Wholesale Funding Runs*

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Abstract

We investigate bank runs in the wholesale funding market. We use novel and granular data on a large, yet so far neglected, segment of the European wholesale funding market. We document that this market did not freeze during a period that includes both the aftermath of the subprime crisis and the European sovereign crisis. Yet, many banks experienced "wholesale funding runs". These banks are significantly weaker than average, and the fact that they experience a run successfully predicts further deterioration of their financial conditions. Among banks that did not experience a run, the most profitable were more likely to increase their funding on this market, particularly during periods of high market stress.

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1 Introduction

To finance themselves, banks rely both on retail deposits and on wholesale funding. A prevailing view among economists and regulators is that wholesale funding is vulnerable to market freezes. In the presence of asymmetric information, theories of market freezes predict that uninsured wholesale lenders cannot discriminate between good and bad banks, implying that both types are prevented from borrowing in times of stress (Freixas and Jorge, 2008; Huang and Ratnovski, 2011; Malherbe, 2014; Heider et al., 2015). Consistent with this view, new banking regulation heavily penalizes the use of wholesale funding relative to retail deposits (e.g., Tarullo, 2014).

Two basic facts motivate our analysis. First, many of the largest segments of the wholesale funding market were resilient during the financial crisis. Earlier papers have used transaction-level data to challenge the leading view on market freezes. The repo market did not collapse in aggregate, neither in the U.S. (Krishnamurthy et al., 2014; Copeland et al., 2014), nor in Europe (Boissel et al., 2015; Mancini et al., 2015). Perhaps more surprisingly, some unsecured markets, such as the U.S. Fed funds market, continued to operate even in the days following the collapse of Lehman Brothers (Afonso et al., 2011). The second basic fact is that some banks did lose access to wholesale funding markets (see Shin, 2009, for a case study on Northern Rock). Together, the facts that (i) markets do not freeze in aggregate and that (ii) some individual institutions face runs suggest that funds are reallocated across institutions. A natural question is then whether such reallocation affects low and high-quality banks equally.

In this paper, we investigate how the wholesale funding market reallocates funds across banks in times of stress. We use novel data on a large, yet so far neglected, segment of the European wholesale market. During a period that includes both the aftermath of the subprime crisis and the European sovereign crisis, we show that banks experiencing wholesale funding runs display lower performance and higher risk. Moreover, the fact that they experience a run successfully predicts further deterioration of their financial conditions, even after controlling for observable characteristics at the time of the run. Finally, among banks that do not experience a run, well-performing banks tend to increase funding in this market, particularly during periods of high market stress. Our main conclusion is that during periods of stress, wholesale markets do not shut down indistinctly for both good and bad banks, but reallocate funds from low-quality to high-quality banks.

Our sample consists of a large segment (about 80%) of the market for euro-denominated Certificates of Deposits (CDs), which is itself a sizable component of the European wholesale market. CDs are unsecured short-term debt securities issued by banks. The data include characteristics of all issues in this market segment at the ISIN level, as well as the identity of issuers, from January 2008 to December 2014. Our sample includes more than 1.3 million ISIN-level observations for 276 European banks. We match issuance data with issuer-specific characteristics from Bankscope and with market data from Bloomberg. We first document that this market, which has not been studied earlier, is large: The amount of debt outstanding in our sample is similar to the size of the European repo market, and about two times as large as the unsecured interbank market. Second, we observe that the CD market did not experience a freeze during the period.

This resilience, however, masks considerable heterogeneity. We identify a number of issuing banks that experienced *wholesale funding runs*, i.e., banks whose amount of CDs outstanding dropped to zero (full run), or dropped by more than 50% in the course of 50 days (partial run), in an otherwise stable market. We isolate 79 runs over the 2008-2014 period (of which 33 are full runs). We are careful in making sure that these runs are not demand driven, i.e., do not come from banks' decisions to switch funding sources. For instance, we document that runs are preceded by a rapid shortening of debt maturity.

We ask whether runs affect high and low quality banks differentially. We start by comparing ex ante characteristics of banks that experience runs to those of other banks. The former have on average lower profitability, more impaired loans, a higher book leverage, and higher credit risk. Interestingly, they display a lower regulatory leverage (Acharya et al., 2014). We then ask whether wholesale funding runs are informative about *future* bank performance. We find that banks experiencing runs are those whose performance (using various measures) is set to decrease in the future, controlling for past characteristics. The occurrence of runs also successfully predicts a subsequent increase in CDS spreads – and to a lesser extent negative excess stock returns. We address reverse causality (i.e., that runs could *cause* lower future performance) using several consistency checks. First, runs predicts an increase in impaired loans, a measure admittedly less prone to reverse causality. Second, the predictive power of runs on performance is not driven by banks that heavily rely on CD funding. Third, the lower future ROA of banks facing runs does not seem to be due to fire sales as their total assets remain constant.

Finally, we turn to banks that did not experience runs. We test whether banks that increase funding in the CD market are those that will perform better in the future (in terms of ROA). Again, we find that receiving more funds during periods of stress is informative about current as well as future performance. Importantly, we show that this effect increases with market stress –as measured by the number and size of runs. This finding strongly supports our main conclusion, that periods of stress are characterized by a cross-sectional reallocation through which better-performing banks receive *more* funds, not less.

This paper primarily contributes to the literature on the behavior of wholesale funding markets in times of stress. Most papers so far study repo markets (Krishnamurthy et al., 2014; Copeland et al., 2014; Boissel et al., 2015; Mancini et al., 2015), and find that they did not freeze during the crisis. In contrast, we focus on unsecured borrowing, which is arguably more subject to runs. Chernenko and Sunderam (2014) study the dollar funding run on European banks from the perspective of money market mutual funds, and find evidence of contagion to non-European borrowers. Closer to our paper is Afonso et al. (2011), who focus on the unsecured Fed funds market. As we do, they investigate the effect of bank characteristics on wholesale funding. Their analysis is centered on the stress of the Fed Funds market during the Lehman crisis, while we study a cross-section of runs, in which banks suddenly lose access to a large wholesale funding market over an extended period of time.

Furthermore, in showing that runs forecast future performance, we also contribute to the debate on the determinants of bank capital structure. Following Diamond and Dybvig (1983), most of the literature views bank runs as inefficient sunspot events, coming from the maturity mismatch inherent to the fact that banks provide insurance against liquidity shocks. A few papers, however, argue that runs also act as a useful disciplining device on managers in the presence of moral hazard (Calomiris and Kahn, 1991; Flannery, 1994; Diamond and Rajan, 2001). By threatening to run, short-term depositors optimally induce high effort ex ante by the bank, even if runs may be ex-post inefficient. While we do not provide direct evidence of this ex ante disciplining effect, we offer evidence that bank runs are ex post informative of future performance. The fact that the maturity of new issues shortens several months before a run also suggests that investors tighten monitoring when the fundamentals of a bank deteriorate.

We proceed as follows. Section 2 describes our data and the CD market. Section 3 documents the bank-specific nature of the runs that we observe. Section 4 shows that runs predict future bank performance and offers evidence against explanations based on reverse causality. Section 5 shows that periods of stress are characterized by a reallocation of funds towards better-performing banks. Section 6 concludes.

2 Data description

Our main dataset covers a large part of the euro-denominated CD market. Before we describe the content of our data, we shortly provide some institutional details about this market.

2.1 The certificate of deposit contract

CDs are short-term papers issued by credit institutions, with an initial maturity ranging between one day and one year. These securities are unsecured, unlike central bank funding or repo funding. Issuance in the primary market is over-the-counter. While CDs may be traded after issuance, there is no liquid secondary market. They are mainly placed to institutional investors, such as money market funds, and they have a minimum principal amount of EUR 150,000. They can be zero-coupon or bear a fixed or variable interest rate.

Certificates of deposits are issued as part of *programs*. The documentation of a program specifies a number of legal characteristics that all issuances attached to it must satisfy. The advantage of issuing CDs within a program is that no new legal documentation has to be provided to investors each time a new CD is issued, as would be the case for traditional longer-term bond issues. In a given jurisdiction, an issuer typically operates one single program only; an issuer may nonetheless run CD programs in multiple jurisdictions, either to overcome some form of market segmentation or to borrow in different currencies.

2.2 Data coverage

From the Banque de France, we obtained daily issuance data on the euro-denominated CD market, from January 1, 2008 to December 31, 2014. All currencies combined, the French market is the largest market for CDs in Europe and the second largest worldwide (behind the U.S. market but before the London market, see Banque de France (2013)). For euro-denominated CDs, it is much larger than the second most active marketplace, the London-based ECP (European Commercial Paper) market, which is mostly important for GBP and USD-denominated financing.[1]

The aggregate size of the euro-denominated CD market is depicted in Figure 1, between January 1, 2008 and December 31, 2014. Over this period, the average market size, measured daily by taking the sum of all outstanding CDs, is EUR 372 Bn and the average daily amount of new issues is EUR 21.1 Bn. Even if unsecured, the CD market remained remarkably resilient during the most dramatic episodes of market stress, as shown in Figure 1. There was no significant drop in the size of the CD market until mid 2012. The subsequent decline in CD volume is not due to market stress but to the low interest rate environment. Indeed, in July 2012, the ECB lowered its deposit facility rate to 0%. The yields on euro-denominated CDs responded immediately and also decreased to close to 0% (Figure 2). After that, the CD market became less attractive to investors.

[1] CDs in a number of other currencies (e.g. USD, JPY, GBP, CHF, CAD, SGD, etc.) are also issued in the French CD market. The issuance activity in currencies other than the euro, however, is much more limited and is not included in our analysis.

Our data represent a large share of the euro-denominated CD market. To precisely assess their coverage, we do not have access to any publicly available statistics on the aggregate size of other markets for such CDs. To make that comparison, we instead rely on detailed data on the largest and most liquid subsegment of the European CD market, namely that for issuers that benefit from the Short-Term European Paper (STEP) label.[2] From the ECB, we obtained daily data on the volumes outstanding of each CD program benefiting from the STEP label. Figure 3 plots the breakdown of aggregate volumes for euro-denominated CDs. The French CD market is by far the largest, before the U.K. market and other markets (Belgian, Luxembourgian, etc.). On average over the sample period, it represents 81.5% of all euro-denominated CD volumes.

A given issuer can run CD programs in several jurisdictions. To further show that our coverage of the euro-denominated CD market is extensive, we use the legal documentation filled by each issuer to the Banque de France to hand-collect information on whether issuers run other CD programs abroad, and on the nature of these programs. Out of the 247 issuers for which this information is available, 176 (71.3%) do not run other CD programs. Moreover, banks issuing CDs in other jurisdictions are unlikely to target funding in euro, as their programs are launched primarily in the U.K. and in the U.S.[3]

2.3 Securities and issuer characteristics

Our data consists of the universe of CDs issued in the French market. There are 276 individual issuers, which are described in Panel A in Table 1.[4] Among them, 196 are

[2]Introduced in 2006, the STEP label results from an initiative of market participants aimed at increasing the Europe-wide integration and the liquidity of the market for short-term debt securities. Financial and non-financial firms benefiting from the STEP label can more easily issue CDs (or commercial paper) throughout Europe. Today, most of the largest CD issuers Europe-wide benefit from the STEP label. These issuers are mostly non-French institutions likely to consider CDs issued under French law on an equal footing with CDs issued in other jurisdictions. There is thus no bias in the attribution of the STEP label towards issuers which are also in our sample. See Banque de France (2013) for additional information on the STEP label.

[3]In total, our sample investors run 133 CD programs outside the French market. 42% of them are in the London market, and 29% in the United States. Both are likely to be aimed at obtaining GBP or USD-denominated funding. Other programs are in Hong-Kong (8 programs), Canada (7), Sweden (6), and Australia (5). There are only 6 other programs in Eurozone countries (Luxembourg and Spain).

[4]The full dataset includes 304 individual issuers. We drop CD issuers that never issued euro-denominated CDs (but possibly CDs in other currencies). We also consolidate issuers who appear in

French and 80 non-French, almost exclusively from European countries (Italy, Germany, U. K., Netherlands, and Ireland). Most of the largest European commercial banks are in our dataset. Some issuers enter or exit the market during the sample period, due to failures or mergers and acquisitions, thus, our panel is unbalanced.

The dataset contains 1,383,002 observations, corresponding to 838,703 individual securities (ISINs). After the initial issuance of an ISIN, additional observations correspond to buybacks or further issuance of the same security before it reaches maturity. Our data include a number of security characteristics at the ISIN level, including the issuance and maturity dates, the issuer name, and the debt amount. Aggregated statistics on issuances, outstanding amounts, and maturities can thus be constructed for each issuer at a daily frequency. Furthermore, we observe any event occurring during the lifetime of any security, including (partial or total) buybacks or re-issuances on the same ISIN. The breakdown of ISIN-level events is detailed in Panel B in Table 1.

As seen in Panel C of Table 1, the distribution of issued amounts is highly skewed, with a median of EUR 900,000 and a mean of EUR 51 Mn. CDs are mostly very short-term as reflected by the 33-day median maturity. The issuance frequency per bank is high: its median is 2.1/week and its mean 8.4/week.

We further match issuers with a number of balance sheet and market characteristics, including credit ratings. We obtain balance sheet data for 263 issuers from Bankscope; Those which we cannot match are issuers with very small CD programs. We retrieve variables pertaining to banks' activity, asset quality, profitability and capital structure. Descriptive statistics for these variables are given in Panel A of Table 2. We obtain stock price and CDS spread data at a daily frequency from Bloomberg for 43 and 64 issuers, respectively. All variables are defined in the appendix Table A1.

2.4 CDs versus other wholesale funding instruments

European banks are the most reliant on wholesale funding worldwide, far before U.S. banks (see International Monetary Fund, 2013, for a comparison across geographic ar-

the database under different names.

eas). To get a sense of the relative size of the euro-denominated CD market, we compare in Figure 4 its outstanding amount to three close substitutes in the wholesale funding market: the repo market (Panel A), the European Central Bank (ECB)'s Main Refinancing Operations (Panel B), and the unsecured interbank debt market (Panel C), all measured at the Eurozone level.[5]

From this benchmarking analysis, it clearly appears that the CD market accounts for a large fraction of the Eurozone wholesale funding market. It is almost as large as the private repo market (CCP-based + bilateral + triparty), even if this comparison overestimates the size of the repo market, as repo data are prone to double-counting (Mancini et al., 2015). As seen in Panel C, the aggregate volume of CDs outstanding is roughly twice larger than all funding provided by the ECB to European banks through its Main Refinancing Operations (MROs).[6] Finally, as observed in Panel D, the CD market is also much larger than the unsecured interbank market, which has nonetheless received much more attention (Afonso et al., 2011; de Andoain et al., 2015; Gabrieli and Georg, 2015; Abbassi et al., 2015).

For our sample banks, Panel B of Table 2 provides descriptive statistics on the relative magnitude of CD funding. At the median, CD funding represents 21.5% of bank equity and 3.5% of total liabilities. For a subset of banks, reliance on CD funding is much larger, representing 69% of equity and 9% of total liabilities at the 75th percentile.

3 Market freezes versus bank-specific runs

We show in this Section that there was no market freeze on wholesale funding over the 2008-2014 period. We then turn to defining and describing the events which we treat as

[5]Data on the European repo market have been provided to us by Mancini et al. (2015). Data on the European unsecured interbank debt market have been provided to us by de Andoain et al. (2015). We focus on outstanding amounts rather than on turnover. They are economically more relevant as they refer to the amount of funds available to banks. Turnover, in contrast, changes if the maturity of contracts varies, even though the aggregate amount of funds borrowed by banks is constant.

[6]MROs are one-week liquidity-providing operations, denominated in euros. They take the form of repurchase agreements against eligible assets. Due to their short maturity, they are a closer potential substitute to CD funding than other non-standard operations, such as the Long-Term Refinancing Operations (LTROs), which have much longer maturities.

bank-specific wholesale funding runs.

3.1 The absence of market freeze

A market freeze on wholesale funding would translate into a large and sudden drop in issuances in the CD market. We see in Figure 1 that such a drop did not happen over our sample period. The CD market turned out to be resilient during recent episodes of market stress. The aggregate volume of CDs outstanding remained around EUR 400 Bn until mid 2012. After that, investors slowly left the market in an environment of near zero interest rates.

The fact that there was no market freeze is remarkable in two respects. First, CDs are unsecured, and could in theory be more subject to runs than collateralized wholesale funding instruments such as repurchase agreements. Second, our sample period spans both the 2008 financial crisis following the default of Lehman Brothers and the European sovereign debt crisis. Both of these periods were characterized by high levels of stress in the financial sector. Major events that could have led to a freeze in wholesale funding markets (see Figure 1), such as the nationalization of Northern Rock, the failure of Lehman Brothers or the near-failure of Royal Bank of Scotland did not lead to system-wide drops in volumes or issuances. Similarly, volumes did not drop during the European sovereign debt crisis, following the bailouts of Greece and Ireland or other major events.

To establish the result that there was no market freeze, we address two potential concerns. First, there was a EUR 100 Bn contraction of outstanding volume in 2009. One may be concerned that this is symptomatic of a run on the CD market. To show that this is unlikely, we superimpose in Figure 1 the 5-year CDS spread on the EU Banks Index provided by Datastream. When market stress increased following the default of Lehman Brothers, volumes in the CD market remained stable and, if anything, slightly increased. The drop in CD volumes in 2009 corresponds to a period in which CDS spreads on European banks were also falling. In the subsequent period, during the European debt crisis, the large increase in CDS spreads for European banks took place while the CD market was stable or increasing, not decreasing. Overall, the positive comovement between CDS spreads and volumes in the CD market casts serious doubt on the idea that a market freeze could have been taking place.

A second concern is that, even though there is no run on CD volumes, there may be an increased system-wide fragility of the CD market through maturity shortening for all issuers. In Figure 5, we plot the volume-weighted average maturity of new CD issues at a weekly frequency, together with the 5-year CDS spread Index on EU banks. There is no system-wide reduction in the average maturity of new CD issues when CDS spreads increase, either during the global financial crisis or during the European sovereign debt crisis. Similarly, there was no large increase in CD yields. Over the period, average CD yields always remained below the ECB Main Refinancing Operations rate (see Figure 2). Taken together, all results in this section are strongly suggestive of the fact that there was no market freeze on CDs over the sample period.

3.2 The importance of bank-specific runs

While we do not observe any freeze on the CD market, we do observe a number of runs on individual banks, which we term *bank-specific wholesale funding runs*. This section gives a precise definition of such events and draws a distinction between full and partial runs. We define a *full run* by the fact that an issuer loses all of its CD funding, i.e., its amount of CDs outstanding falls to zero. We define a *partial run* by the fact that an issuer loses 50% or more of its CD funding over a 50-days period. This 50% threshold is higher than what is typically considered in the literature; for instance Covitz et al. (2013), Oliveira et al. (2014) and Ippolito et al. (2015) use thresholds between 10 and 20%. We take this conservative approach to ensure that the events we are considering are indeed runs. With this threshold, misclassification errors are unlikely. We also stress that our main results are robust to more restrictive definitions of runs, either with a higher threshold (80%) or with a shorter time window (30 days).

Classifying drops in CD funding as runs relies on the implicit assumption that these events are supply-driven. A natural concern comes from the fact that issuer-level demand for CD funding is not observed. This concern can be particularly important for infrequent borrowers. In contrast, if a bank has been regularly issuing large amounts of CDs, it is unlikely that it would stop issuing CDs for pure demand reasons. We restrict attention to such issuers and exclude from our sample any issuer with an outstanding CD amount below EUR 100 million before the run starts. We also ensure that all banks included in our sample issue at least one CD every week over the six months period preceding the run. To further address the concern that drops in issuance may reflect demand factors, we check, run event by run event, whether the absence of new CD issues is not caused by mergers, acquisitions or nationalizations, which would force issuers to close their program or to become inactive.

To further check whether the identified runs really reflect a shortage of funds, we investigate the dynamics of the maturity of new issues in the six months before these events. If the reduction in CD funding reflects rollover risk rather than demand factors, we should observe a shortening of the maturity of new issuances prior to the run. We estimate

$$Maturity_{it} = \sum_{j=1}^{6} \beta_j Run_{i,\tau-j} + FE_i + FE_t + \varepsilon_{it}, \tag{1}$$

where $Maturity_{it}$ is the volume-weighted average maturity of all new issues by bank i in month t. τ is the month in which institution i faces a run and $Run_{i,\tau-j}$ a dummy variable that equals 1 for bank i if it faces a run at date $t = \tau - j$. We estimate six of these dummy variables, for $j \in \{1, ..., 6\}$. The specification also includes bank fixed effects (FE_i), as we focus on within-issuer variations, and month fixed effects (FE_t), to difference out any time trend in maturity common to all issuers. Estimates are compiled in Table 4, for all types of runs (Panel A) and full runs only (Panel B).

The average maturity of new issues for banks that face a run starts to shorten about five months before the run actually takes place, and the shortening becomes statistically significant at the 1% level three months before the run. This is true for both full and partial runs. The effect is economically large, as the within-bank average maturity of new issues (after accounting for time trends) drops by about 30 days before full runs and by 25 days before partial runs. The fact that the average maturity drops monotonically each month before the run also suggests that this is a very strong pattern. It is suggestive of the fact that creditors strengthen their discipline over the bank several months before a run actually occurs. As a general feature of events which we treat as runs, such maturity shortening is hard to reconcile with a demand-driven explanation, but is consistent with a supply-driven explanation.

A final concern is that, even if demand for short-term funding is unchanged, banks may obtain funds by turning to different wholesale funding sources which are close substitutes, such as the interbank or the repo market, or to the central bank. If this is true, the fact that they no longer issue CDs would not be reflective of a genuine run. There are several reasons, however, why we think this is unlikely. If an alternative source of funding was becoming more attractive than CDs, it would arguably not become more attractive only for issuers for which we identify a run, but for most or all issuers in the market. This is inconsistent with the fact that we do not see any system-wide decrease in the market size, at least before the last part of the sample period, when short-term interest rates approach zero or become negative. This is also inconsistent with the fact that the occurrence of runs is spread over all our sample period (see below, Panel A of Figure 6). Finally, the interest rate to be paid on CDs over most of the sample period is lower than close substitutes such as the ECB Main Refinancing Operations rate, as seen in Figure 2. This is true even though CD funding, as compared to most substitutes, except interbank lending, does not require collateral to be pledged.

We provide summary statistics on partial and full runs in Table 3. Panel A displays the number of runs, broken down by year and by country. We identify 79 runs, 33 of which are full runs. The year with the largest number of partial and full runs is 2011. This particular year marked the height of the European sovereign debt crisis and is also the year which researchers have used to document runs on USD-denominated funds by U.S. money market funds (Ivashina et al., 2015). The main difference is that we do not see any system-wide dry-up in volumes, but a larger number of bank-specific runs. Over the sample period, countries facing the highest number of full runs are Ireland, Italy, and the United Kingdom. Panel A of Figure 6 further illustrates the timeline of full runs.

Panel B of Table 3 quantifies the magnitude of runs. The magnitude of a run is defined as the difference in CD amount outstanding before the run starts until it ends.[7] There is large heterogeneity in the absolute amount of funding lost in runs. To ease interpretation, we normalize the change in CD funding by the amount of bank equity as of the end of the previous year. For a subset of institutions heavily reliant on CD funding, the amount of funding lost during the run is larger than the equity value.

Figure 7 provides illustration of our events of interest by focusing on two full (Panel A) and on two partial runs (Panel B). Full runs are those on Banca Monte dei Paschi (BMPS) and on Allied Irish Banks (AIB). BMPS (run in November 2012) had been facing large acquisition-related write-downs and had large exposure to the Italian government debt. Hidden derivative contracts were made public by the end of November 2012, inducing a large loss. AIB (run in June 2010) had been hit hard by the global financial crisis and the collapse of the Irish property market. In 2010, the Irish government injected capital so as to become the majority shareholder. Examples of partial runs are those on Unicredit and Dexia, and also occurred at time major losses for these institutions were revealed. Unicredit had to make writedowns on acquisitions and had large exposure to the Greek sovereign debt. Dexia was greatly exposed to the U.S. subprime market through its U.S. monoline subsidiary.

Finally, we provide an aggregate representation of bank-specific runs by computing an aggregate *Run Index*. The index is computed at a monthly frequency as

$$RunIndex_t = \frac{\sum_i R_{it}}{CD_{mt}}, \tag{2}$$

where R_{it} is the euro amount of the run faced by any issuer i in month t (conditional on i facing a run; $R_{it} = 0$ otherwise) and CD_{mt} the aggregate size of the CD market at the beginning of that month. Both partial and full runs are included in the computation of the index. A high value of the index signals that a subset of issuers lose large amounts of funds in a given month, leaving possibly larger potential for a dynamic reallocation

[7] For full runs, the magnitude is equal to the outstanding amount 50 days before it falls to zero. For partial runs, the magnitude is equal to the difference between the outstanding amount 50 days before the run and the post-run amount.

of funds in the cross-section of issuers. Panel B of Figure 6 plots the Run Index over the sample period. Because this index can be interpreted as a measure of stress in the CD market, we plot it together with the spread on the 5-year EU Banks CDS Index provided by Datastream. It was high in 2008 and also spiked a number of times during the European sovereign debt crisis of 2011-2012. We later rely on this index, as a measure of stress in the CD market, in our regressions.

Idiosyncratic runs tend to occur at times of high market stress, and at times previous research has expressed concerns about market freezes. This result has an important consequence: from the observation that one or a few banks lose access to wholesale funding markets, one cannot conclude that these markets are frozen or that they dysfunction as a whole. This observation stands in stark contrast with most of the recent literature, which has focused on market freezes on wholesale funding. On the contrary, our results suggest that runs are mostly bank-specific. This calls for a shift in focus. Once the bank-specific nature of runs is recognized, two new questions arise. In the next two sections, we study (i) whether bank-specific runs are informed, i.e., whether they affect high and low-quality banks differentially, and (ii) whether funds are efficiently reallocated among banks.

4 Informational content of runs

This section studies the informational content of bank-specific wholesale funding runs. Our null hypothesis is that runs affect good and bad banks equally. Instead, we show that banks facing a run are significantly weaker ex ante and, more importantly, that runs also predict future bank characteristics, even when such characteristics are likely to be unrelated to the occurrence of runs. It also addresses endogeneity concerns.

4.1 Observable bank characteristics before runs

We start by documenting which ex ante observable characteristics are associated with the occurrence of runs. To test whether the occurrence of runs correlates with observable bank characteristics, we compare the mean and median values of balance sheet characteristics for banks that face a full run and for banks that do not. For each institution that faces a run during the calendar year t, we test whether its balance sheet characteristics at the end of years $t-1$ and $t-2$ differ from that of banks that do not face a run during year t. We compute statistics in the pooled sample, after differencing out each bank characteristic by a year fixed effect, to control for time trends. The equality of means is tested using a two-sample t-test and that of medians using the Wilcoxon-Mann-Whitney test. Results are displayed in Table 5.

Banks facing a run and those not facing a run do not differ from each other significantly in terms of their sources (deposits / assets) and uses (loans / assets) of funds. They differ to a statistically significant extent, however, along several other important dimensions, including profitability, asset quality, capitalization, and credit risk. Banks that are about to experience a run have a lower ROA at the end of the previous year, indicating that they use less efficiently their funds. The fact that funds are less productively allocated by such banks is also reflected in the lower ROE, lower net income, and lower net interest margins before the run. One year before the run, these differences are statistically significant at the 1% level in all but one case. In some cases, they are also significant two years before. The fact that the profitability of banks that will face a run is lower arises in part from the fact that their asset quality is lower, as measured by their ratio of impaired loans to equity. These institutions have higher credit risk, as evidenced by a higher CDS spread the year before the run, and by a significantly lower credit rating up to two years before the run.

Institutions that will experience a run also have a significantly lower ratio of equity to total assets, up to two years before a run. The fact that they are significantly less capitalized, with an average equity ratio lower by 3.6 percentage points, is not reflected, however, by differences in regulatory capital, measured either by Tier 1 or total regulatory capital, normalized by risk-weighted assets. Measures of regulatory capital poorly predict the occurrence of runs. This is consistent with Acharya et al. (2014), who find no correlation between regulatory capital and market perception of bank risk.

Overall, these results strongly suggest that runs do not affect good and bad banks equally, but correlate with banks' fundamentals, as reflected in publicly observable information. The fact that runs do not occur as sunspots but correlate with fundamentals is consistent with the historical evidence on depositor runs by Gorton (1988) and Kaminsky and Reinhart (1999).

4.2 Runs predict future bank characteristics

In this section, we provide evidence that runs are informative about future bank characteristics, unobservable at the time of the run. For each run occurring during year t, only the balance sheet characteristics at the end of year $t-1$ are observable. We test whether the occurrence of runs predicts the change in relevant balance sheet characteristics between dates $t-1$ and t, after including as controls standard predictors of such bank outcomes. We focus on year-to-year changes in balance sheet characteristics, because variables in levels are likely to be autocorrelated.[8] We estimate

$$\begin{aligned} \Delta Y_{it} \quad &= \quad \beta_0 \mathbb{1}\left\{t-1 \leq \tau_{Run_i} < t\right\} + \beta_1 \text{Size}_{i,t-1} + \beta_2 \text{Controls}_{i,t-1} \\ &\quad +\beta_3 \text{Controls}_{c,t-1} + FE_c + FE_t + \varepsilon_{i,t}, \end{aligned} \tag{3}$$

where $\Delta Y_{it} = Y_{it} - Y_{it-1}$ is the change is a given balance sheet characteristic between the end of year $t-1$ (observable) and the end of year t (unobservable at the time of the run, denoted τ_{Run}). $\mathbb{1}$ denotes the indicator function, and takes value one when a run occurs on issuer i between the end of year $t-1$ and the end of year t. FE_c and FE_t are country and year fixed effects. We estimate regression coefficients separately for full and partial runs. Our coefficient of interest is β_0.

Consistent with our focus on the efficiency of the allocation of funds in the CD market, our main dependent variable is the change in ROA. Regression coefficients are in Table 6. Panel A is for all runs and Panel B for full runs only. As seen in our main specifications (Columns 1 and 2), the occurrence of a run during year t is associated with a decrease in ROA between the end of year $t-1$ and the end of year t. This is true for all types

[8]This regression specification is in the spirit of Bertrand et al. (2007). In their paper, future changes in ROA of bank-dependent firms is regressed on the lending policy of banks.

of runs, at statistically significant levels. It is also robust to the inclusion of several relevant bank-level controls (size, ROA, and impaired loans over total loans at $t-1$) and country-level controls (GDP growth between $t-1$ and t). The magnitude of the effect is economically significant. This result suggests that runs contain information which is not publicly observable at the time they occur.

A potential endogeneity concern when estimating Equation (3), however, is reverse causality. If drops in ROA are caused by the occurrence of runs, then even non-informed or non-fundamental runs may predict future bank characteristics. We address this endogeneity concern in three ways. First, we replace changes in ROA by changes in impaired loans over total loans as the dependent variable when estimating Equation (3). Changes in impaired loans arguably cannot be caused by the occurrence of a run, because they primarily relate to a stock of pre-existing loans, which have already been made at times the run occurs. It is thus arguably exogenous with respect to the occurrence of a run. Estimation results are in Table 7 for both partial and full runs (Panels A and B respectively). The estimation results are consistent with those obtained for changes in ROA. The occurrence of runs predicts an increase in the ratio of impaired loans, at statistically significant levels, even after including bank-level and country-level controls associated with loan performance.

Second, if changes in bank characteristics ΔY_{it} are endogenous to the occurrence of runs on CDs, this should be primarily true for banks which rely on CD funding to a larger extent. Similarly, the effect, if any, should be smaller for banks with moderate CD financing. To test for this mechanism, we re-estimate Equation (3) by interacting the *Run* dummy variable with additional dummy variables equal to one if the share of a bank's CD financing over total liabilities as of the end of the previous year is in the third or fourth quartiles of the distribution (respectively, if the bank's share of CD funding over total liabilities is between 4% and 9% or above 9%). If the endogeneity concern is important, these interaction terms are expected to be statistically significant, with the same sign as that of the β_0 coefficient on the *Run* dummy variable, and increasing in magnitude. Estimation results are in column (3) of Tables 6 (for ROA) and 7 (for impaired loans). In all cases, the estimated interaction coefficients are not statistically significant, indicating that the estimate for our main coefficient is not driven by a subset of banks with a large exposure to the CD market. Runs are also predictive of future profitability and asset quality even for banks with little CD funding. This result casts serious doubt on the idea that the endogeneity concern is major in our context. In contrast, it is fully consistent with the view that investors run on information about future fundamentals, as the share of CD funding over total liabilities should not matter in this case.

As additional evidence against reverse causality, we show that runs do not seem to force banks to downsize significantly. In the appendix Table A2, we re-estimate Equation (3) with changes in size (Panel A) and changes in loans to total assets (Panel B) as dependent variables. Coefficients on the dummy variable capturing the occurrence of runs are never statistically significant. As seen in Column (3), they are also not significant even for banks that rely heavily on CD funding. A potential explanation is that these banks manage to substitute CD funding with alternative sources of funds, such as ECB funding.[9] The fact that runs do not force banks to downsize significantly means that, in our case, runs on CD do not force banks to change significantly the course of their operations. If this would have been the case, the endogeneity concern would have been more important, as a lower ROA could have been the consequence of fire sales.

4.3 Consistency checks

In this section, we extend our baseline results along three dimensions. First, we provide evidence of the informational content of runs at longer-term horizons. We re-estimate Equation (3) with $Y_{it+1} - Y_{it-1}$ as the dependent variable, i.e., we consider whether runs predict future changes in ROA or impaired loans over a two-year period starting at the end of December of the year preceding a run. Estimates are in the appendix Table A3. In Panel A, runs predict a long-term decrease in ROA, even though not significant. In Panel B, they predict a long-term increase in the ratio of impaired loans, which is significant at

[9] Drechsel et al. (2015) provide evidence that European banks borrowing from the ECB between 2007 and 2011 are significantly weaker than average. They document that the relationship between weak bank capitalization and borrowing from the ECB facilities is economically large.

the 1% level. These results are again true regardless of whether banks rely on CD funding to a large extent or not, as seen in Column (3), and thus unlikely to be driven by reverse causality.

Second, we show that the informational content of runs does not disappear in times of high market stress. Indeed, with asymmetric information, the ability of lenders to distinguish between high and low-quality borrowers should be greater in turbulent times (Heider et al., 2015). If this is the case, runs may not be informative any longer during crises. In Column (4) of Tables 6 and 7, we re-estimate Equation (3) after including an interaction term between the *Run* dummy and a *Crisis* dummy that equals one in 2011 and 2012. These years correspond to the height of the European debt crisis. As seen in Figure 1, they are also the years in which the CDS spread of EU banks reached its highest level. If the predictive power of runs diminishes or disappears in times of crisis, the estimated coefficient on this interaction term should have opposite sign as that on the *Run* dummy and be significant. We do not find this in any of the specifications, highlighting the fact that runs contain information even when market stress is high. This finding also suggests that information-based contagion is, at most, limited.

Finally, another potential concern with our approach is that it relies on accounting data only available at a yearly frequency. Thus, new information may be revealed between the end of the preceding year (when balance sheet information is released) and the time of the run. If this is the case, runs may not be informative about future characteristics but simply correlate with observable characteristics not yet reflected in balance sheet data. We address this concern by estimating Equation (3), using both excess stock returns and changes in CDS spreads as dependent variables.[10] Switching to market data brings the benefit of a higher frequency but also comes at the cost of only having data for a smaller number of banks, mainly publicly-traded ones. In Table 8, results are provided for the 6-month and one-year periods that follow the occurrence of a run. As seen in Panel A, the occurrence of a run is associated with a negative excess return at both horizons, which is significant in one case. In Panel B, the occurrence of a run successfully predicts a

[10]To compute excess stock returns, we use the return on an equally-weighted portfolio of all sample stocks as the market return.

subsequent increase in CDS spread, at both horizons, and at significant levels. This is true even after including bank-level and country-level controls. The latter result suggests that the informational content of runs does not only arise from observable characteristics not yet incorporated in balance sheet data. Runs do predict future bank-specific outcomes, even after controlling for observable characteristics.

5 Reallocation of funds during runs

The absence of market freeze and the occurrence of bank-specific runs suggest that funds get reallocated in the cross-section when runs occur. We study whether reallocation of funds is particularly important when runs occur and whether it benefits institutions that are better able to allocate funds productively, i.e., banks that will increase their ROA in the future.

5.1 Reallocation towards profitable banks

We shift our attention from banks that face runs to banks that increase their reliance on CD funding. We study whether banks whose CD funding grows more than the aggregate market are those that will make a profitable use of these funds, as measured by a high ROA or by an increase in ROA in the future. We find strong evidence that this is indeed the case.

We start by comparing the growth of CD issuance by each bank to the growth of the aggregate CD market. At a monthly frequency, we compute E_{it}, the growth rate in issuance by bank i in excess of the growth rate in issuance at the market level:

$$E_{it} = \Big[\log\left(CD_{it}\right) - \log\left(CD_{i,t-1}\right) \Big] - \Big[\log\left(CD_{mt}\right) - \log\left(CD_{m,t-1}\right) \Big], \tag{4}$$

where CD_{it} is the amount of CD outstanding by issuer i at the end of month t and CD_{mt} the aggregate size of the CD market in that month. We drop observations for which $CD_{i,t-1}$ is below a threshold of EUR 10 Mn, so as to avoid including observations of issuers with low and volatile CD activity, or issuers that enter the CD market.

We test two related hypotheses. First, we check whether high and positive values of E_{it} forecast future increases in ROA unconditionally. If true, this means that banks whose CD funding grows more are able to make a productive use of these funds, and funds flow to such banks regardless of whether there are runs or not in the market. Second, we test the hypothesis that the reallocation of funds towards better-performing banks is stronger at times runs occur in the market. We find support for both hypotheses in the data.

We construct a dummy variable I_{it} that equals one for any issuer i in month t if E_{it} is above some percentile α of the distribution of E_{it} at time t, and zero otherwise. We provide results for both $\alpha = 50\%$ and $\alpha = 25\%$, i.e., we only consider banks that are above the median and in the top quartile in terms of the growth of their CD funding relative to the market. We estimate a probit model

$$\begin{aligned}\Pr\left(I_{it} = 1 | X_t\right) &= \Phi\Big(\beta_0 \Delta ROA_{it} + \beta_1 \text{Controls}_{i,t-1} \\ &\quad + \beta_2 \text{Controls}_{c,t-1} + FE_c + FE_m\Big), \qquad (5)\end{aligned}$$

where $\Delta ROA_{it} = ROA_{it} - ROA_{i,t-1}$ is the change in ROA between the end of the previous year (observable at the time of the run) and the ROA at the end of the current year (unobservable at the time of the run). We include bank-level and country-level controls, as well as country fixed effects. In contrast with previous regressions, we turn to the monthly frequency, because we want to isolate higher frequency changes in CD funding, in particular those taking place when the CD market is stressed—as measured by the occurrence of bank-specific runs. To account for the fact that past balance sheet characteristics may be more informative about early months of each year (and, symmetrically, that late quarters of a year may correlate more with future balance sheet characteristics), we include month fixed effects, FE_m, for eleven out of twelve months. The fact that we focus on monthly variations in CD funding is also the reason why we use ΔROA_{it} as an independent variable, and not as a dependent variable as in the previous section. Finally, Φ denotes the c.d.f. of a standard normal distribution. Our coefficient of interest is β_0.

Estimates are provided in Table 9 for threshold values $\alpha = 0.5$ (Column 1) and $\alpha = 0.25$ (Column 3). Estimated coefficients are positive and significant at the 1% or 5% level. This means that, regardless of whether bank-specific runs occur in the market, banks whose CD funding grows faster than the market are banks that increase their future ROA, i.e., tend to make a more productive use of the funds they receive.

5.2 Reallocation in times of high market stress

We test whether this effect is stronger during periods in which bank-specific runs occur in the market. To do so, we re-estimate Equation (5) after including interaction terms between ΔROA_{it} and dummy variables taking value one if the Run Index—defined in Equation (2)—is in the second, third or fourth quartile of its distribution (i.e., higher values of the Run Index). Estimates are in Columns (2) and (4) of Table 9. The base coefficient on Δ ROA, corresponding to the periods in which the Run Index is the lowest, remains positive and significant. Coefficients on the interaction terms, however, indicate that this effect is much larger in magnitude at times the Run Index is high, i.e., when it is in its third or fourth quartile. This is indicative of the fact that the reallocation of funds towards banks that will perform well in the future is amplificated in times of financial stress. The economic magnitude of the effect is large; the estimated coefficient on the interaction term corresponding to highest market stress is twice larger than that on the unconditional coefficient β_0.

The evidence in Table 9 is suggestive of the fact that funds get reallocated towards better-performing institutions during times of stress. This result has important economic implications. First, even though we cannot rule out the idea that there can be limited contagion, our results show that the mere existence of one or several runs in wholesale markets does not generally trigger additional runs on a broader scale. It does not imply that higher-quality banks are also prevented from borrowing, i.e., that the market freezes. On the contrary, better-performing institutions are able to increase funding, particularly when market stress is high. This reallocation process leaves the market size close to unchanged. Second, while most of the existing literature considers either (i) runs on individual banks considered in isolation or (ii) market freezes that lead to breakdowns of the market as a whole, our results suggest to take an alternative and intermediate perspective. They suggest to consider instead the productive use of funds in the cross-section of banks, as well as the role of runs to reallocate funds among financial institutions.

6 Conclusion

Our main conclusion is that periods of stress in wholesale markets are better described as accelerated reallocation of funds in the cross-section rather than as system-wide market freezes. This result calls for a reorientation of the literature on bank runs. In contrast with a leading view that sees whole markets as inherently subject to market-wide disruptions, we show that runs are mostly bank-specific and driven by bank-level information. It is not the case that both good and bad banks alike are denied access to wholesale funds in times of stress. We show that (i) banks that face runs are those performing poorly in the future and that (ii) banks receiving more funds during stress episodes are those increasing their profitability in the future. Aggregate statistics are thus not well-suited to understand periods of stress in wholesale markets, as they hide significant cross-sectional heterogeneity: runs contribute to the reallocation of funds from worse-performing to better-performing institutions.

References

Abbassi, P., F. Brauning, F. Fecht, and J.-L. Peydro (2015). Cross-border liquidity, relationships and monetary policy: Evidence from the euro area interbank crisis. *Working Paper*.

Acharya, V., R. Engle, and D. Pierret (2014). Testing macroprudential stress tests: The risk of regulatory risk weights. *Journal of Monetary Economics 65*, 36–53.

Afonso, G., A. Kovner, and A. Schoar (2011). Stressed, not frozen: The federal funds market in the financial crisis. *Journal of Finance 66*, 1109–1139.

Banque de France (2013). The French short-term negotiable debt securities market, the STEP label and the role of the Banque de France. *Focus 8*.

Bertrand, M., A. Schoar, and D. Thesmar (2007). Banking deregulation and industry structure: Evidence from the French banking reforms of 1985. *Journal of Finance 62*, 597–628.

Boissel, C., F. Derrien, E. Ors, and D. Thesmar (2015). Systemic risk in clearing houses: Evidence from the European repo market. *Working paper*.

Calomiris, C. W. and C. M. Kahn (1991). The role of demandable debt in structuring optimal banking arrangements. *American Economic Review 81*, 497–513.

Chernenko, S. and A. Sunderam (2014). Frictions in shadow banking: Evidence from the lending behavior of money market funds. *Review of Financial Studies 27*, 1717–1750.

Copeland, A., A. Martin, and M. Walker (2014). Repo runs: Evidence from the tri-party repo market. *Journal of Finance 69*, 2343–2380.

Covitz, D., N. Liang, and G. Suarez (2013). The evolution of a financial crisis: Collapse of the asset-backed commercial paper market. *Journal of Finance 68*, 815–848.

de Andoain, C., F. Heider, M. Hoerova, and S. Manganelli (2015). Lending-of-last-resort is as lending-of-last-resort does: Central bank liquidity provision and interbank market functioning in the euro area. *Working Paper*.

Diamond, D. W. and P. H. Dybvig (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy 91*, 401–419.

Diamond, D. W. and R. G. Rajan (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking. *Journal of Political Economy 109*, 287–327.

Drechsel, T., I. Drechsler, D. Marques-Ibanez, and P. Schnabl (2015). Who borrows from the lender of last resort? *Journal of Finance* (forthcoming).

Flannery, M. (1994). Debt maturity and the deadweight cost of leverage: Optimally financing banking firms. *American Economic Review 84*(1), 320–331.

Freixas, X. and J. Jorge (2008). The role of interbank markets in monetary policy: A model with rationing. *Journal of Money, Credit and Banking 40*, 1151–1176.

Gabrieli, S. and C.-P. Georg (2015). A network view on interbank liquidity. *Working Paper*.

Goldstein, I. and A. Pauzner (2005). Demand-deposit contracts and the probability of bank runs. *Journal of Finance 60*, 1293–1327.

Gorton, G. (1988). Banking panics and business cycles. *Oxford Economic Papers 40*, 751–781.

Heider, F., M. Hoerova, and C. Holthausen (2015). Liquidity hoarding and interbank market rates: The role of counterparty risk. *Journal of Financial Economics 118*, 336–354.

Huang, R. and L. Ratnovski (2011). The dark side of bank wholesale funding. *Journal of Financial Intermediation 20*, 248–263.

International Monetary Fund, . (2013, October). Changes in bank funding patterns and financial stability risks. *Global Financial Stability Report* (Chapter 3), 105–148.

Ippolito, F., J.-L. Peydro, A. Polo, and E. Sette (2015). Double bank runs and liquidity risk management. *Working paper*.

Ivashina, V., D. S. Scharfstein, and J. C. Stein (2015). Dollar funding and the lending behavior of global banks. *Quarterly Journal of Economics 130*, 1241–1281.

Kaminsky, G. L. and C. M. Reinhart (1999). The twin crises: The causes of banking and balance-of-payments problems. *American Economic Review 89*, 473–500.

Krishnamurthy, A., S. Nagel, and D. Orlov (2014). Sizing up repo. *Journal of Finance 69*, 2381–2417.

Malherbe, F. (2014). Self-fulfilling liquidity dry-ups. *Journal of Finance 69*, 947–970.

Mancini, L., A. Ranaldo, and J. Wrampelmeyer (2015). The euro interbank repo market. *Review of Financial Studies* (forthcoming).

Oliveira, R. F., R. F. Schiozer, and L. Barros (2014). Depositors' perception of "too-big-to-fail". *Review of Finance* (forthcoming).

Shin, H. S. (2009). Reflections on Northern Rock: The bank run that heralded the global financial crisis. *Journal of Economic Perspectives 23*, 101–119.

Tarullo, D. K. (2014). Liquidity regulation. *Speech at the Clearing House 2014 Annual Conference (New York).*

Table 1: Description of the dataset on CD issuance

This table describes our main dataset on CD issuance. Panel A describes issuers and provides a breakdown by country. Panel B describes the contract-level information. Each ISIN-level observation is associated with either an issuance, a buyback, or with the cancellation of any of these operations. Each ISIN can appear multiple times in the dataset, due to the buyback of previously issued CDs, or to the re-issuance on previously issued ISINs. Panel C describes the distribution of CD-level information for new issuances in the pooled sample. "Issued amount" is the euro amount of an individual CD in the pooled dataset. "Issuances by issuer" is the total number of issuances by any issuer from January 2008 to December 2014. CD data are from the Banque de France.

Panel A: Description of issuers

	N. issuers	% Issuers	% Issued amount	Largest issuer
All	276	100.00	100.00	—
Austria	2	0.72	0.15	Oesterreich. Kontrollbank
Belgium	2	0.72	6.21	Dexia Credit Local
China	2	0.72	0.12	Bank of China
Denmark	3	1.09	0.51	Jyske Bank
France	196	71.01	72.78	BNP Paribas
Germany	12	4.35	1.03	HypoVereinsbank
Ireland	7	2.54	0.43	Allied Irish Banks
Italy	14	5.07	3.13	Unicredit
Japan	3	1.09	0.38	Sumitomo Mitsui
Netherlands	8	2.90	5.37	Rabobank
Spain	2	0.72	0.53	BBVA
Sweden	4	1.45	0.84	Svenska Handelsbanken
Switzerland	2	0.72	0.44	UBS
United Kingdom	11	3.98	7.36	HSBC
Others	8	2.90	1.12	—

Panel B: Description of CD contracts

	N. Obs.	Frequency (%)
Number of CDs (ISINs)	819,318	—
Issuance	1,304,213	95.88
Buyback	44,482	3.27
Cancellation	11,577	0.85
Total	1,360,272	100

Panel C: Distribution of CD characteristics

	Min.	10th	25th	Mean	Median	75th	90th	Max.
Issued amount (EUR Th)	100	180	300	51,153	900	10,000	67,850	1.36e+07
CD maturity (days)	1	2	13	66.4	33	92	181	367
Issuances by bank	1	27	125	3,072	777	2,886	7,273	106,997
Issuances by bank / week	<0.01	0.07	0.34	8.44	2.13	7.93	19.98	293.94

Table 2: Balance sheet of CD issuers

Panel A provides descriptive statistics on the distribution of the balance sheet characteristics for CD issuers. Means and quantiles are as of end-December and are computed from the pooled sample over the period from 2008 to 2014. The number of issuer-year observations on which they are computed is provided in the last column. Panel B relates CD outstanding amounts as of end-December to other balance sheet characteristics, in the pooled sample. Statistics are conditional on the issuer having a non-zero amount of CD outstanding. Calculation of CD / (CD + Repo) is also conditional on the issuer having a non-zero amount of repurchase agreements outstanding. All variables are defined in Table A1. Balance sheet data are from Bankscope.

	10th	25th	Mean	Median	75th	90th	N. Obs.
Panel A: Distribution of balance sheet characteristics							
Size (log Total assets)	20.834	22.077	23.503	23.338	24.708	26.669	1,452
Loans / Assets	0.270	0.485	0.634	0.699	0.820	0.882	1,448
Customer deposits / Assets	0.036	0.202	0.375	0.351	0.577	0.669	1,422
ROA (%)	-0.201	0.159	0.332	0.406	0.748	1.047	1,446
ROE (%)	-3.883	2.526	1.576	5.424	8.342	13.461	1,446
Net income / Assets							
Net interest margin / Assets							
Impaired loans / Loans (%)	1.028	2.243	5.414	3.908	6.586	11.899	1,059
Impaired loans / Equity (%)	8.231	17.134	58.575	38.381	72.999	135.547	1,074
Equity / Assets	0.030	0.046	0.083	0.075	0.110	0.136	1,452
Tier 1 capital (%)	7.600	9.230	13.074	11.200	14.300	18.250	458
Total regulatory capital (%)	9.900	11.600	16.124	13.705	16.910	21.400	486
Panel B: Distribution of CD funding relative size							
CD / Equity (cond.)	0.008	0.053	1.176	0.215	0.693	2.246	971
CD / (CD + Repo) (cond.)	0.010	0.053	0.340	0.229	0.611	0.855	218
CD / Total liabilities	0.003	0.010	0.095	0.035	0.091	0.222	1,007

Table 3: Descriptive statistics of runs

This table provides descriptive statistics related to wholesale funding runs. Panel A gives the total number of runs, broken down by year, by type of run, and by home country of the bank. Panel B provides descriptive statistics on the magnitude of runs, both in absolute terms and relative to the bank's equity as of end of December of the preceding year. The magnitude of the run is defined as the euro amount of the difference between the volume outstanding on the day a run is identified and that 50 days before the run. Both partial and full runs are defined in Section 3.2.

Panel A: Number of runs

	Partial and full runs		*Full runs only*	
	Number of runs	% Total	Number of runs	% Total
2008	4	5.06	2	6.06
2009	8	10.13	5	15.15
2010	11	13.92	6	18.18
2011	19	24.05	9	27.27
2012	14	17.72	4	12.12
2013	13	16.45	3	9.09
2014	10	12.65	4	12.12
Total	79	100	33	100
By country:				
Austria	2	2.53	2	6.06
France	31	39.24	2	6.06
Denmark	3	3.79	0	0.00
Germany	4	5.06	4	12.12
Ireland	7	8.86	7	21.21
Italy	8	10.13	5	15.15
Netherland	3	3.79	2	6.06
Sweden	2	2.53	0	0.00
United Kingdom	8	10.13	5	15.15
Other	11	13.92	6	18.18

Panel B: Magnitude of runs

	Min.	10th	25th	Mean	Median	75th	90th	Max.
Partial and full runs:								
Magnitude (EUR Mn)	63	136	228	967	512	1,260	3,258	5,289
Δ CD / Equity	0.001	0.008	0.016	0.233	0.068	0.174	0.491	5.293
Full runs only:								
Magnitude (EUR Mn)	103	152	216	847	403	1,004	2,240	4,182
Δ CD / Equity	0.051	0.054	0.089	0.639	0.259	0.517	2.250	5.293

Table 4: Maturity shortening before runs

The volume-weighted average maturity of new issues at a monthly frequency is regressed on issuer and time fixed effects, and on a set of dummy variables. A dummy variable at date $\tau - t$ equals one if the bank faces a run at date τ and zero otherwise, for $t \in \{1, ..., 6\}$, i.e., up to six quarters before the run. Panel A is for both partial and full runs. Panel B is for full runs only. Standard errors are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable: Weighted average maturity of new issues (1)	(2)
	Panel A: Partial and full runs	*Panel B: Full runs only*
$\tau - 1$	-24.660***	-29.732***
	(2.281)	(4.521)
$\tau - 2$	-17.278***	-30.198***
	(3.939)	(6.004)
$\tau - 3$	-12.134***	-14.664***
	(1.699)	(4.742)
$\tau - 4$	-7.628	-11.610
	(4.902)	(7.368)
$\tau - 5$	-7.506*	-3.930
	(3.750)	(5.243)
$\tau - 6$	-0.689	15.504***
	(4.132)	(3.858)
Issuer fixed effect	Yes	Yes
Month fixed effect	Yes	Yes
Adj. R^2	0.166	0.165
N. Obs.	11,420	11,420

Table 5: Balance sheet characteristics before full runs

This table compares balance sheet characteristics as of end of December of years $t-1$ and $t-2$ between banks that face a full run during year t and banks that do not face a run. All reported statistics are differences in means and medians for banks that face a run during year t, relative to banks that do not face a run. All coefficients are computed after differencing out a year fixed effect, to control for time trends common to both groups. The equality of means is tested based on a two-sample t-test. The equality of medians is tested using the Wilcoxon-Mann-Whitney test. Balance sheet variables are defined in Table A1. The p-values are in square brackets. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	One year before run		Two years before run		
	Diff. from mean	Diff. from median	Diff. from mean	Diff. from median	N. Obs.
		Loans and deposits			
Loans / Assets	-0.016	-0.065	0.019	0.009	1,119
	[0.744]	[0.472]	[0.686]	[0.745]	
Deposits / assets	0.021	0.022	0.052	0.129	1,105
	[0.653]	[0.618]	[0.268]	[0.259]	
		Profitability			
ROA	-1.249***	-0.577***	-0.271	-0.150**	1,120
	[0.000]	[0.000]	[0.230]	[0.018]	
ROE	-24.293***	-11.832***	0.226	0.019	1,120
	[0.000]	[0.000]	[0.971]	[0.937]	
Net income / Assets	-0.014***	-0.006***	-0.003	-0.002**	1,120
	[0.000]	[0.000]	[0.301]	[0.018]	
Net interest margin / Assets	-0.649	-0.755***	-0.421	-0.506	1,088
	[0.107]	[0.007]	[0.273]	[0.118]	
		Asset quality			
Impaired loans / Total loans	1.827	1.325	0.064	0.485	825
	[0.206]	[0.259]	[0.962]	[0.574]	
Impaired loans / Equity	55.879***	52.790***	22.362	11.234*	836
	[0.001]	[0.006]	[0.174]	[0.054]	
		Capitalization			
Equity / Assets	-0.036***	-0.033***	-0.032**	-0.024***	1,122
	[0.007]	[0.000]	[0.015]	[0.000]	
Tier 1 / RWA	6.886*	-0.664	7.350*	0.590	380
	[0.054]	[0.718]	[0.034]	[0.181]	
Regulatory cap. / RWA	8.166*	-0.453	8.354*	0.331	404
	[0.088]	[0.910]	[0.072]	[0.216]	
		Credit risk			
CDS spread	82.180	110.245**	0.041	10.584	516
	[0.249]	[0.014]	[0.999]	[0.402]	
Short-term credit rating	-0.424***	-0.474**	-0.320**	-0.118	977
	[0.005]	[0.011]	[0.036]	[0.179]	

Table 6: Runs forecast future changes in ROA

In this table, we estimate Equation (3), with changes in ROA as a dependent variable. Panel A is for both partial and full runs. Panel B is for full runs only. Changes in ROA are between the end of year $t-1$ (observable at the time of the run) and the end of year t (unobservable at the time of the run). *Run* is a dummy variable that takes value one for bank i if it faces a run during year t. Time and country fixed effects are included. In Column (3), we interact the *Run* dummy with two dummy variables that equal one if a bank's share of CD funding to total liabilities is between 4% and 9% or is above 9%, respectively. In Column (4), we interact the *Run* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Variables are defined in Table A1. Standard errors are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable: $\Delta ROA = ROA_t - ROA_{t-1}$			
	(1)	(2)	(3)	(4)
	Baseline		Share CD	Crisis
	Panel A: Partial and full runs			
Run	-0.341**	-0.508***	-0.874***	-0.610***
	(0.135)	(0.139)	(0.176)	(0.143)
Size_{t-1}		-0.018	-0.004	-0.017
		(0.025)	(0.025)	(0.025)
ROA_{t-1}		-0.713***	-0.717***	-0.717***
		(0.038)	(0.037)	(0.038)
Impaired / Loans_{t-1}		-0.025***	-0.026***	-0.026***
		(0.009)	(0.009)	(0.009)
GDP growth		38.957***	37.561***	38.732***
		(4.969)	(4.955)	(4.954)
Run $*$ Share CD $\in [4\%, 9\%]$			0.372	
			(0.407)	
Run $*$ Share CD $\geq 9\%$			0.351	
			(0.302)	
Run $*$ Crisis				0.133
				(0.192)
Adj. R^2	-0.001	0.407	0.415	0.411
N. Obs.	948	684	684	684
	Panel B: Full runs only			
Run	-0.395	-0.603**	-0.854***	-0.748**
	(0.292)	(0.281)	(0.313)	(0.338)
Size_{t-1}		-0.008	-0.003	-0.007
		(0.025)	(0.025)	(0.025)
ROA_{t-1}		-0.713***	-0.710***	-0.711***
		(0.038)	(0.038)	(0.038)
Impaired / Loans_{t-1}		-0.025***	-0.023**	-0.025***
		(0.009)	(0.009)	(0.009)
GDP growth		39.440***	38.459***	39.251***
		(4.999)	(5.028)	(5.007)
Run $*$ Share CD $\in [4\%, 9\%]$			0.904	
			(0.411)	
Run $*$ Share CD $\geq 9\%$			0.524	
			(0.501)	
Run $*$ Crisis				0.466
				(0.605)
Adj. R^2	-0.006	0.400	0.401	0.399
N. Obs.	948	684	684	684

Table 7: Runs forecast future changes in asset quality (Impaired loans / Loans)

In this table, we estimate Equation (3), with changes in the ratio of impaired loans to total loans as a dependent variable. Panel A is for both partial and full runs. Panel B is for full runs only. Changes in impaired loans are between the end of year $t-1$ (observable at the time of the run) and the end of year t (unobservable at the time of the run). *Run* is a dummy variable that takes value one for bank i if it faces a run during year t. Time and country fixed effects are included. In Column (3), we interact the *Run* dummy with two dummy variables that equal one if a bank's share of CD funding to total liabilities is between 4% and 9% or is above 9%, respectively. In Column (4), we interact the *Run* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Variables are defined in Table A1. Standard errors are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable: Δ Impaired loans / Loans			
	(1)	(2)	(3)	(4)
	Baseline		Share CD	Crisis
	Panel A: Partial and full runs			
Run	0.582***	0.507***	0.640***	0.612***
	(0.139)	(0.138)	(0.177)	(0.151)
Size_{t-1}		-0.038	-0.042*	-0.040
		(0.025)	(0.025)	(0.025)
ROA_{t-1}		-0.011	-0.010	-0.007
		(0.038)	(0.038)	(0.038)
Impaired / Loans_{t-1}		-0.017*	-0.017*	-0.017*
		(0.009)	(0.009)	(0.009)
GDP growth		-24.918***	-24.463***	-24.706***
		(5.044)	(5.068)	(5.031)
Run ∗ Share CD $\in [4\%, 9\%]$			-0.490	
			(0.385)	
Run ∗ Share CD $\geq 9\%$			-0.233	
			(0.306)	
Run ∗ Crisis				-0.052
				(0.093)
Adj. R^2	0.100	0.140	0.140	0.145
N. Obs.	676	675	675	675
	Panel B: Full runs only			
Run	1.773***	1.681***	2.104***	1.937***
	(0.274)	(0.269)	(0.298)	(0.272)
Size_{t-1}		-0.043*	-0.051**	-0.046*
		(0.024)	(0.024)	(0.024)
ROA_{t-1}		-0.003	-0.007	-0.013
		(0.037)	(0.037)	(0.037)
Impaired / Loans_{t-1}		-0.016*	-0.018*	-0.016*
		(0.009)	(0.009)	(0.009)
GDP growth		-24.717***	-23.316***	-23.638***
		(4.948)	(4.953)	(4.892)
Run ∗ Share CD $\in [4\%, 9\%]$			-0.507	
			(1.047)	
Run ∗ Share CD $\geq 9\%$			-0.499	
			(0.958)	
Run ∗ Crisis				-0.098
				(0.157)
Adj. R^2	0.131	0.172	0.182	0.193
N. Obs.	676	675	675	675

Table 8: Runs forecast future stock returns and CDS spread changes
In this table, we estimate Equation (3), with changes in market data as the dependent variable. In Panel A, the dependent variable is the excess return of each bank's stock over the return of the market index. The latter is the return of an equally-weighted portfolio of all sample stocks. In Panel B, the dependent variable is the change in CDS spread. Regressions are estimated over two time horizons, respectively 6 months and 1 year after the run occurs. All regressions include time and country fixed effects. Data are at a quarterly frequency. Variables are defined in Table A1. Standard errors, clustered at the bank level, are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)
	Panel A: Excess stock return			
	6 months		1 year	
Run	-0.054	-0.041	-0.126*	-0.071
	(0.056)	(0.077)	(0.067)	(0.062)
Size_{t-1}		0.020**		0.024*
		(0.008)		(0.012)
ROA_{t-1}		0.068**		0.046*
		(0.029)		(0.026)
Impaired / Loans_{t-1}		-0.001		0.001
		(0.008)		(0.009)
GDP growth		0.242		0.796
		(1.558)		(0.185)
Adj. R^2	0.145	0.203	0.649	0.653
N. Obs.	1,092	536	1,052	536
	Panel B: Δ CDS spread			
	6 months		1 year	
Run	36.443**	49.033***	43.824*	61.896**
	(15.748)	(17.577)	(25.510)	(28.891)
Size_{t-1}		-0.707		-1.680
		(0.901)		(1.770)
ROA_{t-1}		-2.354		3.948
		(1.552)		(2.756)
Impaired / Loans_{t-1}		-2.041**		-2.410**
		(0.787)		(1.180)
GDP growth		-1214.823*		-2187.64
		(650.329)		(1437.262)
Adj. R^2	0.570	0.585	0.563	0.573
N. Obs.	2,099	956	1,937	956

Table 9: Reallocation of funds after runs

This table provides estimates of the probit model in Equation (5). The dependent variable equals one for an issuer in a given month if its excess issuance over the market (defined in Equation (4)) is above a threshold α. Columns (1) and (2) are for $\alpha = 0.5$ (50% of institutions with the largest excess issuance) and Columns (3) and (4) are for $\alpha = 0.25$ (25% of institutions with the largest excess issuance). In Columns (2) and (4), Δ ROA is interacted with dummy variables that equal one if the *Run Index* (defined in Equation (2)) is in the second, third or fourth quartile of its distribution. Each specification includes fixed effects for eleven out of twelve months. Standard errors are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable: Prob. of CD issuance in excess of the market			
	(1)	(2)	(3)	(4)
	$\alpha = 0.5$		$\alpha = 0.25$	
Δ ROA	0.024***	0.018**	0.031**	0.016***
	(0.005)	(0.009)	(0.014)	(0.006)
Δ ROA * Run Index in Quartile 2		-0.003		0.008
		(0.016)		(0.006)
Δ ROA * Run Index in Quartile 3		0.033***		0.039
		(0.012)		(0.033)
Δ ROA * Run Index in Quartile 4		0.048**		0.030**
		(0.020)		(0.015)
N. Obs.	10,979	10,979	10,979	10,979

Figure 1: Size of the euro-denominated CD market

This figure displays the aggregate size of the euro-denominated CD market (solid line), as constructed from our CD issuance data, from January 2008 to December 2014. It also plots (dashed line) the spread on the 5-year EU Banks CDS Index. Vertical lines represent six events associated with market stress: Event 1 — Nationalization of Northern Rock (February 22, 2008); Event 2 — Failure of Lehman Brothers (September 15, 2008); Event 3 — Blue Monday crash in the U.K., with the fall of Royal Bank of Scotland (January 19, 2009); Event 4 — First bailout of Greece (April 11, 2010); Event 5 — Bailout of Ireland (November 21, 2010); Event 6 — Announcement of the Outright Monetary Transactions (OMT) by the ECB (August 2, 2012). Data are averaged at a monthly frequency.

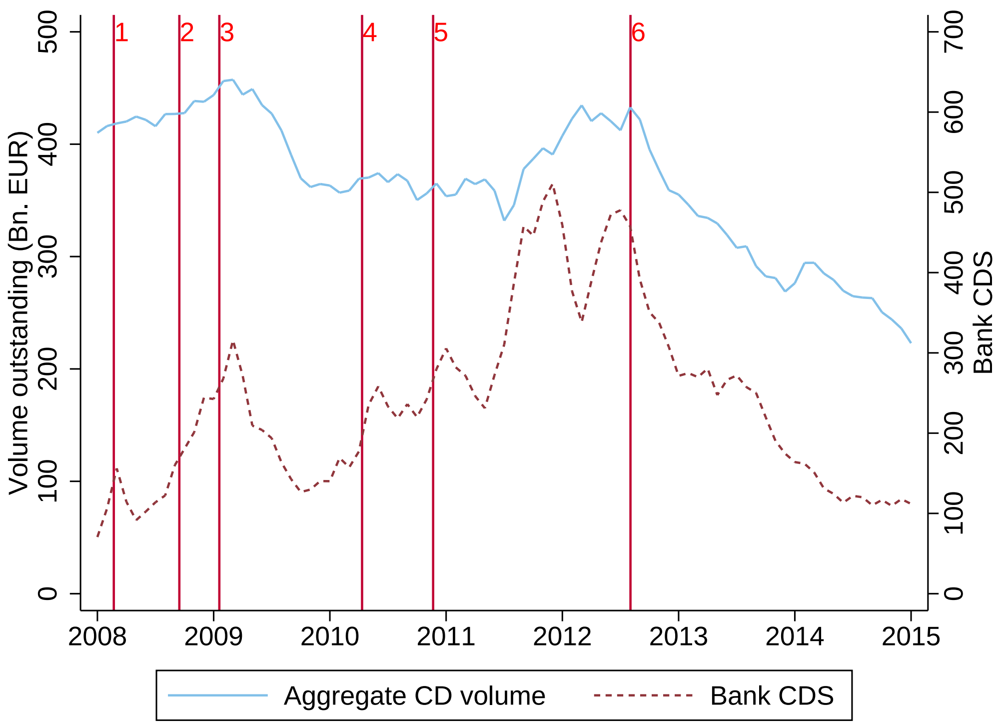


Figure 2: CD yields

This figure displays the volume-weighted average yield on CDs issued by banks in the highest short-term rating bucket, from January 2008 to December 2014. The rate is for CDs with an initial maturity up to 7 days. For reference, the three policy rates set by the ECB are also plotted. The ECB rate for its Main Refinancing Operations (MROs) is in red. The deposit facility rate and the lending facility rate are, respectively, in orange (bottom) and blue (top). Data source: European Central Bank.

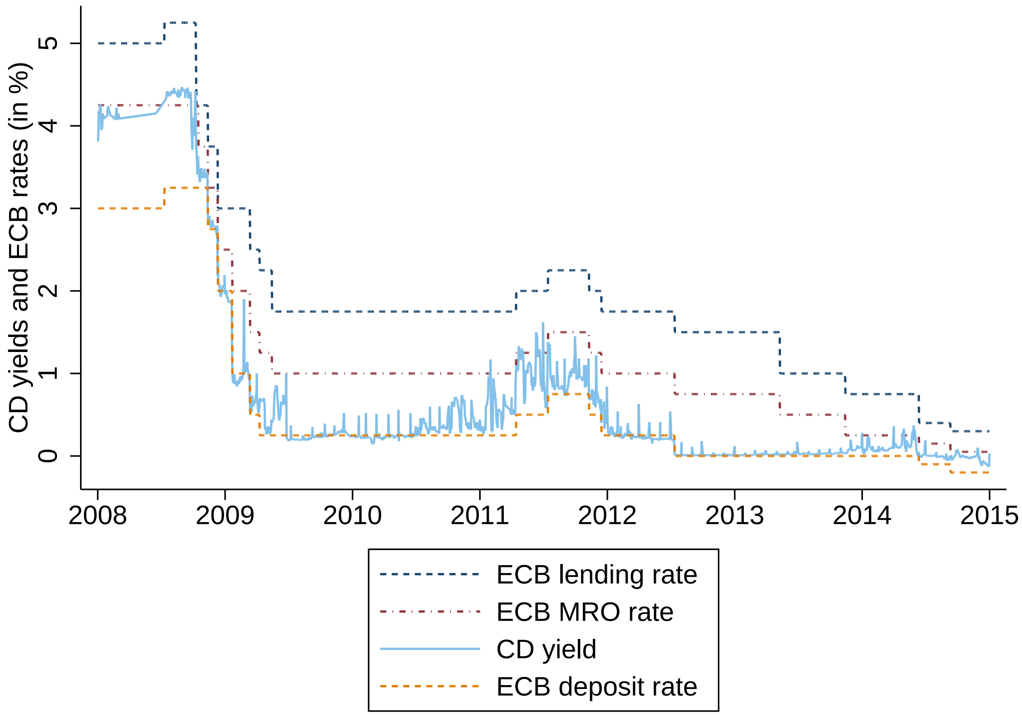


Figure 3: Decomposition of volumes in the euro-denominated CD market
This figure displays the decomposition of aggregate volumes of euro-denominated CDs by jurisdiction of issuance. These data are only for the subset of issuers that benefit from the Short-Term European Paper (STEP) label, i.e., primarily the largest issuers that raise funds on a European scale. The two main markets are the French market and the U.K. (European Commercial Paper) market. Other markets include primarily the Belgian and the Luxembourgian markets. This figure is constructed from program-level data provided to us by the European Central Bank. Volumes are averaged at a monthly frequency. ECB data for U.K. and other markets only start in 2009Q4.

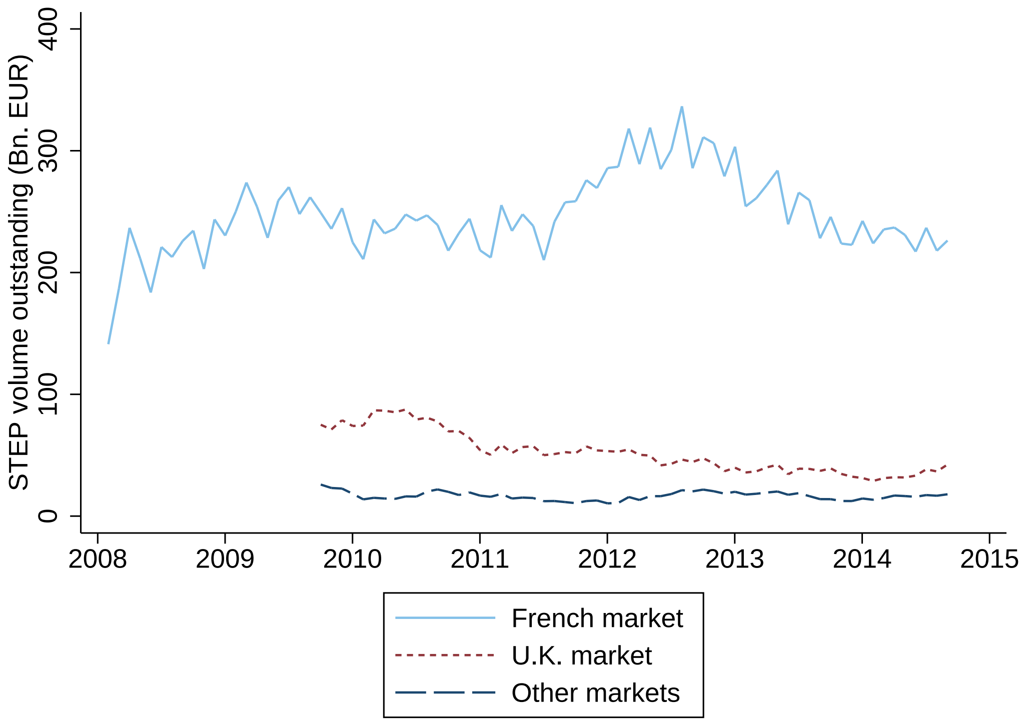
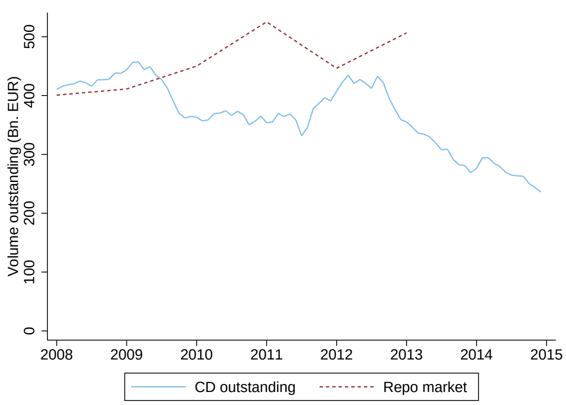
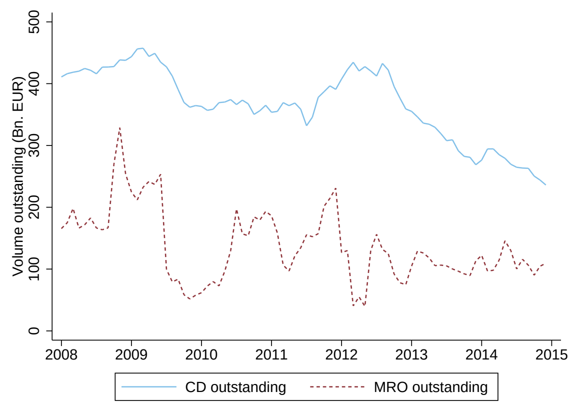


Figure 4: Size of the CD market relative to other wholesale funding markets
This figure compares the amount of euro-denominated CDs outstanding in the French market with three other segments of European wholesale funding markets. Panel A compares CDs with repurchase agreements. Data on the European repo market have been provided by Mancini et al. (2015) for the 2008-2013 period. The repo data involve partial double-counting. Panel B compares CDs with the amount of euro-denominated funding provided by the ECB to European banks through its Main Refinancing Operations (MROs). MROs have a maturity of one week and are provided in the form of repurchase agreements against eligible assets. Data on MROs are obtained from the European Central Bank. Panel C compares CDs with overnight interbank loans. Data on the European interbank market have been provided by de Andoain et al. (2015).

Panel A: CDs versus repurchase agreements



Panel B: CDs versus ECB refinancing operations



Panel C: CDs versus interbank loans

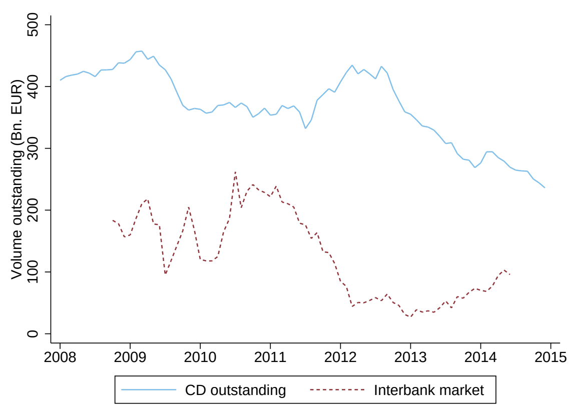


Figure 5: Average maturity of new issues in the euro-denominated CD market
This figure displays the volume-weighted maturity of new issues in the CD market (solid line), from January 2008 to December 2014. It also plots (dashed line) the spread on the 5-year EU Banks CDS Index. Data are averaged at a monthly frequency.

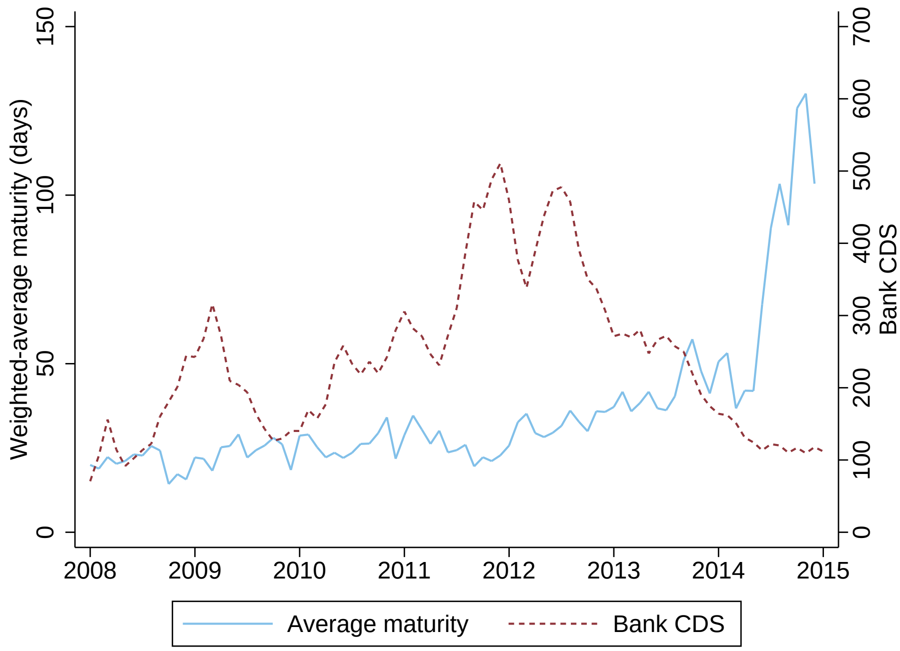


Figure 6: Timeline of full runs and Run Index

This figure displays the distribution of runs over time as well as their magnitude. Panel A provides a timeline of full runs. A full run is defined by the fact that the outstanding amount of CDs falls to zero for an issuer. The home country of each bank is reported. The y-axis plots the amount of CD outstanding 50 days before the run occurs. Panel B plots the Run Index (solid line), as defined in Section 3.2, at a monthly frequency. It also plots the spread on the 5-year EU Banks CDS Index (dashed line).

Panel A: Timeline of full runs

Panel B: Run Index

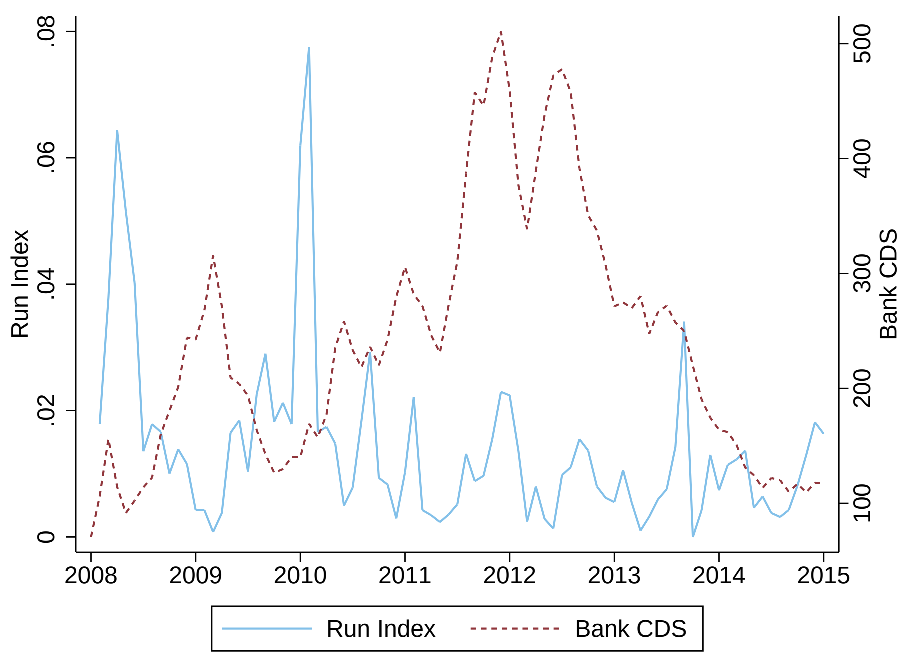
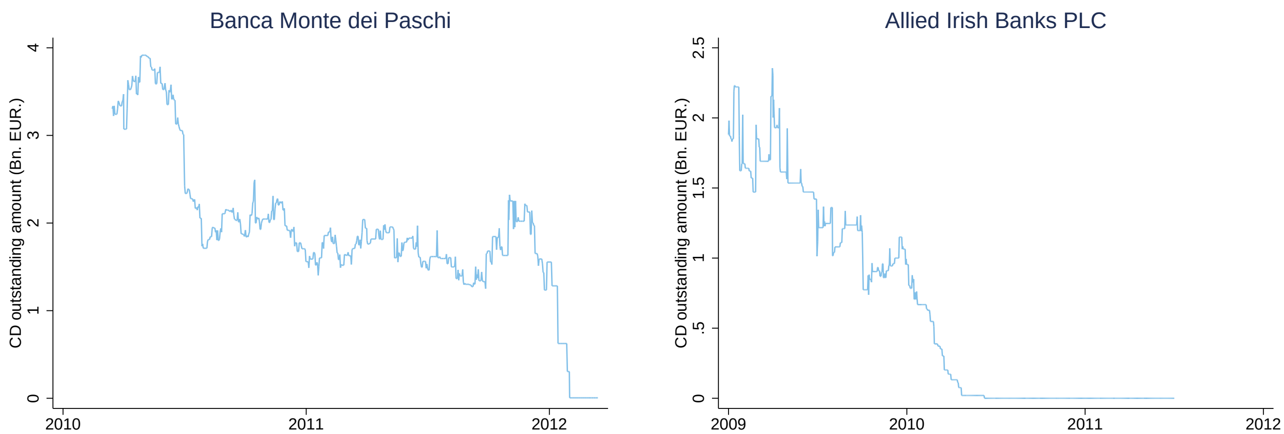


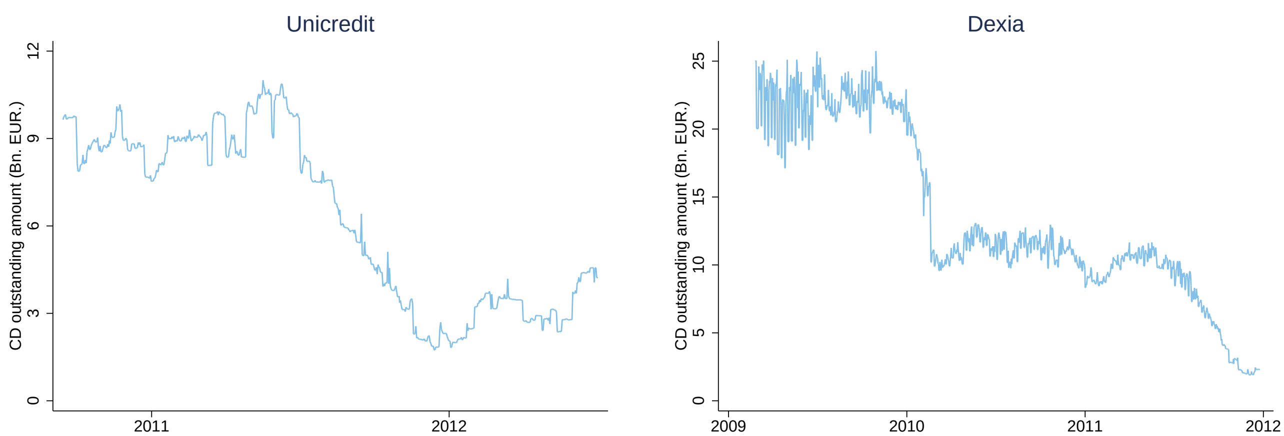
Figure 7: Complete and partial runs

This figure gives four examples of full and partial runs. It plots the amount of CDs outstanding for four selected European banks, at a daily frequency. Panel A provides two examples of full runs (Banca Monte dei Paschi and Allied Irish Banks), i.e., the amount of CDs outstanding after the run falls to zero. Panel B provides two examples of two partial runs (Unicredit and Dexia), i.e., the amount of CDs outstanding falls but does not reach zero.

Panel A: Full wholesale funding runs



Panel B: Partial wholesale funding runs



Online appendix - Not for publication

Table A1: Variable definitions

This table defines the variables used in the empirical analysis. The CD data, obtained from the Banque de France, are complemented with data from Bankscope. The definitions of the balance sheet variables are obtained from the Bankscope user guide. The "id" code is the index number in Bankscope. Variables related to issuer profitability and asset quality are winsorized at the 1st and 99th percentiles.

Variable	Definition	Data source
	Issuer balance sheet	
Assets	Total assets (id: 11350).	Bankscope
Equity	Common Equity (id: 11800).	Bankscope
Tier 1 capital	Tier 1 capital, as a percentage of risk-weighted assets (id: 18150).	Bankscope
Total regulatory capital	Tier 1 + Tier 2 capital, as a percentage of risk-weighted assets (id: 18155).	Bankscope
Loans	Gross loans (id: 11100).	Bankscope
Customer deposits	Total customer deposits: Current + Savings + Term (id: 11550).	Bankscope
Repos and cash collateral	Includes all securities designated for repurchase or cash received as collateral as part of securities lending (id: 11565).	Bankscope
	Issuer profitability and asset quality	
Net interest margin	Net interest margin, i.e., net interest income as a percentage of earning assets (id: 4018).	Bankscope
Net income	Net income (id: 10285).	Bankscope
ROA	Return on average assets (id: 4024).	Bankscope
ROE	Return on average equity (id: 4025).	Bankscope
Impaired loans / Gross loans	Impaired Loans over Gross Loans (id: 18200).	Bankscope
Impaired loans / Equity	Impaired Loans over Equity (id:4037).	Bankscope
	Market data	
Short-term credit rating	Encoded on a scale from 1 to 5 ("B"=1; "F3"=2; "F2"=3; "F1"=4; "F1+"=5)	Fitch Ratings / Moody's or S&P if Fitch unavailable
CDS spread	CDS spread (mid-quote)	Bloomberg
Stock price	End-of-day stock price	Bloomberg

Table A2: Runs do not forecast future changes in size or loans to total assets

In this table, we estimate Equation (3), with changes in bank size (Panel A) and in loans to total assets (Panel B) as a dependent variable. Bank size is defined as the logarithm of total assets. Changes in both size and loans are between the end of year $t-1$ (observable at the time of the run) and the end of year t (unobservable at the time of the run). *Run* is a dummy variable that takes value one for bank i if it faces a partial or a full run during year t. Time and country fixed effects are included. In Column (3), we interact the *Run* dummy with two dummy variables that equal one if a bank's share of CD funding to total liabilities is between 4% and 9% or is above 9%, respectively. In Column (4), we interact the *Run* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Variables are defined in Table A1. Standard errors are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)
	Baseline		Share CD	Crisis
		Panel A: Δ Size		
Run	-0.039	-0.014	-0.008	-0.019
	(0.035)	(0.013)	(0.017)	(0.018)
Size_{t-1}		-0.005**	-0.005**	-0.005**
		(0.003)	(0.002)	(0.002)
ROA_{t-1}		0.008**	0.008**	0.008**
		(0.003)	(0.003)	(0.003)
Impaired / Loans_{t-1}		-0.000	-0.000	-0.000
		(0.001)	(0.001)	(0.001)
GDP growth		0.028	0.054	0.014
		(0.497)	(0.500)	(0.497)
Run $*$ Share CD $\in [4\%, 9\%]$			-0.009	
			(0.041)	
Run $*$ Share CD $\geq 9\%$			-0.017	
			(0.030)	
Run $*$ Crisis				0.008
				(0.007)
Adj. R^2	0.031	0.197	0.195	0.198
N. Obs.	950	685	685	685
		Panel B: Δ Loans / Assets		
Run	0.004	0.008	0.000	0.012
	(0.007)	(0.008)	(0.010)	(0.009)
Size_{t-1}		-0.004**	-0.003**	-0.004**
		(0.002)	(0.002)	(0.001)
ROA_{t-1}		-0.002	-0.002	-0.002
		(0.002)	(0.002)	(0.002)
Impaired / Loans_{t-1}		-0.001***	-0.001***	-0.001***
		(0.000)	(0.000)	(0.001)
GDP growth		0.584**	0.560**	0.589**
		(0.282)	(0.283)	(0.282)
Run $*$ Share CD $\in [4\%, 9\%]$			0.026	
			(0.023)	
Run $*$ Share CD $\geq 9\%$			0.014	
			(0.017)	
Run $*$ Crisis				-0.015
				(0.017)
Adj. R^2	0.015	0.073	0.072	0.073
N. Obs.	947	685	685	685

Table A3: Runs forecast future changes in longer-term profitability and asset quality
In this table, we estimate Equation (3), with changes in ROA (Panel A) and in impaired loans to total loans (Panel B) as a dependent variable. Changes in ROA are between the end of year $t-1$ (observable at the time of the run) and the end of year $t+1$ (unobservable at the time of the run). *Run* is a dummy variable that takes value one for bank i if it faces a partial of a full run during year t. Time and country fixed effects are included. In Column (3), we interact the *Run* dummy with two dummy variables that equal one if a bank's share of CD funding to total liabilities is between 4% and 9% or is above 9%, respectively. In Column (4), we interact the *Run* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Variables are defined in Table A1. Standard errors are in parentheses. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)
	Baseline		Share CD	Crisis
		Panel A: $ROA_{t+1} - ROA_{t-1}$		
Run	-0.105	-0.228	-0.464**	-0.407*
	(0.150)	(0.174)	(0.221)	(0.209)
Size_{t-1}		0.007	0.016	0.007
		(0.032)	(0.032)	(0.032)
ROA_{t-1}		-0.829***	-0.839***	-0.835***
		(0.064)	(0.065)	(0.064)
Impaired / Loans_{t-1}		0.000	-0.001	-0.000
		(0.012)	(0.012)	(0.012)
GDP growth		28.729***	26.968***	28.355***
		(7.479)	(7.546)	(7.473)
Run $*$ Share CD $\in [4\%, 9\%]$			0.657	
			(0.528)	
Run $*$ Share CD $\geq 9\%$			0.559	
			(0.377)	
Run $*$ Crisis				0.123
				(0.370)
Adj. R^2	0.004	0.278	0.279	0.280
N. Obs.	772	538	538	538
		Panel B: Δ *Impaired* $loans_{t+1}$		
Run	1.419***	1.152***	1.554***	1.562***
	(0.363)	(0.360)	(0.459)	(0.443)
Size_{t-1}		-0.104	-0.118*	-0.104
		(0.066)	(0.067)	(0.066)
ROA_{t-1}		0.105	0.120	0.132
		(0.141)	(0.141)	(0.141)
Impaired / Loans_{t-1}		-0.089***	-0.088***	-0.087***
		(0.026)	(0.027)	(0.026)
GDP growth		-67.570***	-64.602***	-66.471***
		(15.399)	(15.569)	(15.338)
Run $*$ Share CD $\in [4\%, 9\%]$			-1.236	
			(1.016)	
Run $*$ Share CD $\geq 9\%$			-0.858	
			(0.791)	
Run $*$ Crisis				-0.201
				(0.351)
Adj. R^2	0.110	0.166	0.167	0.174
N. Obs.	527	527	527	527