ensure that the results are not driven by outliers, we construct an alternative measure of exposure. We compute the mean exposure of all banks with positive exposure to conduits and divide the sample into two groups: banks with low exposure (below mean) and banks with high exposure (above mean). We estimate the baseline specification using indicator variables for banks with low exposure and for banks with high exposure and in unreported results find qualitatively and quantitatively similar effects. We also drop outliers in terms of conduit exposure and include banks with less than $50 billion in assets, and our results are qualitatively and quantitatively unchanged.

We also examine the relation of conduit exposure and stock returns in August and the months prior to August 2007. For each month from January 2007 to August 2007, we estimate the same set of regressions as in Column 2.

Table 9
Event study - effect of conduit exposure on stock returns.
This table shows the effect of conduit exposure on stock returns. We restrict the sample to commercial banks that (i) have at least $10 billion in assets (ii) are located in the Europe or the United States, and (iii) have share price data available. In Columns (1) and (2), the dependent variable is the total stock return over the three-day period from August 8 to August 10, 2007. In Columns (3)–(10), the dependent variable is the stock return in the month indicated under "time." We measure "Conduit exposure (total)" as ABCP relative to equity. Columns (2)–(10) include country-fixed effects. The control variables are defined in the Appendix. We report heteroskedasticity-consistent standard errors in parentheses. ***, **, * represent 1%, 5%, and 10% significance, respectively.

	Dependent variable: Stock return (percent)									
	Event regressions			Placebo regressions						
Time	August 8–10	August 8–10	August	January	February	March	April	May	June	July
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Conduit exposure	−1.443***	−1.096**	−2.334***	0.688	−0.373	0.322	−0.617	−0.588	1.420	1.083
	(0.437)	(0.465)	(0.690)	(1.298)	(0.417)	(0.600)	(0.872)	(1.442)	(1.513)	(0.953)
Log(Assets)		−1.391	0.967	−0.234	−0.053	−0.229	0.600	−1.018	1.215	0.169
		(1.661)	(0.797)	(0.588)	(0.558)	(0.511)	(0.415)	(0.562)	(1.055)	(0.776)
Return on assets		−1.175**	−1.020	1.086	0.254	1.163	1.376	0.164	6.313	2.965
		(0.493)	(2.311)	(1.496)	(0.837)	(0.735)	(1.108)	(1.636)	(4.576)	(2.570)
Share short-term debt		−1.072	−6.381	5.781	−6.369	9.677	12.593*	−4.750	5.686	1.693
		(3.660)	(6.762)	(5.571)	(4.509)	(6.130)	(7.205)	(9.992)	(7.654)	(6.291)
Share deposits		−0.412	−3.651	−4.879	−1.725	−1.248	−0.767	−7.050	7.921*	11.743
		(2.820)	(6.322)	(4.680)	(4.329)	(3.153)	(5.354)	(4.683)	(4.655)	(7.820)
Share loans		−2.759	4.789	5.556	6.705*	0.592	1.716	−5.729	5.443	−8.896
		(3.591)	(6.058)	(4.296)	(3.984)	(3.503)	(3.789)	(5.400)	(7.055)	(5.878)
Country fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	88	88	88	88	88	88	88	88	88	88
R-squared	0.059	0.470	0.374	0.526	0.490	0.523	0.542	0.539	0.384	0.403

We find no statistically significant relation between conduit exposure and stock returns from January 2007 to July 2007 (Columns 4–10). However, in the month of the crisis in the ABCP market, August 2007, we find a negative and statistically significant effect of conduit exposure on stock returns after controlling for the full set of observables (Column 3). The coefficient is about twice as large as the coefficient in Column 2. Again, this finding suggests that investors revised their expectation of the negative effect of conduit exposure on stock returns upward for several days after the start of the financial crisis. However, we caution against a fully conclusive interpretation because the estimation is over a longer event window and, therefore, could be confounded by other factors.

5. Benefits to banks of securitization without risk transfer

The empirical analysis shows that banks suffered significant losses because conduits were unable to roll over maturing ABCP. This raises the question of how large was the benefit to banks from setting up conduits.

We can assess the benefits to banks by quantifying how much profit conduits yielded to banks from an ex ante perspective using a simple back-of-the-envelope calculation. Assuming a risk weight of 100% for underlying assets, banks could avoid capital requirements of roughly 8% by setting up conduits relative to on-balance sheet financing. We assume that banks could finance short-term debt at close to the riskless rate, which is consistent with the rates paid on ABCP before the start of the financial crisis. Further assuming an equity beta of one and a market risk premium of 5%, banks could reduce the cost of capital by $8\%*5\%=0.004$ or 40 basis points by setting up conduits relative to on-balance sheet financing.

It is difficult to estimate the profits generated by conduits because only a few banks report revenues from conduits separately. For example, Deutsche Bank states in its annual report in December 2007 that conduits generated fees of 6 million euros relative to a total commitment of 6.3 billion euros. Bank of New York Mellon reports in December 2006 revenues of $3 million relative to a commitment of $3.2 billion (Arteta, Carey, Correa, and Kotter, 2008). Assuming that conduits have no costs and revenues are equal to profits, banks earned—until a run occurred—a carry of about 10 basis points on conduit assets.

Comparing the costs and benefits of conduits, it seems clear that conduits would not have been profitable if banks had been required to hold equity against the assets in their conduits to the same extent as for assets on their balance sheets. In fact, banks would have made a loss (negative carry) of 30 basis points on each dollar invested. However, given that banks were not required to hold equity to the same extent as for assets on their balance sheets, they could earn a profit of 10 basis points. Conduits were thus a relatively low-return activity but offered a way for some banks to attract money market savings and effectively increase bank size without increasing regulatory capital.

To see quantitatively how large was the capital saving for banks, Table 10 lists the 30 largest conduit sponsors. We find that missing capital, the additional capital if conduit assets had been entirely on bank balance sheets, was on average 6.1% of total equity or about $69 billion in total across banks. This is not necessarily a large amount of equity capital, but it masks considerable heterogeneity across banks, as the

Table 10
Missing capital.

This table lists the 30 largest bank sponsors of asset-backed commercial paper (ABCP) as of January 1, 2007. For each bank, we compute the required capital assuming ABCP requires a capital charge of 8%, i.e., ABCP*0.08 = Total, expressed in billions of US dollars. We also compute the missing capital as a share of the bank's equity. We measure equity as Tier 1 capital. If a bank does not report Tier 1 capital, we multiply shareholder equity with the average Tier 1/equity shareholder ratio of banks that report both shareholder equity and Tier 1 ratio.

			Missing capital	
Name	Tier 1	ABCP	Total	Percent
Citigroup	90.9	92.7	7.4	8.2
ABN Amro	31.2	68.6	5.5	17.6
Bank of America	91.1	45.7	3.7	4.0
HBOS	44	43.9	3.5	8.0
JP Morgan Chase	81.1	42.7	3.4	4.2
HSBC Holdings	87.8	39.4	3.2	3.6
Deutsche Bank	31	38.7	3.1	10.0
Société Générale	29.4	38.6	3.1	10.5
Barclays	45.2	33.1	2.6	5.9
Mitsubishi UFJ Financial Group	68.5	32.0	2.6	3.7
Rabobank	34.8	30.8	2.5	7.1
Westdeutsche Landesbank	9.5	29.9	2.4	25.1
ING Groep	54.3	26.4	2.1	3.9
Dresdner Bank	18.7	23.2	1.9	9.9
Fortis	16.4	22.6	1.8	11.0
Bayerische Landesbank	15.8	22.4	1.8	11.3
Bayerische Hypo-und Vereinsbank	14.1	22.3	1.8	12.6
State Street Corporation	24.1	21.9	1.7	7.2
Crédit Agricole	6.5	19.5	1.6	24.1
Hypo Real Estate	4.5	18.9	1.5	33.4
Lloyds Banking Group	6.1	18.8	1.5	24.6
Countrywide Financial Corporation	25.2	18.3	1.5	5.8
GMAC	15.4	17.5	1.4	9.1
Royal Bank of Scotland	75.2	15.8	1.3	1.7
Royal Bank of Canada	52.3	15.6	1.2	2.4
Bear Stearns Companies	19.1	13.8	1.1	5.8
KBC Group	22.9	12.6	1	4.4
Sachsen Landesbank	1.3	12.5	1	79.9
BNP Paribas	62.3	11.6	0.9	1.5
Bank of Montreal	45.3	11.5	0.9	2.0
Total	1,124.0	861.5	68.9	6.1

proportion of missing capital ranges from 1.5% to 79.9% of capital levels. The bank with the largest exposure relative to bank size, Sachsen Landesbank, was the first bank to be bailed out (on August 17, 2007) because it was unable to provide the guarantees it had extended to its conduits. Other banks with large exposure, such as Westdeutsche Landesbank and ABN Amro (later bought by Royal Bank of Scotland), also suffered large losses due to recourse from conduits and had to be bailed out. Hence, for some smaller banks the conduit activities were, in fact, large enough to wipe out the entire bank capital. For larger banks, conduit activities were small enough to withstand the losses on conduit assets, but these banks were weakened as the financial crisis continued.

In summary, an ex ante capital requirement of 8% against conduit assets would not have been sufficient to cover all possible losses from conduits when the assets declined in value. However, the key observation is that a capital charge for guarantees, similar to capital charges for on-balance sheet assets, would have most probably discouraged banks from setting up conduits in the first place.

6. Related literature

Gorton and Souleles (2007), Gorton (2008), Brunnermeier (2009), and Kacperczyk and Schnabl (2010a) provide examples of maturity transformation outside the regulated banking sector. Our focus, in contrast to theirs, is to provide an in-depth analysis of the structure of ABCP conduits: how risk transfer was designed to take place through conduits and how it materialized and contributed to the start of the financial crisis of 2007–2009.

Ashcraft and Schuermann (2008) present a detailed description of the process of securitization of subprime mortgages, of which conduits were one component. Nadauld and Sherlund (2008) study the securitization by investment banks of AAA-rated tranches—"economic catastrophe bonds" as suggested by Coval, Jurek, and Stafford (2009)—and argue that the change in the Securities and Exchange Commission ruling regarding the capital requirements for investment banks spurred them to engage in excessive securitization. Nadauld and Sherlund (2008) view the banks as warehousing these risks for further distribution, whereas Shin (2009) argues that banks were concentrating highly leveraged risk exposures (given the low capital requirements) by so doing. Our view in this paper is more along the lines of Shin (see also Acharya and Richardson, 2009; Acharya and Schnabl, 2009), that banks were securitizing without transferring risks to outside investors, and in particular, conduits were a way of taking on systemic risk of the underlying pool of credit risks.

In other related literature that too is focused on the economic causes of the increasing propensity of the financial sector to take on such risks, Arteta, Carey, Correa, and Kotter (2008) examine one class of conduits, namely credit arbitrage vehicles, and provide evidence consistent with government-induced distortions and corporate governance problems being the root causes (see also similar arguments in Calomiris, 2009). Beltratti and Stulz (2009) examine bank stock returns during the financial crisis and find that stricter country-level capital regulation is correlated with better bank performance during the crisis. Covitz, Liang, and Suarez (2009) use data on ABCP and show that the decline in securitized assets was driven by both market-wide factors and program fundamentals. Kacperczyk and Schnabl (2010b) examine the incentives of money market funds to purchase ABCP during the financial crisis of 2007–2009.

Finally, our results on the difficulty in rolling over ABCP and the rise in their spreads are somewhat akin to the analysis of the run on the repo market by Gorton and Metrick (2012). They find that a counterparty risk measure for the banking sector as a whole, the spread of LIBOR over Overnight Index Swap (OIS), explained over time the variation in the credit spreads of a large number of securitized bonds and the rise in repo haircuts, that is, the difference between the market value of an asset and its secured borrowing capacity. However, important differences exist between our laboratory and theirs. While conduits resemble repo transactions to some extent, the presence of explicit guarantees to conduits by sponsoring financial institutions establishes a direct linkage between

Table A1
Variable definitions.
This table defines the variables used throughout the paper.

Variable	Definition	Source
Conduit exposure (total)	Total asset-backed commercial paper (ABCP) outstanding divided by Equity	Moody's Investors Service, Bankscope
Conduit exposure (liquidity)	Total ABCP sponsored with liquidity guarantees divided by Equity	Moody's Investors Service, Bankscope
Conduit exposure (credit)	Total ABCP sponsored with credit guarantees divided by Equity	Moody's Investors Service, Bankscope
Assets	Total bank assets	Bankscope
Equity	Total bank equity	Bankscope
Leverage ratio	Equity divided by Assets	Bankscope
Tier 1 ratio	Regulatory capital ratio	Bankscope
Return on assets	Net profit divided by Assets	Bankscope
Share short-term debt	Short-term debt divided by Assets	Bankscope
Share deposits	Deposits divided by Assets	Bankscope
Share loans	Loans divided by Assets	Bankscope
Spread	Overnight return on ABCP minus federal funds rate (annualized)	Depository Trust and Clearing Corp.
Outstanding	ABCP outstanding	Depository Trust and Clearing Corp.
Credit	Indicator variable for whether conduit has credit guarantee	Moody's Investors Service
Extendible	Indicator variable for whether conduit has extendible guarantee	Moody's Investors Service
SIV	Indicator variable for whether conduit has SIV guarantee	Moody's Investors Service
Receivables	Indicator variable for whether conduit assets are primarily receivables	Moody's Investors Service
Loans	Indicator variable for whether conduit assets are primarily loans	Moody's Investors Service
Asset-backed securities (ABS)	Indicator variable for whether conduit assets are primarily ABS	Moody's Investors Service
Mixed	Indicator variable for whether conduit assets are mixed	Moody's Investors Service
Bank	Indicator variable for whether conduit sponsor is a bank	Moody's Investors Service
Mortgage	Indicator variable for whether conduit sponsor is a mortgage originator	Moody's Investors Service
Stock return	Equity return	Datastream

the ability to issue commercial paper and the guarantee provided by the sponsor. We can, therefore, test directly for the impact of the guarantees on commercial paper issuance and spreads using variation across and within conduit sponsors over time, instead of relying on market-wide measures of banking sector health.

7. Conclusion

In this paper, we analyze ABCP conduits and show how the structure of risk sharing in these conduits implies recourse back to bank balance sheets. We find evidence supporting the view that exposure to these conduits was undertaken by commercial banks to engage in regulatory arbitrage, i.e., to reduce their effective capital requirements. We also find that outside investors who purchased ABCP very often suffered no losses even when collateral backing the conduits deteriorated in quality, supporting our main finding that conduits were a form of securitization without risk transfer. Consistent with the lack of risk transfer, the stock price deterioration of banks at the start of the financial crisis was linked to the extent of their conduit exposure relative to equity capital. Once the crisis broke out, ABCP spreads rose and issuance fell, and more so when guarantees were weaker and sponsoring banks were weaker.

Our analysis makes it clear that from an economic standpoint conduits are less regulated banks that operate in the shadow banking system, but typically with recourse to fully regulated entities, mainly commercial banks, that have access to government safety net. Our results also indicate that when these less regulated banks do not have such recourse (extendible notes and SIVs guarantees), they struggle to survive a systemic crisis. While some could interpret this finding to justify the accordance of government safety net to all those parts of the shadow banking world that, like banks, engage in maturity transformation, the bigger lesson in our view is that banks have incentives to get around regulatory capital requirements to invest in aggregate risks in a leveraged manner.

Appendix A

See Table A1.

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