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Wholesale funding dry-ups

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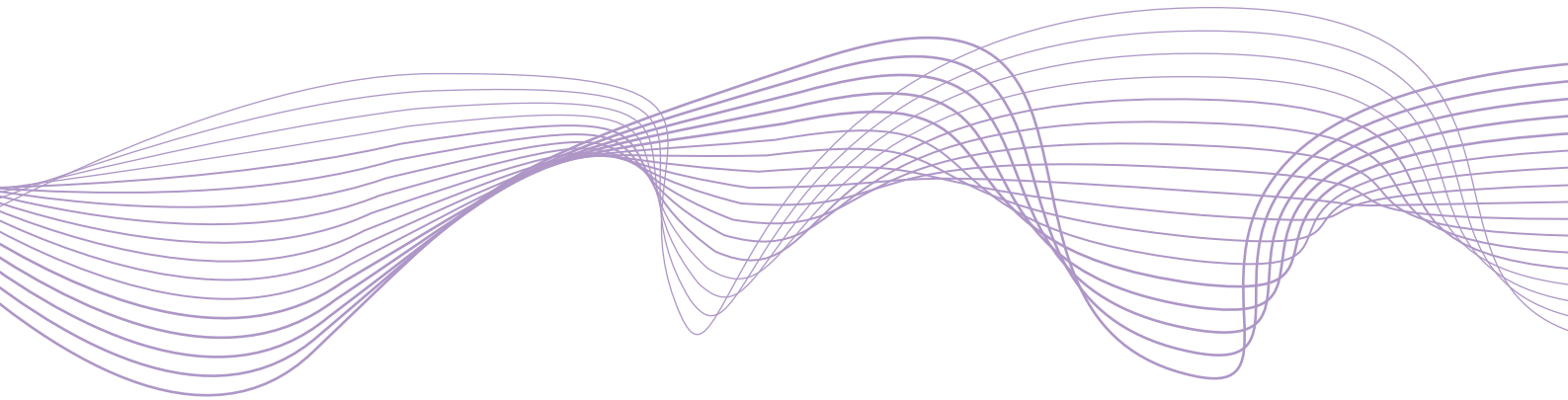

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the dry-up is larger than their equity. Thus, these are large funding shocks.

To get an aggregate view on dry-ups, we compute a *Stress Index* at a monthly frequency as

$$Stress\ Index_t = \frac{\sum_i D_{i,t}}{CD_{m,t}}, \tag{1}$$

where $D_{i,t}$ is the euro amount of the dry-up faced by any issuer i in month t (conditional on i facing a dry-up; $D_{i,t} = 0$ otherwise) and $CD_{m,t}$ the aggregate size of the CD market at the beginning of that month. Both partial and full dry-ups 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. The Appendix Figure A3 plots the *Stress Index* over the sample period. It was high in 2008 and also spiked a number of times during the European sovereign debt crisis of 2011-2012. In our regressions, we use this index as a measure of stress in the CD market.

In the sample, banks facing dry-ups do not subsequently fail, and substitute CD funding with funding from the ECB and from the repo market. Following a dry-up, we find that total borrowing from the central bank and other commercial banks, normalized by total assets, is on average 8% higher for banks facing a dry-up, relative to banks not facing a dry-up (see Panel C or Table 3). Since unsecured interbank funding is small relative to ECB funding (see Figure 3), this substitution is mainly driven by the central bank. Similarly, reliance on repo funding is larger for banks facing a dry-up after this event occurs, but the increase is not statistically significant for the median. The fact that banks losing access to unsecured markets turn primarily to the central bank is consistent with more detailed evidence by Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016).

4.3 Observable bank characteristics before dry-ups

To describe dry-ups, we document the ex ante observable characteristics associated with them. We compare the mean and median values of balance sheet and market characteristics for banks that face a full dry-up and for banks that do not, and we do so one year and two years before each dry-up. Specifically, we compute statistics in the pooled sample,

after differencing out a year fixed effect for each bank characteristic, 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 4.

Banks facing dry-ups tend to be weaker on average. Major differences exist in terms of profitability, asset quality, capitalization, and credit risk. Banks close to a dry-up have a lower ROA at the end of the previous year, indicating that they use their funds less efficiently. The same lower profitability is reflected in a lower net income before the drop in CD funding. One year before the dry-up, 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 dry-up is lower arises in part from their asset quality being lower, as measured by their ratio of impaired loans to equity. These institutions have higher credit risk, as evidenced by a higher credit default swap spread the year before the drop in CD funding, and by a significantly lower credit rating up to two years before the drop. Finally, banks that are about to experience a dry-up have a lower reliance on CD funding, measured as a share of total debt.

Finally, institutions that will experience a drop in CD funding also have a significantly lower ratio of book equity to total assets, up to two years before the drop. The fact that they are significantly less capitalized, with an average book equity ratio lower by 3.6 percentage points, is not reflected, however, by differences in regulatory capital. Measures of regulatory capital poorly predict the occurrence of dry-ups. This is consistent with Acharya, Engle, and Pierret (2014), who find no correlation between regulatory capital and market perception of bank risk. Furthermore, banks close to a dry-up have a more negative stock return over the past year.

Overall, these results suggest that dry-ups do not occur as sunspots, as would be the case if they were pure coordination failures among lenders (Diamond and Dybvig, 1983). Instead, the fact that dry-ups correlate with worse publicly observable fundamentals is consistent with the idea that CDs have to become information-sensitive before dry-ups occur.

5 Informational content of funding dry-ups

We test whether funding dry-ups affect high- and low-quality banks equally. We measure quality that is not observable by the market at the time of dry-ups using future performance conditional on public information. Theories based on adverse selection predict a positive relation between funding dry-ups and bank quality. In contrast, we find a negative relation, which points towards the existence of informed lenders.

5.1 Funding dry-ups predict lower future bank quality

In this section, we show that funding dry-ups predict lower future bank quality. We start by using balance sheet data only, and then extend the analysis to market data. For each drop in CD funding occurring during year t, only the balance sheet characteristics at the end of year $t-1$ are observable. We test whether the occurrence of dry-ups 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.[10] We estimate

$$\begin{aligned} \Delta Y_{i,t} \quad = \quad & {}_0 DryUp_{i,t} + \ {}_1 Size_{i,t-1} + \ {}_2 Controls_{i,t-1} \\ & + \beta_3 Controls_{c,t-1} + FE_c + FE_t + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where $DryUp_{i,t} = \mathbb{1}\{t-1 \leq \tau_{DryUp_i} < t\}$ and τ_{DryUp_i} is the time of the dry-up. $\mathbb{1}$ denotes the indicator function and takes a value of one when a dry-up affects issuer i between the end of year $t-1$ and the end of year t. $\Delta Y_{i,t} = Y_{i,t} - Y_{i,t-1}$ is the change in 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 dry-up). FE_c and FE_t are country and year fixed effects. We estimate regression coefficients separately for full and partial dry-ups. We use the change in ROA as our main dependent variable. Our coefficient of interest, ${}_0$, is

[10] This regression specification is in the spirit of Bertrand, Schoar, and Thesmar (2007). In their paper, future changes in ROA of bank-dependent firms are regressed on the lending policy of banks.

positive and significant if adverse selection is driving our results (i.e., better-performing banks withdraw from the market).

Regression coefficients are in Table 5. Panel A is for all dry-ups and Panel B for full dry-ups only. As seen in our main specifications (Columns 1 and 2), the occurrence of a drop in CD funding 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 of dry-ups, at statistically significant levels. It is also robust to the inclusion of several bank-level controls (size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, and short-term credit rating) and country-level controls (sovereign CDS spread).[11] Our empirical evidence suggests that dry-ups contain information about future bank quality. These estimates have a cross-section interpretation: in the cross-section, banks facing a dry-up are more likely to have lower future performance.

This baseline result can be extended along three dimensions. First, it is robust to the inclusion of bank fixed effects, as seen in Column (3). Therefore, over time, a given bank faces a dry-up before large decreases in ROA. Second, we provide evidence of the informational content of dry-ups at longer-term horizons. We re-estimate Equation (2) with $Y_{i,t+1} - Y_{i,t-1}$ as the dependent variable, i.e., we consider whether dry-ups predict future changes in ROA over a two-year period starting at the end of December of the year preceding a dry-up. Estimates, in Appendix Table A3, show that dry-ups predict a longer-term decrease in ROA.

Third, we show that the informational content of dry-ups does not disappear in times of high market stress. Indeed, if market stress corresponds to more acute information asymmetries between lenders and borrowers, lenders are expected to find it more difficult to distinguish between high- and low-quality borrowers (Heider, Hoerova, and Holthausen, 2015). If this is the case, dry-ups may not be informative any longer during crises. In Tables 5 and 6, we re-estimate Equation (2) after including an interaction term between the *DryUp* dummy and a *Crisis* dummy that equals one in 2011 and 2012. These years correspond to the height of the European sovereign debt crisis. As seen in Figure 1, they

[11] In unreported regressions, we check that our estimates are robust to dropping the impaired loans variable, which shrinks the sample size. The results are also robust to using a constant sample size.

are also the years in which the credit default swap spread of European banks reached its highest level. If the predictive power of dry-ups diminishes or disappears in times of crisis, the estimated coefficient on this interaction term should have opposite sign as that on the *DryUp* dummy and be significant. We do not find this in any of the specifications, highlighting the fact that dry-ups contain information even when market stress is high.

5.2 Addressing reverse causality concerns

While previous results cast doubt on the idea that adverse selection is driving funding dry-ups, they do not allow us yet to conclude that dry-ups are due to informed lenders. Indeed, a potential endogeneity concern when estimating Equation (2) is reverse causality: drops in bank performance could be *caused* by a reduction in funding. This can occur if dry-ups are due to coordination failures among lenders, as in Diamond and Dybvig (1983) and Goldstein and Pauzner (2005), which may force asset fire sales or prevent banks from investing in valuable projects. If this is the case, a negative relation between dry-ups and future performance could arise even if dry-ups are ex ante random. We address this reverse causality concern in three ways. Then, we discuss why coordination failures are unlikely in our context.

First, we replace changes in ROA by changes in the ratio of impaired loans over total loans as the dependent variable when estimating Equation (2). Changes in impaired loans arguably cannot be caused by funding shocks because they relate to a stock of pre-existing loans, which have been extended before the dry-up. They are thus exogenous with respect to the occurrence of the drop in CD funding. Estimation results in Table 6 are consistent with those obtained for changes in ROA. The occurrence of dry-ups 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. This result also extends at a two-year horizon, as seen in Appendix Table A3. Dry-ups predict a longer-term increase in the ratio of impaired loans, which is significant at the 1% level.

Second, if funding shocks were actually causing performance drops, this effect should be particularly severe for banks that depend a lot on CDs. Thus, we interact the *DryUp*

dummy variable with another dummy variable equal to one if the share of a bank's CD financing over total liabilities is in the third or fourth quartiles of the distribution. If endogeneity concerns are important, these interaction terms are expected to be statistically significant, with the same sign as β_0, and increasing in magnitude. Estimation results are in Column 5 of Tables 5 (for ROA) and 6 (for impaired loans). In all cases, the estimated interaction terms are not statistically significant, indicating that the estimate for our coefficient of interest is not driven by a subset of banks with a large exposure to the CD market. Dry-ups are also predictive of future profitability and asset quality even for banks with little CD funding. This result extends to a two-year horizon, as seen in Appendix Table A3. It casts serious doubt on the idea that endogeneity concerns are severe in our context. In contrast, it is consistent with lenders cutting funding based on information about future fundamentals, as the share of CD funding over total liabilities should not matter in this case.

Third, we show that dry-ups do not force banks to downsize significantly. In Table 7, we re-estimate Equation (2) 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 dry-ups are never statistically significant. They are also not significant even for banks that rely heavily on CD funding. The fact that banks facing dry-ups do not engage in costly fire sales is likely due to the substitution of CD funding by central bank funding (see Section 4.2). This result suggests that the reduction in ROA is not due to fire sales, which mitigates reverse causality concerns.

Finally, we stress that dry-ups arising from coordination failures are unlikely in our context. A necessary condition for coordination failures to arise is that strategic complementarities among lenders are present: the decision of a given lender to withdraw funding should depend on other lenders' decisions to maintain or withdraw funding. Such strategic complementarities can exist only if cutting funding can induce the borrowing bank to default. Instead, we do not find that dry-ups induce banks to default (since we observe their balance sheet after dry-ups), or even to downsize significantly. Moreover, if strategic complementarities were present, they should be stronger for banks which rely more on

CD funding. Indeed, a funding shock is more likely to induce such banks to default or liquidate assets. Our finding that the predictive power of dry-ups on future performance is equally strong even for banks relying on CDs to a small extent (Column 3 of Tables 5 and 6) further suggests that coordination failures are unlikely to explain dry-ups.

Taken together, all results in this section suggest that the observed funding dry-ups are driven by at least some informed lenders monitoring and cutting funding to low-quality banks. Below, we show that results point to the coexistence of such informed lenders with uninformed lenders.

5.3 Market returns around dry-ups

We provide evidence that dry-ups are triggered by the disclosure of new information by analyzing stock returns around dry-ups. First, if dry-ups are caused by the release of negative news, we expect this information to also be reflected in the stock market. Second, if dry-ups correspond to high-quality banks self-selecting out of the market, we expect positive abnormal returns to be realized when dry-ups occur. Instead, if dry-ups are caused by funding cuts from both informed and uninformed investors, no abnormal returns could be observed. This is the case if the negative news has already been priced because informed lenders also participate in the stock market. Third, unless there is massive segmentation between the CD and equity markets, we do not expect dry-ups to forecast long-term stock returns.

We perform an event study over the period of eight weeks preceding dry-ups. We define the beginning of the dry-up as the first day following the last CD issuance. In Panel A of Table 8, we report weekly cumulative abnormal returns over the event window, and compute standard errors using the formulas in MacKinlay (1997). There is a negative cumulative abnormal return of 8% over the 5 weeks preceding dry-ups, which is statistically significant at the 1% level. This result gives further reassurance that dry-ups are initially driven by adverse fundamental information.

Next, we study excess stock returns during dry-ups. Since data on CD issues by banks are published by the Banque de France at a weekly frequency, the information that a dry-

up occurred should quickly become public. Therefore, if dry-ups correspond to funding cuts by lenders to borrowers, information related to their occurrence should be priced. In Panel B, we compute the average cumulative abnormal return on the week of occurrence of dry-ups, which equals 0.006 and is statistically insignificant. When extending the window to a period covering one week before and one week after dry-ups, the cumulative abnormal return remains insignificant. These estimates are consistent with information about dry-ups being incorporated into prices, and inconsistent with adverse selection.

Finally, if investors do not understand that dry-ups correspond to adverse selection by high-quality banks, we expect dry-ups to be followed by positive excess returns. We re-estimate Equation (2), using future realized abnormal stock returns as dependent variables. In Panel C of Table 8, we provide results for the 6-month and one-year periods that follow the occurrence of a dry-up. We do not find any statistically significant relation between dry-ups and future abnormal stock returns, at either horizon. Therefore, dry-ups are unlikely to be driven by adverse selection.

6 Heterogeneity between informed and uninformed lenders

A potential interpretation of the results in the previous section is that all lenders are perfectly informed about the quality of borrowers, i.e., there are no uninformed lenders. If so, lenders should price counterparty risk for each bank individually. If the requested interest rate is above the rate at which the ECB is lending, then borrowers turn to the central bank. In this case, dry-ups would be demand-driven and correspond to banks switching funding sources. In this section, we provide multiple pieces of evidence suggesting that such mechanism is unlikely to explain the main patterns in the data. In contrast, our findings are more consistent with models in which uninformed lenders coexist with informed lenders and purchase CDs as long as they remain information-insensitive.

6.1 Interest rate dispersion

We start by studying the dispersion of interest rates in the CD market. If all lenders are informed, then CD rates should change with bank quality. Given that there is significant dispersion in measures of bank quality among our sample banks (see Table 2), we should expect significant dispersion of interest rates. Though we do not directly observe individual CD rates, we can compute the spread between the average rate paid by banks with the highest rating and the rate paid by lower rated banks. We do so for CDs with initial maturities between 0 and 7 days, and between 8 and 31 days. We show in Figure 5 that spreads remain remarkably low over our sample period. For CDs with maturities between 0 and 7 days (respectively 8 and 31 days), the spread is on average 1.3 basis points (8.7 basis points) over the entire sample period, and only rarely exceeds 10 basis points (20 basis points). In contrast, the difference between CD yields and the main ECB rate is 51 basis points on average over the sample period (see Figure 2). Therefore, we conclude that price dispersion is extremely limited, even below the ECB rate. This feature of the data is most consistent with models in which some lenders are uninformed, and in which borrowers of different quality can access funding at similar rates as long as they are perceived as safe.

Next, we ask whether borrowing rates increase significantly in the months preceding dry-ups. If all lenders were informed, one would observe an increase in rates as borrowers are perceived as riskier – the CD market would continue to clear as long as the CD rate is below the cost of ECB borrowing. Our lack of bank-level data forces us to rely on aggregate time series. Specifically, we check whether spikes in the number and magnitude of dry-ups, as measured by the *Stress Index* (see Section 4.2), are preceded by increases in spreads between highly-rated and low-rated banks. We regress the *Stress Index* on contemporaneous and lagged values of this spread, at a weekly frequency. We run this regression both in levels and in first differences, and collect estimates in Appendix Table A4. We are unable to find evidence that interest rates for low-rated issuers increase prior to dry-ups. For CDs with an initial maturity between 8 and 31 days, the relation in levels is even negative, but disappears when the model is estimated in first differences. We

further confirm graphically, in Appendix Figure A4, that there is no positive relationship between the spread paid by low-rated issuers and stress in the CD market. Overall, these results further suggest that adjustments in the CD market occur primarily through quantities rather than through prices, a feature which is most consistent with theories by Gorton and Pennacchi (1990) and Dang, Gorton, and Holmström (2012). Below, we provide further evidence consistent with these theories, and hard to reconcile with either adverse selection or with a model in which all lenders are fully informed.

6.2 Heterogeneity across lenders and maturity shortening

In the presence of informed lenders, debt securities are valuable for uninformed lenders as long as they remain information-insensitive. However, for a given issuer, not all CDs become information-sensitive simultaneously. When fundamentals deteriorate, theory predicts that longer-term CDs become information-sensitive before shorter-term CDs, since they get repaid later (Holmström, 2015). Therefore, we should observe a shortening of the maturity of new issues prior to dry-ups. On the contrary, the view that all investors are perfectly informed does not yield any specific prediction about maturity.

We provide evidence for this mechanism by investigating the dynamics of the maturity of new issues in the six months leading to dry-ups. We estimate

$$Maturity_{i,t} = \sum_{j=1}^{6} \beta_j DryUp_{i,\tau-j} + FE_i + FE_t + \varepsilon_{i,t}, \tag{3}$$

where $Maturity_{i,t}$ 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 dry-up and $DryUp_{i,\tau-j}$ a dummy variable that equals 1 for i if it faces a dry-up 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 9, for all types of dry-ups and for full dry-ups only.

The average maturity of new issues starts to shorten about five months before the

dry-up takes place, and the shortening becomes statistically significant at the 1% level three months before the dry-up. This is true for both full and partial dry-ups. 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 dry-ups and by 25 days before partial dry-ups. The monotonic drop in average maturity suggests that creditors become increasingly reluctant to buy CDs at longer maturities. Such maturity shortening is consistent with longer-term CDs turning information-sensitive before shorter-term CDs, therefore giving rise to dry-ups.[12] This result is in line with Gorton, Metrick, and Xie (2015), who document maturity shortening for US money market instruments before the failure of Lehman Brothers. As a general feature of events which we treat as dry-ups, maturity shortening is hard to reconcile with a demand-driven explanation, including explanations based on adverse selection.

6.3 Events triggering dry-ups

If dry-ups occur when information-insensitive securities turn information-sensitive, a public news is needed to trigger a change in beliefs by uninformed lenders (Dang, Gorton, and Holmström, 2012). Appendix Table A2, already discussed, provides evidence of bad public news in the weeks surrounding dry-ups. Furthermore, we documented that stock prices tend to fall prior to dry-ups. In this subsection, we show that rating downgrades play a significant role in triggering large changes in CD funding. We focus on downgrades because they are public and easily interpretable. Moreover, ratings are a key determinant of access to the money market for borrowers (see Crabbe and Post, 1994).

We estimate

$$\log(CD_{i,t}) = \sum_{j=-5}^{5} \beta_j Downgrade_{i,\tau+j} + FE_i + FE_t + \varepsilon_{i,t}, \tag{4}$$

where $CD_{i,t}$ is the amount of CDs outstanding for bank i in month t. τ is the month when institution i faces a downgrade of its short-term credit rating and $Downgrade_{i,\tau+j}$ a

[12] A related interpretation is that some creditors engage in costly monitoring and use maturity shortening to strengthen their discipline over the bank prior to the dry-up (Calomiris and Kahn, 1991).

dummy variable that equals 1 for bank i at date $t = \tau + j$. We estimate eleven coefficients on such dummy variables, for $j \in \{-5, ..., 5\}$.

We display estimated coefficients in Table 10. As seen in Column (1), the occurrence of a downgrade is associated with a significant drop in CD funding outstanding, starting in the month of the downgrade. Restricting attention to downgrades at the bottom of the rating scale (F2 to F3, or lower), in Column (2), the drop in CD funding is larger in magnitude and more persistent. The economic magnitude of the drop is large, since CD funding gets cut by about 63%, which falls within our definition of dry-ups. We complete our analysis in Column (3), by comparing the timing of rating downgrades with the timing of dry-ups. We find that credit ratings drop significantly one month before dry-ups occur. However, ratings are not the only public news that can trigger dry-ups. Indeed, the drop in rating becomes economically and statistically more significant after dry-ups occur.

6.4 CD market re-entry after dry-ups

Finally, as a last piece of evidence in favor of theories based on heterogeneity across lenders, we highlight that issuers facing a full dry-up never re-enter the market, except in one case, and even though the banks still operate. This is consistent with CD investors seeking information-insensitive securities, and not considering as safe any more CDs issued by institutions that faced a dry-up. Instead, if dry-ups were associated with high-quality banks self-selecting out of the market, these banks would be expected to re-enter the market after market conditions have normalized.

7 Reallocation of funds during stress episodes

The absence of market freeze (total market volume remains stable) and the occurrence of bank-specific dry-ups suggest that funds are reallocated in the cross-section during stress episodes. We study reallocation to provide additional evidence on the informational content of funding patterns.

7.1 Bank borrowing as a function of quality

We shift our attention from banks that face dry-ups to banks that increase their CD funding. If CD lenders value information-insensitive debt securities, they should reallocate their funds to such CDs when dry-ups occur. Therefore, high-quality banks should increase reliance on CD funding in times of stress. Instead, if adverse selection is driving the allocation of funds, high-quality banks should reduce reliance on wholesale funding during such episodes. We study whether banks whose CD funding grows faster than the aggregate market are high-quality banks, i.e., banks that will make a more profitable use of these funds, as measured by an increase in ROA in the future. We find strong evidence that this is indeed the case. This further suggests that monitoring by informed lenders, not adverse selection, explains the allocation of funds in the market.

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,

$$E_{i,t} = \Big[\log\left(CD_{i,t}\right) - \log\left(CD_{i,t-1}\right)\Big] - \Big[\log\left(CD_{m,t}\right) - \log\left(CD_{m,t-1}\right)\Big], \tag{5}$$

where $CD_{i,t}$ is the amount of CD outstanding by issuer i at the end of month t and $CD_{m,t}$ 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, and for issuers that enter the CD market for the first time.

We proceed in two steps. First, we check whether high and positive values of $E_{i,t}$ forecast future increases in ROA. 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 dry-ups or not in the market. Second, we test whether the reallocation of funds towards better-performing banks is stronger at times dry-ups occur in the market.

We construct a dummy variable $I_{i,t}$ that equals one for any issuer i in month t if $E_{i,t}$ is above some percentile α of the distribution of $E_{i,t}$ in the same month, 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

$$\Pr\left(I_{i,t} = 1 | X_t\right) = \Phi\Big(\beta_0 \Delta ROA_{i,t} + \beta_1 Controls_{i,t-1} + \beta_2 Controls_{c,t-1} + FE_c + FE_m\Big), \tag{6}$$

where $\Delta ROA_{i,t} = ROA_{i,t} - ROA_{i,t-1}$ is the change in ROA between the end of the previous year (observable at the time of the dry-up) and the ROA at the end of the current year (unobservable at the time of the dry-up). 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 dry-ups. To account for the fact that past balance sheet characteristics may be more informative about the 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 $\Delta ROA_{i,t}$ as an independent variable, and not as a dependent variable as in the previous section. Finally, Φ denotes the c.d.f. of the standard normal distribution.

Estimates are provided in Table 11 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 dry-ups 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.

7.2 Focusing on times of high market stress

We test whether the reallocation effect is stronger during periods in which bank-specific dry-ups occur in the market. Theory suggests that information asymmetries are larger in

times of stress, possibly increasing adverse selection and reducing the informational content of dry-ups. If this is the case, high-quality banks should reduce borrowing in times of stress, thus lowering the baseline coefficient on Table 11. In contrast, high-quality banks should increase borrowing if lenders reallocate funds to other information-insensitive securities. We re-estimate Equation (6) after including interaction terms between $\Delta ROA_{i,t}$ and dummy variables taking a value of one if the *Stress Index*, defined in Equation (1), is in the second, third or fourth quartile of its distribution (i.e., highest values of the *Stress Index*).

Estimates are in Columns 2 and 4 of Table 11. The base coefficient on ΔROA, corresponding to periods in which the *Stress 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 *Stress 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 increase performance in the future is amplified 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 as large as that on the unconditional coefficient β_0.[13]

This result is of particular interest for two reasons. First, it provides additional and strong evidence against adverse selection. Indeed, it goes against the main prediction of adverse selection models, that higher-quality banks self-select out of the market. In addition to finding that they do not exit the market, we also show that they instead increase funding. They do so particularly in times of high market stress, at times information asymmetries are arguably more severe.

Second, these results are compatible with a model in which lenders value debt securities as long as they remain information-insensitive, and reallocate funds accordingly. This is consistent with the fact that reallocation towards high-quality banks is stronger in times of

[13]Results in Table 11 are robust to endogeneity tests. As in Section 5.2, we find that the effect is similar in magnitude for banks that rely heavily on CD funding or not. It is also robust to replacing the dependent variable by changes in non-performing loans. Since the endogeneity concern (i.e., that improvements in bank performance would be due to the inflow of CD funding) is less severe than in Section 5, we do not report these regression coefficients.

high market stress. However, the fact that increases in CD funding predict better future performance shows that reallocation is, at least partially, informed. It suggests that informed lenders do not only monitor low-quality issuers, but are also able to identify well-performing institutions, based on unobserved characteristics.

Finally, we are unable to find any significant relation between the reallocation of funds towards high-quality banks and the spread between the rate paid by low-rated issuers relative to high-rated issuers. In columns (3) and (6) of Appendix Table A4, we regress the *Stress Index*, which captures the magnitude of funds reallocated due to dry-ups, on contemporaneous and future spreads. If reallocation drives interest rate down for high-rated banks, we should expect the spread to widen when dry-ups occur or right after. Estimating this regression at a weekly frequency, both in levels and in first-differences, we are unable to find any such statistically significant relation. A possible interpretation is that the magnitude of funds reallocated is relatively small relative to the market size, and therefore does not affect prices. The absence of significant relationship may also partly be due to the low level of granularity of our interest rate data. Further research of reallocation is therefore needed.

8 Conclusion

We draw three main conclusions from our study on CD funding. First, wholesale funding dry-ups are mostly bank-specific and driven by information about future bank quality. This is in contrast with the view that wholesale funding markets are inherently subject to market-wide disruptions. Second, the cross-sectional allocation of funds in wholesale funding markets is not primarily driven by adverse selection between lenders and borrowers in times of stress. Third, this fund allocation is consistent with models based on heterogeneity between informed and uninformed investors. In such models, bank debt derives value from being information-insensitive, and dry-ups occur when debt turns information-sensitive. Such theories allow us to explain actual patterns in the data: funding adjustments occur primarily through quantities, not through prices; banks that face

dry-ups are those whose performance will deteriorate in the future; and banks receiving more funds during stress episodes are those whose profitability will improve.

The bank-specific nature of dry-ups helps to understand the resilience of wholesale funding markets. As such, our results do not support one of the main premises on which new regulation on liquidity coverage ratios is based. However, since our analysis disregards the negative externalities triggered by dry-ups, we cannot draw any definite conclusion about the soundness of these regulatory tools. Similarly, we leave the study of the implications of our results for optimal disclosure or opacity for future work.

From our analysis, one can also draw lessons for central banking. We show that high-quality banks are still able to access wholesale funding in times of stress, and eventually to increase funding. They are thus less likely to require funding from the central bank. This finding is in contrast with the received theory on the lender of last resort, according to which central banks should only lend to solvent institutions facing temporary liquidity needs. However, it is consistent with recent empirical evidence by Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016), who find that central bank funding mainly benefited weakly-capitalized banks during the recent financial crisis.

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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 displays information at the contract-level. 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 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 bank" is the total number of issuances by any bank from January 2008 to December 2014. In Panel C, the minimun issued amount of EUR 100,000 corresponds to re-issuance on an existing ISIN. The minimum issued amount for new ISINs is EUR 150,000. 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	Oesterreichische 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 balance sheet characteristics of CD issuers. Means and quantiles are as of end of December and are computed from the pooled sample over the period from 2008 to 2014. The number of issuer-year observations used to compute these moments is provided in the last column. Panel B relates CD outstanding amounts as of end of December of each year 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.

Panel A: Balance sheet characteristics

	10th	25th	Mean	Median	75th	90th	N. Obs.
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	-0.002	0.002	0.003	0.004	0.007	0.010	1,446
Net interest margin / Assets	0.005	0.011	0.017	0.016	0.021	0.030	1,414
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: Size of CD funding in balance sheets

CD / Equity	0.008	0.053	1.176	0.215	0.693	2.246	971
CD / (CD + Repo)	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 – Number and magnitude of dry-ups

This table provides descriptive statistics on wholesale funding dry-ups. Panel A gives the total number of dry-ups, broken down by year, by type, and by home country of the bank. Panel B provides descriptive statistics on the magnitude of dry-ups, both in absolute terms and relative to the bank's equity as of end of December of the preceding year. The magnitude of the dry-up is defined as the euro amount of the difference between the volume outstanding on the day a dry-up is identified and that 50 days before the dry-up. Both partial and full dry-ups are defined in Section 4.2. Panel C provides evidence on the substitution between CDs and other sources of funds following dry-ups. It compares banks funding sources as of end of December of year t between banks that face a full dry-up during year t and banks that do not. All reported statistics are differences in means and medians for banks that face a full dry-up during year t, relative to banks that do not face a full dry-up. All coefficients are computed after differencing out a year fixed effect. 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. 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.

Panel A: Number of dry-ups

	Partial and full dry-ups		*Full dry-ups only*	
	Number of dry-ups	% Total	Number of dry-ups	% Total
2008	4	5.33	2	6.90
2009	6	8.00	3	10.34
2010	11	14.67	6	20.69
2011	18	24.00	8	27.59
2012	13	17.33	3	10.34
2013	13	17.33	3	10.34
2014	10	13.33	4	13.79
Total	75	100	29	100
By country:				
Austria	2	2.66	2	6.89
France	29	38.66	0	0.00
Denmark	3	4.00	0	0.00
Germany	3	4.00	3	10.34
Ireland	7	9.33	7	24.14
Italy	8	10.66	5	17.24
Netherlands	3	4.00	2	6.89
Sweden	2	2.66	0	0.00
United Kingdom	8	10.66	5	17.24
Other	10	13.33	5	17.24

Panel B: Magnitude of dry-ups

	Min.	10th	25th	Mean	Median	75th	90th	Max.
Partial and full dry-ups:								
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 dry-ups 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

Panel C: Funding substitution after dry-ups

	One year after dry-up			
	Diff. from mean		Diff. from median	
Loans from central bank and other banks / Assets	0.082***	[0.000]	0.057***	[0.000]
Repurchase agreements / Assets	0.039**	[0.023]	0.026	[0.301]

Table 4 – Balance sheet and market characteristics before full dry-ups

This table compares balance sheet and market characteristics at the end of years $t-1$ and $t-2$ between banks that face a full dry-up during year t and banks that do not face a full dry-up. All reported statistics are differences in means and medians for banks that face a full dry-up during year t, relative to banks that do not face a full dry-up. All coefficients are computed after differencing out a year fixed effect, to control for time trends common to both groups. "Stock return" refers to the return over the past calendar year. 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. 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 dry-up		Two years before dry-up		
	Diff. from mean	Diff. from median	Diff. from mean	Diff. from median	N. Obs.
			CD borrowing		
CD / Total debt	-0.059***	-0.026***	-0.053**	-0.025***	1,032
	[0.007]	[0.000]	[0.016]	[0.001]	
			Loans and deposits		
Loans / Assets	-0.015	-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	-1.253***	-0.582***	-0.271	-0.150**	1,120
	[0.000]	[0.000]	[0.230]	[0.018]	
Net income / Assets	-0.015***	-0.007***	-0.003	-0.002**	1,120
	[0.000]	[0.000]	[0.301]	[0.018]	
			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]	
			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]	
			Capitalization		
Equity / Assets	-0.037***	-0.033***	-0.032**	-0.024***	1,122
	[0.007]	[0.000]	[0.015]	[0.000]	
Regulatory cap. / RWA	8.166*	-0.453	8.354*	0.331	404
	[0.088]	[0.910]	[0.072]	[0.216]	
Stock return	-0.360***	-0.315***	-0.219*	-0.168	273
	[0.001]	[0.001]	[0.064]	[0.400]	

Table 5 – Dry-ups forecast future changes in ROA

In this table, we estimate Equation (2), with changes in ROA as a dependent variable. Panel A is for both partial and full dry-ups. Panel B is for full dry-ups only. Changes in ROA are between the end of year $t-1$ (observable at the time of the dry-up) and the end of year t (unobservable at the time of the dry-up). *DryUp* is a dummy variable that takes a value of one for bank i if it faces a dry-up between $t-1$ and t. Time and country fixed effects are included. In Column (3), we include bank fixed effects. In Column (4), we add excess stock returns in previous year as an additional control variable. In Column (5), we interact the *DryUp* 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 (6), we interact the *DryUp* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Control variables include size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, bank short-term credit rating, and sovereign CDS spread. 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.

	Dependent variable: $\Delta ROA = ROA_t - ROA_{t-1}$					
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline				Share CD	Crisis
	Panel A: Partial and full dry-ups					
DryUp	-0.395**	-1.681***	-0.392*	-1.002**	-0.878***	-0.679***
	(0.142)	(0.427)	(0.121)	(0.577)	(0.295)	(0.206)
DryUp * Share CD $\in [4\%, 9\%]$					0.331	
					(0.357)	
DryUp * Share CD $> 9\%$					0.367	
					(0.423)	
DryUp * Crisis						0.101
						(0.192)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.013	0.351	0.682	0.378	0.366	0.368
N. Obs.	948	496	496	231	496	496
	Panel B: Full dry-ups only					
DryUp	-0.341***	-1.086***	-0.782***	-0.987***	-0.834***	-0.843***
	(0.135)	(0.222)	(0.232)	(0.257)	(0.255)	(0.258)
DryUp * Share CD $\in [4\%, 9\%]$					0.456	
					(0.504)	
DryUp * Share CD $> 9\%$					0.431	
					(0.554)	
DryUp * Crisis						0.321
						(0.551)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	-0.001	0.362	0.691	0.389	0.365	0.369
N. Obs.	948	496	496	231	496	496

Table 6 – Dry-ups forecast future changes in asset quality (Impaired loans / Loans)

In this table, we estimate Equation (2), with changes in the ratio of impaired loans to total loans as a dependent variable. Panel A is for both partial and full dry-ups. Panel B is for full dry-ups only. Changes in impaired loans are between the end of year $t-1$ (observable at the time of the dry-up) and the end of year t (unobservable at the time of the dry-up). *DryUp* is a dummy variable that takes a value of one for bank i if it faces a dry-up between $t-1$ and t. Time and country fixed effects are included. In Column (3), we include bank fixed effects. In Column (4), we add excess stock returns in previous year as an additional control variable. In Column (5), we interact the *DryUp* 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 (6), we interact the *DryUp* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Control variables include size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, bank short-term credit rating, and sovereign CDS spread. 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.

	Dependent variable: Δ Impaired loans / Loans					
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline				Share CD	Crisis
	Panel A: Partial and full dry-ups					
DryUp	0.582***	0.749***	0.385**	0.512***	0.621***	0.596***
	(0.140)	(0.207)	(0.163)	(0.199)	(0.178)	(0.164)
DryUp ∗ Share CD ∈ [4%, 9%]					-0.320	
					(0.385)	
DryUp ∗ Share CD > 9%					-0.214	
					(0.306)	
DryUp ∗ Crisis						-0.049
						(0.098)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.100	0.109	0.529	0.111	0.113	0.115
N. Obs.	676	490	490	229	490	490
	Panel B: Full dry-ups only					
DryUp	1.773***	3.045***	1.345***	2.157***	1.197***	1.076***
	(0.274)	(0.375)	(0.292)	(0.303)	(0.282)	(0.253)
DryUp ∗ Share CD ∈ [4%, 9%]					-0.467	
					(1.047)	
DryUp ∗ Share CD > 9%					-0.453	
					(0.958)	
DryUp ∗ Crisis						-0.087
						(0.157)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.132	0.141	0.558	0.152	0.156	0.159
N. Obs.	676	490	490	229	490	490

Table 7 – Dry-ups do not forecast future changes in size or loans to total assets

In this table, we estimate Equation (2), 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 dry-up) and the end of year t (unobservable at the time of the dry-up). *DryUp* is a dummy variable that takes a value of one for bank i if it faces a partial or a full dry-up between $t-1$ and t. Time and country fixed effects are included. In Column (3), we include bank fixed effects. In Column (4), we add excess stock returns in previous year as an additional control variable. In Column (4), we add excess stock returns in previous year as an additional control variable. In Column (5), we interact the *DryUp* 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 (6), we interact the *DryUp* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Control variables include size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, bank short-term credit rating, and sovereign CDS spread. 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)	(5)	(6)
	Baseline				Share CD	Crisis
	Panel A: Δ Size					
DryUp	-0.039	-0.019	-0.021	-0.015	-0.009	-0.015
	(0.036)	(0.020)	(0.024)	(0.022)	(0.018)	(0.017)
DryUp ∗ Share CD ∈ [4%, 9%]					-0.009	
					(0.032)	
DryUp ∗ Share CD > 9%					-0.016	
					(0.030)	
DryUp ∗ Crisis						-0.008
						(0.009)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.031	0.197	0.274	0.222	0.196	0.201
N. Obs.	950	496	496	231	496	496
	Panel B: Δ Loans / Assets					
DryUp	0.004	-0.001	0.008	0.003	0.002	0.007
	(0.007)	(0.010)	(0.014)	(0.013)	(0.009)	(0.014)
DryUp ∗ Share CD ∈ [4%, 9%]					0.012	
					(0.023)	
DryUp ∗ Share CD > 9%					0.014	
					(0.025)	
DryUp ∗ Crisis						-0.002
						(0.015)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.016	0.034	0.119	0.055	0.054	0.055
N. Obs.	947	496	496	321	496	496

Table 8 – Issuer stock returns around dry-ups

In this table, we study issuer stock returns around dry-ups. Panel A performs event studies before partial and full dry-ups. The week of the event is denoted τ and we focus on an event window of eight weeks preceding the event. We report cumulative abnormal returns over the entire event window. Abnormal returns are computed as $R_{it} - R_{mt}$, where R_{mt} is the equally-weighted return computed for all sample banks. In Panel B, we compute cumulative excess stock returns for banks facing a dry-up the week of the event, and over a period that starts one week before the event and ends after the event. In Panel C, we focus on the period after the event. We estimate Equation (2) with abnormal stock returns as the dependent variable. Regressions are estimated over two time horizons, respectively 6 months and 1 year after the dry-up occurs. All regressions use quarterly data and include time and country fixed effects, and two specifications also include issuer fixed effects. Control variables include size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, bank short-term credit rating, and sovereign CDS spread. 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.

Panel A: Abnormal stock returns before dry-ups

	Cumulative abnormal return	95% confidence interval	p-value
Week $\tau - 8$	-0.016	[-0.031 ; 0.005]	0.101
Week $\tau - 7$	-0.009	[-0.036 ; 0.017]	0.245
Week $\tau - 6$	-0.010	[-0.039 ; 0.017]	0.223
Week $\tau - 5$	-0.017*	[-0.042 ; 0.007]	0.081
Week $\tau - 4$	-0.032**	[-0.060 ; -0.004]	0.011
Week $\tau - 3$	-0.044***	[-0.074 ; -0.014]	0.003
Week $\tau - 2$	-0.071***	[-0.112 ; -0.029]	0.001
Week $\tau - 1$	-0.080***	[-0.130 ; -0.031]	0.001

Panel B: Abnormal stock returns during dry-ups

	Week τ	Weeks $\tau - 1$ to $\tau + 1$
DryUp	0.006	-0.015
	(0.017)	(0.020)

Panel C: Abnormal stock returns after dry-ups

	6 months			1 year		
DryUp	-0.091	-0.078	-0.081	-0.038	-0.093	-0.091
	(0.071)	(0.064)	(0.080)	(0.064)	(0.067)	(0.100)
Controls	No	Yes	Yes	No	Yes	Yes
Issuer fixed effect	No	No	Yes	No	No	Yes
Adj. R^2	0.151	0.319	0.228	0.151	0.698	0.678
N. Obs.	1,131	717	717	1,091	717	717

Table 9 – Maturity shortening before dry-ups

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 (Equation 3). A dummy variable at date $\tau - j$ equals one if the bank faces a dry-up at date τ and zero otherwise, for $j \in \{1, ..., 6\}$, i.e., up to six months before the dry-up. Column (1) is for both partial and full dry-ups. Column (2) is for full dry-ups only. Standard errors, clustered at the bank level, 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)
	Partial and full dry-ups	*Full dry-ups only*
Month $\tau - 1$	-25.360***	-29.511***
	(2.285)	(4.513)
Month $\tau - 2$	-17.345***	-30.001***
	(3.914)	(5.998)
Month $\tau - 3$	-12.134***	-14.664***
	(1.699)	(4.742)
Month $\tau - 4$	-7.628	-11.610
	(4.902)	(7.368)
Month $\tau - 5$	-7.506*	-3.930
	(3.750)	(5.243)
Month $\tau - 6$	-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 10 – Credit rating downgrades and CD funding

This table estimates the effect of short-term credit rating downgrades on CD funding. In Columns (1) and (2), the log of the amount of CDs outstanding for each bank is regressed on issuer and time fixed effects, and on a set of dummy variables at dates $\tau + j$, for $j \in \{-5, ..., 5\}$, equal to one if the bank's credit rating is downgraded at date τ. Column (2) restricts attention to downgrades in the lowest part of the Fitch rating scale (F2 to F3, or lower). In Column (3), the short-term credit rating of a bank is regressed on a set of dummy variables equal to one at date $\tau + j$ if the bank faces a dry-up at date τ. Standard errors, clustered at the bank level, are in parentheses. Note that standard errors in Column (3) are close to equal, due to the low level of granularity of short-term credit ratings. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	(1)		(2)		(3)	
	Dependent variable: log CD outstanding				Credit rating	
	All downgrades		Only F2 to F3 or lower		Full dry-ups	
Month $\tau - 5$	-0.112	(0.112)	-0.271	(0.254)	-0.039	(0.090)
Month $\tau - 4$	-0.049	(0.125)	0.180	(0.619)	-0.020	(0.090)
Month $\tau - 3$	-0.235	(0.134)	-0.196	(0.184)	-0.057	(0.090)
Month $\tau - 2$	-0.284	(0.225)	-0.234	(0.388)	-0.075	(0.090)
Month $\tau - 1$	-0.104	(0.062)	-0.627	(0.402)	-0.157*	(0.090)
Downgrade month τ	-0.303***	(0.100)	-0.691	(0.526)	-0.206**	(0.090)
Month $\tau + 1$	-0.295**	(0.135)	-0.803*	(0.388)	-0.209**	(0.090)
Month $\tau + 2$	-0.315*	(0.151)	-1.445***	(0.254)	-0.201**	(0.090)
Month $\tau + 3$	-0.201	(0.144)	-0.994***	(0.297)	-0.237***	(0.090)
Month $\tau + 4$	-0.183	(0.125)	-1.164**	(0.390)	-0.300***	(0.090)
Month $\tau + 5$	-0.097	(0.121)	-0.702***	(0.056)	-0.312***	(0.090)
Issuer fixed effect	Yes		Yes		Yes	
Month fixed effect	Yes		Yes		Yes	
Adj. R^2	0.137		0.136		0.233	
N. Obs.	8,297		8,297		10,459	

Table 11 – Reallocation of funds after dry-ups

This table provides estimates of the probit model in Equation (6). The dependent variable equals one for an issuer in a given month if its excess issuance over the market (defined in Equation (5)) 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 *Stress Index* (defined in Equation (1)) is in the second, third or fourth quartile of its distribution. Each specification includes fixed effects for eleven out of twelve months. Control variables include size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, bank short-term credit rating, and sovereign CDS spread. Standard errors, clustered at the bank level, 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	0.025***	0.019**	0.033**	0.017***
	(0.005)	(0.009)	(0.014)	(0.006)
Δ ROA * *Stress Index* in Quartile 2		-0.003		0.008
		(0.016)		(0.006)
Δ ROA * *Stress Index* in Quartile 3		0.033***		0.039
		(0.012)		(0.033)
Δ ROA * *Stress Index* in Quartile 4		0.048**		0.030**
		(0.020)		(0.015)
Controls	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes
Month fixed effect	Yes	Yes	Yes	Yes
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 credit default swap (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 UK, 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.

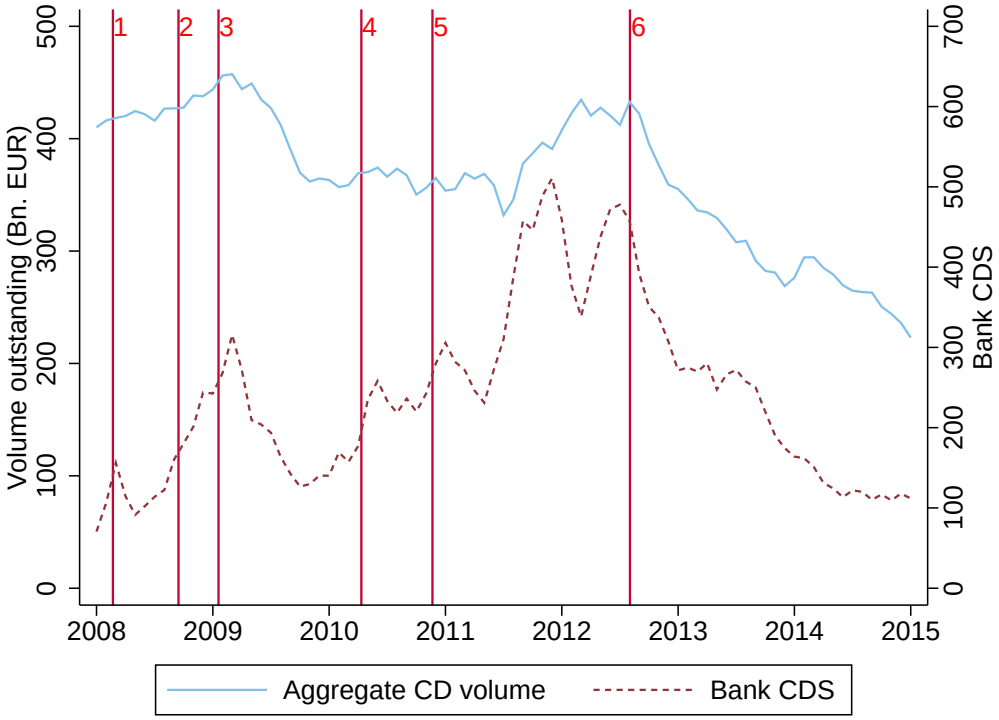
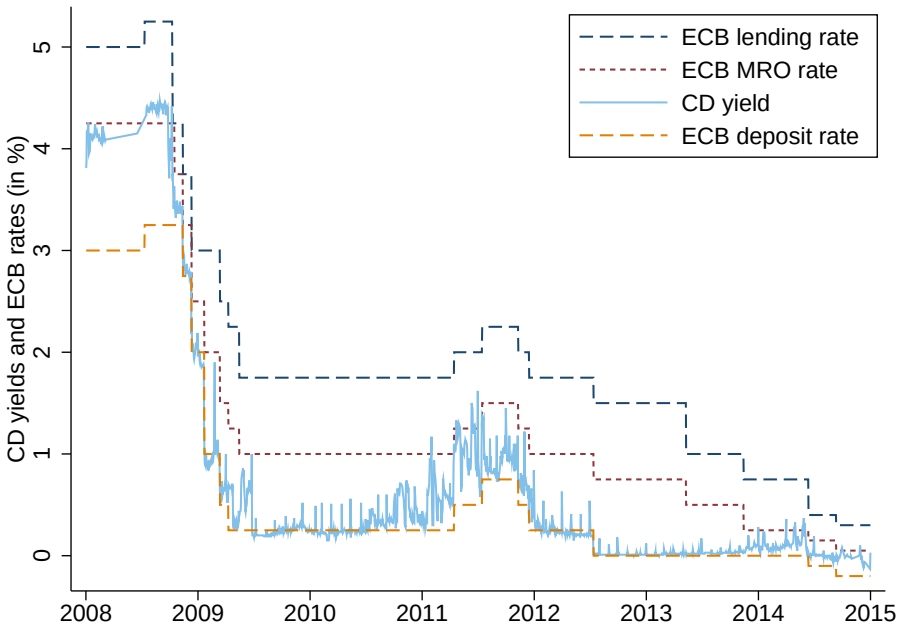


Figure 2 – Short-term interest rates

Panel A 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. The figure also shows the three policy rates set by the ECB. 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). Panel B plots the difference between the one-week CD yield and the one-week Euribor (rate for unsecured interbank lending in euros). Data source: European Central Bank.

Panel A: CD yield and ECB rates



Panel B: Spread between CD yield and Euribor

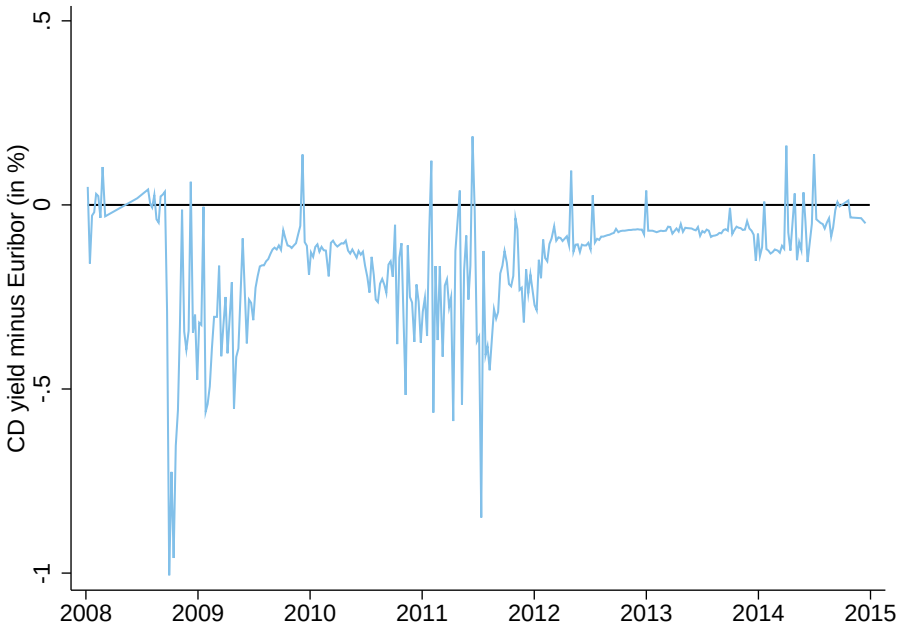
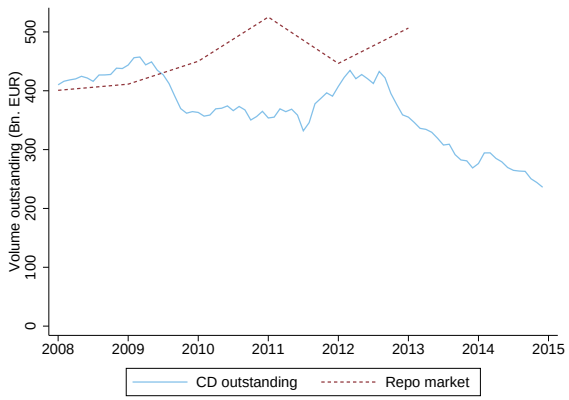


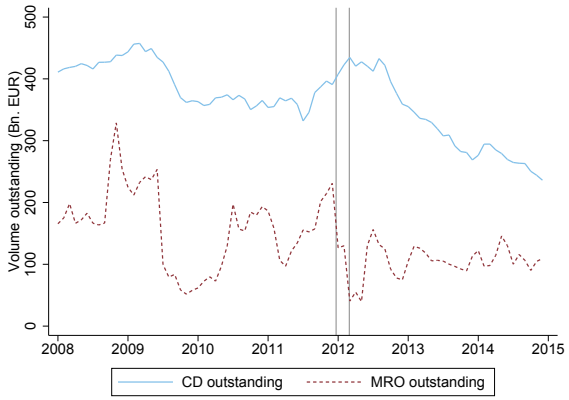
Figure 3 – Size of the CD market relative to other wholesale funding markets

This figure compares the amount of euro-denominated CDs outstanding with three other segments of European wholesale funding markets. Panel A compares CDs with private repurchase agreements (CCP-based + bilateral + triparty). Data on the European repo market have been provided by Mancini, Ranaldo, and Wrampelmeyer (2015) for the 2008-2013 period. The repo data involve partial double-counting. Panel B compares CDs with the outstanding 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. The vertical lines correspond to the two main Long-Term Refinancing Operations (LTROs) on December 21st, 2011, and on February 29th, 2012. LTROs are 3-year refinancing operations. Data on MROs and LTROs have been 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, Heider, Hoerova, and Manganelli (2016). For repo and interbank loan data, we proxy the amount outstanding with the daily turnover, because most contracts on these markets are overnight. All time series are monthly averages, except the repo data, which are at an annual frequency.

Panel A: CDs versus repurchase agreements



Panel B: CDs versus ECB refinancing operations



Panel C: CDs versus interbank loans

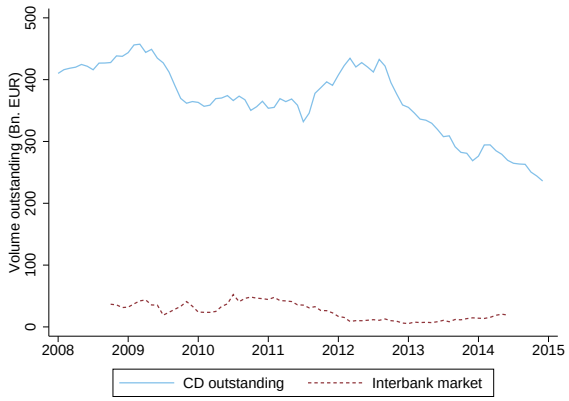
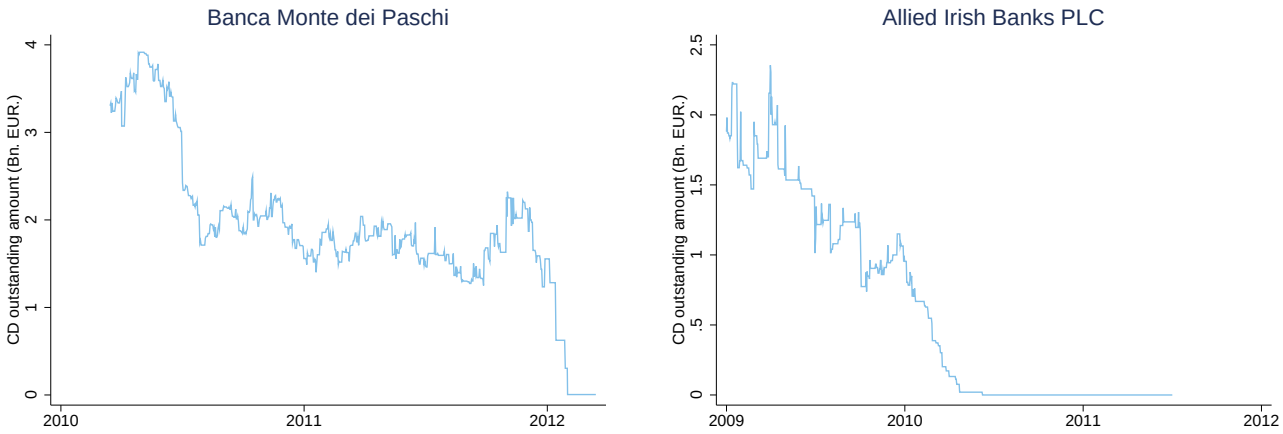


Figure 4 – Complete and partial dry-ups

This figure gives four examples of full and partial dry-ups. It plots the amount of CDs outstanding for four selected European banks, at a daily frequency. Panel A provides two examples of full dry-ups (Banca Monte dei Paschi and Allied Irish Banks), i.e., the outstanding amount of CDs after the dry-up falls to zero. Panel B provides two examples of partial dry-ups (Unicredit and Dexia), i.e., the outstanding amount of CDs falls by 50% or more over 50-day period.

Panel A: Full dry-ups



Panel B: Partial dry-ups

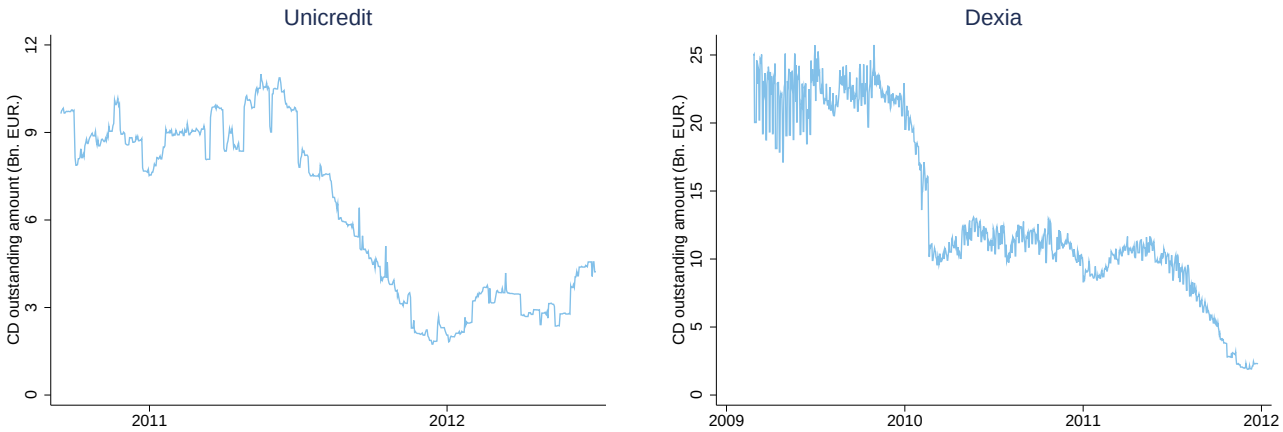
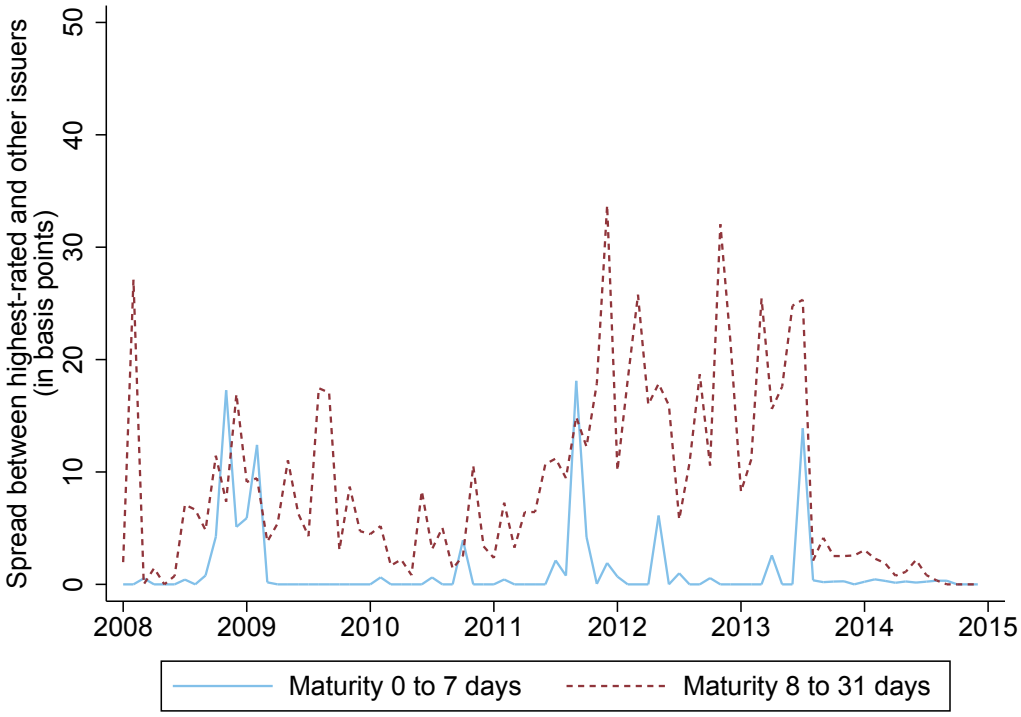


Figure 5 – Price dispersion in the CD market

This figure plots the spread between the average rate paid by issuers with the highest credit ratings and the average rate paid by issuers with the lowest credit ratings. The spreads are computed as monthly averages and expressed in basis points. The highest credit rating is F1+ in the scale by Fitch Ratings. All spreads are weighted by the volume of new issues. The solid line corresponds to new CD issues with an initial maturity between 0 and 7 days, and the dotted line to new CD issues with an initial maturity between 8 and 31 days.



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
Book equity	Common Equity (id: 11800).	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
Loans from central bank and other banks	Deposits from banks (id: 11560)	Bankscope
	Issuer profitability and asset quality	
Net income	Net income (id: 10285).	Bankscope
ROA	Return on average assets (id: 4024).	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
Stock price	End-of-day stock price	Bloomberg
Sovereign CDS spread	5-year CDS spread (mid-quote)	Bloomberg

Table A2 – List of wholesale funding dry-ups

This table is a chronological list of the 29 full wholesale funding dry-ups. For each dry-up, we use Factiva to search for press articles or news releases about the bank around the time of the dry-up. For 27 individual dry-ups, we display an excerpt of such news in the last column.

	Bank name and country	Date	Source	Excerpt
1	Hypo Public Finance Bank (DE)	Jul. 2008	*Business World*, "Hypo writes off E2.5bn at Depfa Bank", 12 November 2008	Troubled German property lender Hypo Real Estate has this morning posted a pretax loss of 3.1 billion euro for the third quarter, more than analysts had expected. Hypo is the parent of two big operations in Dublin's docklands - Depfa Bank and Hypo Public Finance Bank - which employ 300 people between them.
2	Hypo Real Estate Bank Intl. AG (DE)	Oct. 2008	*Business World*, "Hypo writes off E2.5bn at Depfa Bank", 12 November 2008	Troubled German property lender Hypo Real Estate has this morning posted a pretax loss of 3.1 billion euro for the third quarter, more than analysts had expected. Hypo is the parent of two big operations in Dublin's docklands - Depfa Bank and Hypo Public Finance Bank - which employ 300 people between them.
3	Alliance & Leicester PLC (UK)	Mar. 2009	*The Guardian*, "City fears A&L may need Bank rescue", 28 November 2007	Fears that Alliance & Leicester may have to seek emergency funds from the Bank of England circulated in the City last night as ratings agency Standard & Poor's said the bank could suffer from the lending freeze that triggered Northern Rock's downfall. [Subsequently acquired by Santander, but kept operating until after the run under the A&L name. See Factiva, Financial Times, "Abbey, Alliance & Leicester and B&B to disappear from the high street", 27 May 2009.]
4	Depfa Bank plc (IR)	Mar. 2009	*Business World*, "Hypo writes off EUR2.5bn at Depfa Bank", 12 November 2008	Troubled German property lender Hypo Real Estate has this morning posted a pretax loss of 3.1 billion euro for the third quarter, more than analysts had expected. Hypo is the parent of two big operations in Dublin's docklands - Depfa Bank and Hypo Public Finance Bank - which employ 300 people between them.
5	Banca Intesa (France) (IT) [Subsidiary of Intesa Sanpaolo]	Aug. 2009	*Financial Times*, "Intesa Sanpaolo seeks EUR4bn in state aid", 20 March 2009	Intesa Sanpaolo, one of Italy's top two banks, announced on Friday it would seek EUR4bn in government support by issuing bonds to the Italian Treasury, just days after its chief executive, Corrado Passera, denounced conditions attached to the bonds as "demagogic".
6	Allied Irish Banks p.l.c. (IR)	Jun. 2010	*The Sunday Times*, "The moment of truth approaches for AIB", 12 December 2010	Allied Irish Banks is approaching some manner of kismet. Will it be nationalised at the same time as the government brings forward its long-overdue banking resolutions legislation? Investors in the bank's subordinated bonds think so. These bonds are trading at levels where a forced write-down is inevitable.
7	Swedbank Mortgage AB (SW)	Aug. 2010	*Moody's Investors Service*, "Moody's places Swedbank AB and Swedbank Mortgage AB's ratings on review for possible upgrade", 16 November 2010	During the financial crisis, the asset quality of Swedbank AB's Baltic operations deteriorated rapidly, with non-performing loans (NPLs) as a percentage of gross loans increasing to 14% YE 2009 from 3% (YE 2008). In line with other Nordic banks that have Baltic operations, Swedbank AB responded by significantly reducing its exposure to the Baltic countries, achieving around a 35% decrease in its Baltic loan portfolio since Q4 2008.

Table A2 (continued)

	Bank name and country	Date	Source	Excerpt
8	Anglo Irish Bank Corp. Ltd (UK)	Nov. 2010	*Economist Intelligence Unit*, "Ireland economy: A painful outcome", 22 October 2010	With the government desperately seeking a conclusion to Ireland's acute banking crisis, as bailout costs continue to spiral higher, the country's most troubled financial institution, Anglo Irish Bank, has proposed a contentious "burden-sharing" scheme that could see most of its junior bondholders suffer losses of at least 80%.
9	EBS Building Society (IR)	Nov. 2010	*The Daily Telegraph*, "Irish bondholders face heavy losses", 1 June 2011	Meanwhile, Irish Life & Permanent and EBS Building Society said they would also impose losses equivalent to around 80pc-90pc of the face value of some EUR1.1 Bn in junior bonds. The banks said if investors did not accept the offers, the Irish government would take whatever steps necessary to "maximise burden sharing".
10	The Governor & Co. of the Bank of Ireland (IR)	Dec. 2010	*Financial Times*, "Time running out for the last Irish independent", 26 January 2011	Bank of Ireland became the only bank still listed on the Irish Stock Exchange on Tuesday when shares in Allied Irish Banks, which is set to be 92 per cent-state owned in the next few weeks, were delisted. The question now is whether Bank of Ireland can avoid a similar fate. That depends on whether it will have to turn to the government for extra funding in order to meet the core tier one capital ratio of 12 per cent set by the regulators.
11	Banco di Brescia S.p.A. (IT) [Subsidiary of UBI Banca]	Dec. 2010	*Financial Times*, "UBI Banca's share price fall raises concern", 17 June 2011	Shares in UBI Banca, an Italian regional lender, slumped 8 per cent on Thursday complicating its EUR1bn (USD1.4bn) rights issue and raising concerns about investor appetite for capital raisings by other Italian banks in the coming weeks. [...] However, the debt crisis in southern Europe together with low economic growth forecasts and political instability in Italy have undermined investor confidence, particularly in the mid-sized Italian banks, say industry analysts and senior bankers.
12	Irish Life & Permanent P.L.C. (IR)	Dec. 2010	*The Daily Telegraph*, "Irish bondholders face heavy losses", 1 June 2011	Meanwhile, Irish Life & Permanent and EBS Building Society said they would also impose losses equivalent to around 80pc-90pc of the face value of some EUR1.1bn in junior bonds. The banks said if investors did not accept the offers, the Irish government would take whatever steps necessary to "maximise burden sharing".
13	Caixa D'Estalvis De Catalunya Tarragona i Manresa (SP)	Apr. 2011	*Europolitics*, "Banking: Stress tests results welcomed as eight banks fail", 19 July 2011	Eight banks failed to show they could meet the 5% capital requirement: Austria's Oesterreichische Volksbanken, Greece's state-owned ATEbank (which also failed last year's round) and EFG Eurobank and five Spanish regional savings banks - the Caixa d'Estalvis de Catalunya, Tarragona i Manresa, Banco Pastor, Caixa d'Estalvis Unio de Caixes de Manlleu, Sabadell i Terrassa, Grupo Caja3 and the Caja de Ahorros del Mediterraneo.
14	Fortis Banque France (BE)	May 2011	*Moody's Investors Service*, "Moody's downgrades BNP Paribas's long-term ratings to Aa3, concluding review", 9 December 2011	The outlooks on the debt and deposit ratings are now negative, in reflection of the negative outlook assigned to the debt and deposit ratings of parent BNP Paribas. In addition, Fortis Bank SA/NV's Tier 1 instruments were confirmed at Baa1 (hyb) and assigned a negative outlook.
15	Fortis Bank (Nederland) NV (NL)	May 2011	*Moody's Investors Service*, "Moody's downgrades BNP Paribas's long-term ratings to Aa3, concluding review", 9 December 2011	The outlooks on the debt and deposit ratings are now negative, in reflection of the negative outlook assigned to the debt and deposit ratings of parent BNP Paribas. In addition, Fortis Bank SA/NV's Tier 1 instruments were confirmed at Baa1 (hyb) and assigned a negative outlook.

Table A2 (continued)

	Bank name and country	Date	Source	Excerpt
16	Ulster Bank Ireland Ltd (IR)	May 2011	*The Guardian*, "RBS still hamstrung by Ulster Bank impairments in Ireland", 6 May 2011	The troubles in the Ulster Bank arm [...] are being felt across the rest of the group. Ulster is 10% of the group's total gross customer loans or 9% of the gross customer loans in the core division. But the impairment charge represents 80% of the charge in the non-core division and 40% of the impairment charge in the core division. The group's total impairment charge is GBP1.9bn - some GBP1.2bn is related to Ireland.
17	Mediobanca International S.A. (IT)	Sep. 2011	*ADPnews Italy*, "Morgan Stanley sees economy slowdown, higher funding costs affecting Italian banks' profits", 18 November 2011	The expected 1% drop in Italy gross domestic product (GDP) in 2012 and the rising of financing costs could threaten the profits of Italian banks, Morgan Stanley said on Friday. [...] Intesa Sanpaolo (BIT:ISP) and Mediobanca (BIT:MB) can best face rising funding costs, according to Morgan Stanley.
18	Oesterreichische Volksbanken AG (AT)	Nov. 2011	*Europolitics*, "Banking: Stress tests results welcomed as eight banks fail", 19 July 2011	Eight banks failed to show they could meet the 5% capital requirement: Austria's Oesterreichische Volksbanken.
19	FIH Erhvervsbank A/S (DK)	Dec. 2011	*Agence Europe*, "State aid: Public support for Danish bank FIH Erhvervsbank A/S", 30 June 2012	On Friday 29 June, the European Commission temporarily authorised an impaired asset measure and an asset relief measure in favour of FIH Erhvervsbank A/S. The public support measures were approved for a period of six months in order to preserve financial stability. In parallel, the Commission opened a formal investigation because it is concerned that the State may not be adequately remunerated for its support and because of the risks remaining in FIH's balance sheet.
20	Nationwide Building Society (UK)	Sep. 2012	*SNL European Financials Daily*, "S&P lowers outlook on Nationwide Building Society", 20 December 2012	S&P's Ratings Services on Dec. 18 revised its outlook on the long-term rating of Nationwide Building Society to negative from stable. S&P said the revision follows its change to the outlook of the UK's AAA long-term sovereign credit rating to negative from stable. It also attributed the move to a decline in the building society's risk-adjusted capital ratio arising from a net actuarial loss in its employee pension scheme.
21	Banco Popolare Societa Cooperativa (IT)	Nov. 2012	*SNL European Financials Daily*, "Banco Popolare in initial talks to sell bad loans", 9 December 2013 [AND] *ICN.com Financial Markets*, "Banco Popolare Posts Sharp Drop In 2Q Net Profit", 28 August 2013	Banco Popolare SC is in initial discussions with investors over the bad debt portfolio in a vehicle controlled by the lender, Reuters reported Dec. 5. [AND] Banco Popolare SC said on Tuesday that its second-quarter net profit slipped on the back of a rise in loan-loss provisions. Net profit reached 64.3 million euros in the three months through June, compared to 138 million euros a year earlier. Loan-loss provisions climbed to 211.6 million euros from 185.6 million euros in the same period a year ago.
22	Banca Monte Dei Paschi di Siena S.p.A. (IT)	Nov. 2012	*SNL European Financials Daily*, "Monte dei Paschi scandal bursts onto Italian politics", 28 January 2013	Banca Monte dei Paschi di Siena SpA's decision to hide hundreds of millions of euros of losses from investors could take its toll on the left's chances in February's Italian parliamentary election. News that the lender could book losses of at least EUR720 million as a result of derivatives deals allegedly kept secret from investors and regulators has provoked a media storm in Italy and caused investors to dump its stock.

Table A2 (continued)

	Bank name and country	Date	Source	Excerpt
23	The Royal Bank of Scotland N.V. (UK)	Apr. 2013	*BBC News*, "RBS shares fall after biggest loss since financial crisis", 27 February 2014	Shares in Royal Bank of Scotland (RBS) have fallen sharply after the troubled company reported its biggest annual loss since being rescued by the UK government during the financial crisis. The bank's pre-tax loss for 2013 was GBP8.2bn, compared with GBP5.2bn in 2012.
24	Bank of Scotland PLC (UK)	Jun. 2013	n.a.	n.a.
25	SNS Bank N.V. (NL)	Jul. 2013	*Euroweek*, "SNS haircut worries ease but bondholder outcomes still murky", 6 February 2013	SNS Bank's 11.25% EUR 320m tier one perpetual has fallen around 20 points over the last two weeks according to one investor. It bounced up, and then down this week, trading in the low 50% of par region, analysts said. Subordinated bondholders are likely to be called on to help generate capital, the bank's parent SNS Reaal said. How much they are set to lose, however, is highly uncertain.
26	Landesbank Baden-Wurttemberg (DE)	Mar. 2014	n.a.	n.a.
27	DZ Bank Ireland PLC (IR) [Subsidiary of DZ Bank, which failed the ECB stress tests a few months later]	Apr. 2014	*SNL European Financials Daily*, "4 German banks in ECB failure stress", 20 October 2014	However, it is notable that DZ Bank reported at year-end 2013 a low Basel III ratio of 7.1% compared to a cut-off point of 8.0%. NORD/LB showed an 8.6% ratio at the same juncture and a 41% coverage ratio; DZ Bank's coverage figure was higher at 49%. Raising both banks' coverage to 60% would require DZ Bank to lift reserves by EUR500 million and NORD/LB by EUR1.1 billion.
28	Banque Espirito Santo et de la Venetie (PT)	Jul. 2014	*Dow Jones Newswires*, "Behind the Collapse of Portugal's Espirito Santo Empire ", 16 August 2014	Now the empire is in ruins. The family's prized asset and Portugal's second-biggest bank, Banco Espirito Santo SA, collapsed this month, and Espirito Santo's main holding companies have filed for bankruptcy amid allegations of accounting problems and fraud.
29	Oesterreichische Kontrollbank AG (AT)	Sep. 2014	*Euroweek*, "OeKB hits dud note in week of oversubscribed SSA dollar benchmarks", 25 September 2014	But the outlook for seven year issuance, which has been strong since European Investment Bank priced a USD3bn 2.125% October 2021 in the last week of August, began to pall on Thursday as a seven year for Oesterreichische Kontrollbank fell just shy of full subscription.

Table A3 – Dry-ups forecast future changes in longer-term profitability and asset quality

In this table, we estimate Equation (2), 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 dry-up) and the end of year $t+1$ (unobservable at the time of the dry-up). *DryUp* is a dummy variable that takes a value of one for bank i if it faces a partial of a full dry-up between $t-1$ and t. Time and country fixed effects are included. In Column (3), we include bank fixed effects. In Column (4), we add excess stock returns in previous year as an additional control variable. In Column (5), we interact the *DryUp* 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 (6), we interact the *DryUp* dummy with a *Crisis* dummy that equals one in 2011 and 2012. Control variables include size, ROA, impaired loans over total loans at $t-1$, book equity over total assets, bank short-term credit rating, and sovereign CDS spread. 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)	(5)	(6)
	Baseline				Share CD	Crisis
	Panel A: $ROA_{t+1} - ROA_{t-1}$					
DryUp	-0.105	-0.588**	-0.201*	-0.376*	-0.464**	-0.407*
	(0.150)	(0.284)	(0.123)	(0.214)	(0.221)	(0.209)
DryUp * Share CD $\in [4\%, 9\%]$					0.201	
					(0.453)	
DryUp * Share CD $> 9\%$					0.254	
					(0.507)	
DryUp * Crisis						0.123
						(0.370)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.004	0.237	0.729	0.256	0.279	0.281
N. Obs.	772	384	384	201	384	384
	Panel B: Δ Impaired loans/ Total loans$_{t+1}$					
DryUp	1.419***	2.075***	0.392	1.014***	1.563***	1.601***
	(0.363)	(0.577)	(0.419)	(0.385)	(0.451)	(0.444)
DryUp * Share CD $\in [4\%, 9\%]$					-0.456	
					(0.879)	
DryUp * Share CD $> 9\%$					-0.512	
					(0.796)	
DryUp * Crisis						-0.204
						(0.357)
Controls	No	Yes	Yes	Yes	Yes	Yes
Returns control	No	No	No	Yes	No	No
Issuer fixed effect	No	No	Yes	No	No	No
Adj. R^2	0.110	0.166	0.044	0.187	0.171	0.176
N. Obs.	527	378	378	201	378	378

Table A4 – Spread between high- and low-rated issuers around dry-ups

This table studies the spread between high- and low-rated issuers around dry-ups, at a weekly frequency. The spread is computed as the difference between the rate paid on CDs by issuers with the highest short-term credit rating (F1+ in the scale by Fitch Ratings) and issuers with lower ratings. The occurrence of dry-ups is measured market-wide using the *Stress Index*. The *Stress Index* is defined as the sum of the euro amount of all sample dry-ups over the last month, scaled by the aggregate size of the CD market at the beginning of this one-month period (Equation 1). Each specification is estimated in levels (Panel A) and in first difference (Panel B), as well as for CDs issued with initial maturity between 0 and 7 days (Columns 1 to 3) and between 8 and 31 days (Columns 4 to 6). Standard errors are computed using the Newey-West estimator with three lags. *, **, and *** denote respectively statistical significance at the 10%, 5%, and 1% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Stress Index$_t$					
	0 to 7 days			8 to 31 days		
Spread$_t$	-0.175	-0.119	-0.142	-0.171**	-0.128*	-0.079
	(0.130)	(0.134)	(0.134)	(0.067)	(0.073)	(0.073)
Spread$_{t-1}$		-0.118			-0.072	
		(0.135)			(0.076)	
Spread$_{t-2}$		-0.168			-0.047	
		(0.135)			(0.076)	
Spread$_{t-3}$		-0.118			-0.040	
		(0.134)			(0.073)	
Spread$_{t+1}$			-0.106			-0.111
			(0.136)			(0.075)
Spread$_{t+2}$			-0.032			-0.094
			(0.136)			(0.076)
Spread$_{t+3}$			-0.061			-0.110
			(0.135)			(0.073)
Adj. R^2	0.002	0.005	-0.003	0.015	0.015	0.035
N. Obs.	363	362	360	363	361	360
	Panel B: Stress Index$_t$ − Stress Index$_{t-1}$					
	0 to 7 days			8 to 31 days		
Δ Spread$_t$	-0.007	-0.026	0.002	0.007	0.025	-0.019
	(0.043)	(0.052)	(0.052)	(0.025)	(0.031)	(0.031)
Δ Spread$_{t-1}$		-0.037			0.028	
		(0.062)			(0.034)	
Δ Spread$_{t-2}$		-0.090			0.028	
		(0.062)			(0.034)	
Δ Spread$_{t-3}$		-0.035			0.040	
		(0.052)			(0.030)	
Δ Spread$_{t+1}$			0.019			-0.057*
			(0.062)			(0.034)
Δ Spread$_{t+2}$			0.090			-0.028
			(0.062)			(0.034)
Δ Spread$_{t+3}$			0.071			-0.011
			(0.052)			(0.030)
Adj. R^2	-0.002	-0.004	-0.002	-0.002	-0.005	-0.003
N. Obs.	362	360	359	362	360	359

Figure A1 – Segments of the euro-denominated CD market

This figure displays the decomposition of the euro-denominated CD market 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 and the UK (European Commercial Paper) markets. Other markets include primarily the Belgian and the Luxembourgian markets. Data source: European Central Bank.

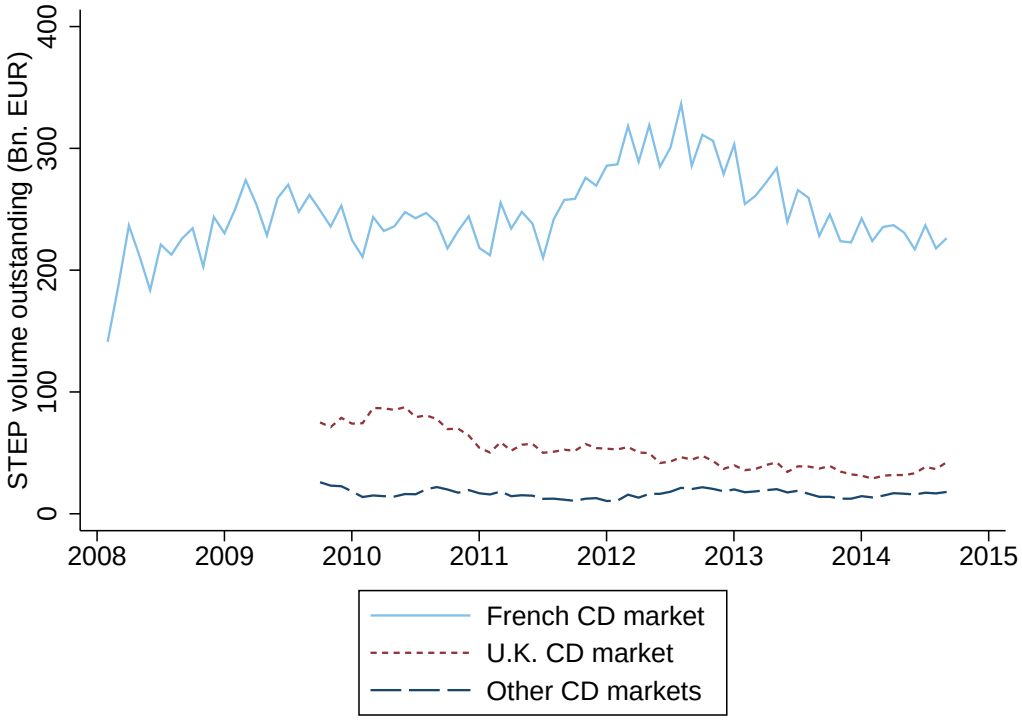


Figure A2 – Average maturity of new issues in the euro-denominated CD market

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.

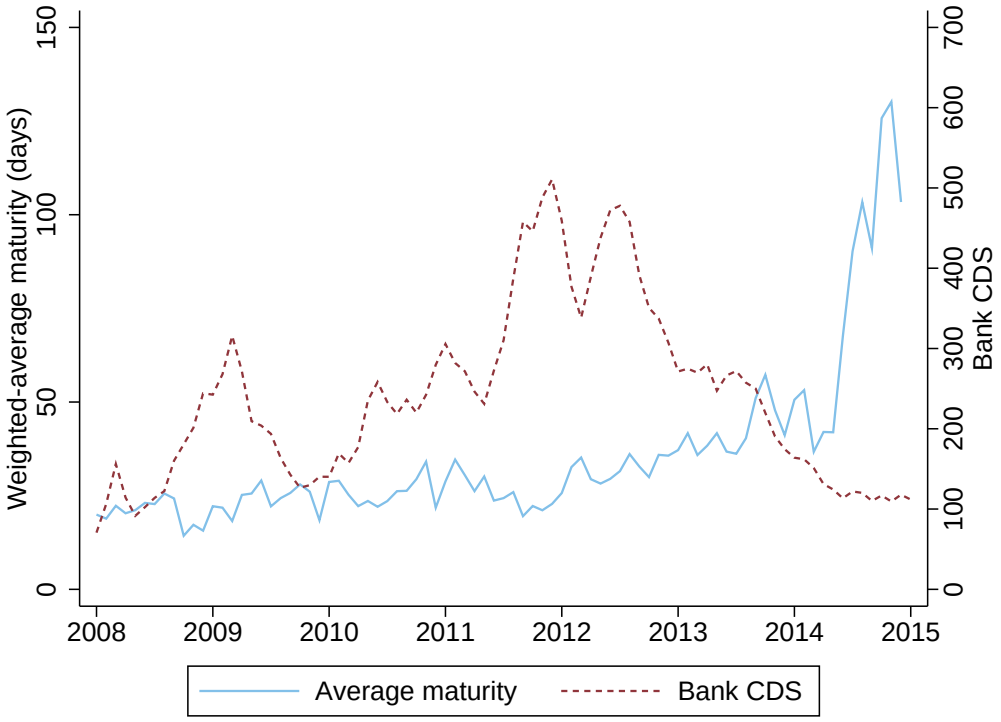


Figure A3 – Stress Index

This figure plots the *Stress Index* in the CD market at a monthly frequency. This index is defined as the sum of the euro amount of all sample dry-ups within a given month, scaled by the aggregate size of the CD market at the beginning of that month (Equation 1). See Section 4.2 for details.

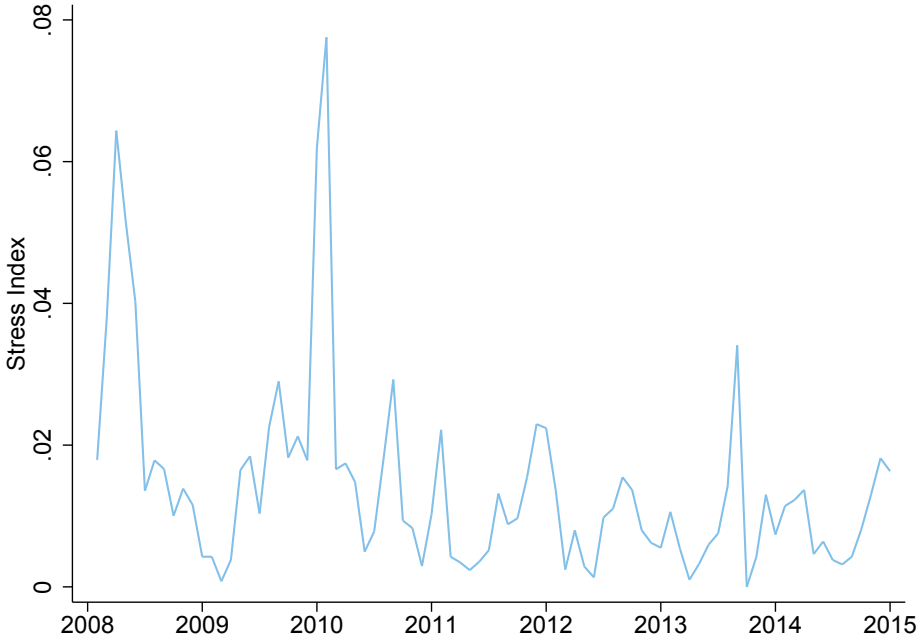
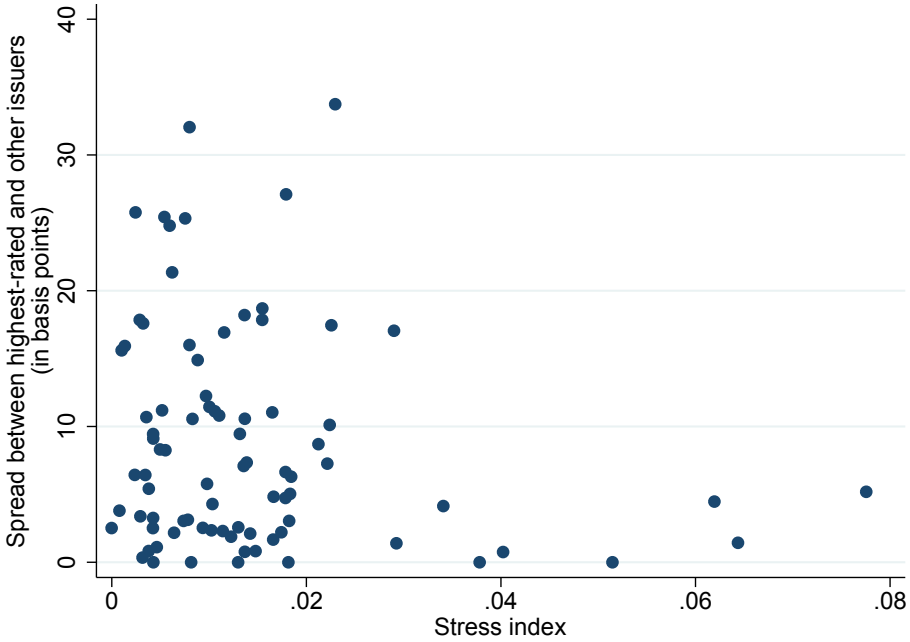


Figure A4 – Stress Index and interest rate dispersion

This figure plots the spread between the interest rate paid by issuers in the highest short-term credit rating bucket and issuers with lower ratings, as a function of the Stress Index. This index is defined as the sum of the euro amount of all sample dry-ups within a given month, scaled by the aggregate size of the CD market at the beginning of that month (Equation 1). See Section 4.2 for details. Spreads are monthly volume-weighted averages.



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