The Private Production of Safe Assets*

Marcin Kacperczyk† Christophe Pérignon‡ Guillaume Vuillemey§

June 9, 2017

Abstract

Do claims on the private sector serve the role of safe assets? We answer this question using high-frequency panel data on prices and quantities of certificates of deposit (CD) and commercial paper (CP) issued in Europe. We show that only very short-term private securities benefit from a premium for safety. We then use several sources of variation to show that the issuance of short-term CDs strongly responds to measures of safety demand. The private production of safe assets is stronger for issuers with high credit worthiness, and breaks down during episodes of market stress. We conclude that even very short-term private assets are sensitive to changes in the information environment and should not be treated as equally safe at all times.

*We are grateful to Robin Greenwood, Raj Iyer, Amir Sufi, and seminar participants at HEC Liège, HEC Paris, and Imperial College for useful comments, and to Laurent Clerc and the Banque de France for providing data on certificates of deposits and commercial paper. Pérignon and Vuillemey thank the Chair ACPR/Risk Foundation: Regulation and Systemic Risk and the Investissements d'Avenir (ANR-11-IDEX-0003/Labex Ecodec/ANR-11-LABX-0047) for supporting their research.

†Imperial College London and CEPR. Email: m.kacperczyk@imperial.ac.uk.

‡HEC Paris. Email: perignon@hec.fr.

§HEC Paris and CEPR. Email: vuillemey@hec.fr.

1 Introduction

A safe asset is an asset that can be valued without expensive and prolonged analysis and is thus immune to adverse selection concerns (Gorton, 2016). Safe assets, such as Treasuries, have money-like attributes and can serve as stores of value (Nagel, 2016). Over the past two decades, the demand for safe assets has surged due to the combined effects of fast-growing savings in developing economies and increasing needs for collateral in financial markets. At the same time, the supply of government-issued safe assets in developed countries did not increase equally fast. The resulting excess demand can explain phenomena such as global imbalances or historically low levels of real interest rates (Caballero, 2006; Caballero and Farhi, 2017).

The unmet demand for safe assets has paved the way for private financial institutions to issue new types of debt securities with similar safety attributes, such as asset-backed securities (Bernanke et al., 2011; Gennaioli et al., 2013). However, the private production of safe assets can be problematic, as it induces bank liabilities to grow, potentially to the point where financial stability is endangered (Greenwood et al., 2016). Understanding the drivers of the private production of safe assets has important implications for the stability of financial markets and for the role of central banks or Treasury authorities.

In this paper, we provide novel evidence on the safety features of privately produced assets using detailed price and quantity data on more than 1.5 million issues of certificates of deposit (CD) issued by commercial banks, and commercial paper (CP) issued by non-financial institutions. Our data cover most of the European short-term debt market between 2008 and 2014. We also collect data on publicly issued Treasury bills. All these assets are reasonable candidates for safe assets: they are short term and are issued in very liquid markets by borrowers with high credit quality.

We make three contributions to the academic literature. First, we provide direct evidence that privately issued securities, even when uncollateralized, can be treated as safe by investors. The rate on these securities remains below the risk-free rate, due to a "safety premium": This premium captures the non-pecuniary benefits associated with holding a safe asset (Krishnamurthy and Vissing-Jorgensen, 2012). Second, we test formally whether the dynamics of the quantity of safe assets is causally driven by demand or supply forces. To do so, we use several identification strategies based on unexpected shocks to the demand for safe assets (e.g., oversubscribed T-bill auctions or abrupt changes in European Central Bank (ECB) collateral rules). Third, we identify types of issuers able to produce safe assets, as well as periods when the private production of safe assets stops.

Our analysis proceeds in three steps. As a first step, we assess the safety of privately produced assets based on the magnitude of their safety premium. This premium is defined as the difference between the interest rate on an asset and a reference risk-free rate. As in Sunderam (2015), we use the overnight interest rate swap rate as reference risk-free rate. We find that both public and private assets can benefit from a safety premium. However, we observe stark differences in the levels of the premia across issuer types and maturities. Public issuers enjoy a safety premium of about -15 basis points per year for one-month maturity and -7 basis points for six-month maturity. In contrast, issuers of CDs enjoy a safety premium of -8 basis points at the very short (one-week) maturity but the premium disappears at longer maturities. These premia are economically large, since the average risk-free rate over our sample period equals 40 basis points. Furthermore, the upward-sloping term structure of safety premia is consistent with the view that shorter-term instruments are less information sensitive. Additionally, we show evidence of a significant time-series variation in the safety premium. While T-bills enjoy a safety premium at all times, private assets lose their safety status in times of market stress.

As a second step, we show that private debt issuers respond to excess demand for safe assets by issuing more short-term debt. To distinguish between explanations based on demand versus supply forces, we use several sources of variation in the excess demand for safe assets. First, we rely on the idea that the safety premium on T-bills is a measure of aggregate safety demand: a large demand for safety should increase the price investors are willing to pay for the non-pecuniary benefits associated with government securities. Thus, we study whether the issuance of private safe assets is related to the level of the T-bill safety premium. We find that, on average, the relationship between net CD issuance and T-bill safety premium is statistically insignificant. However, the relationship is strongly negative and significant for CDs with very short maturities. Thus, high safety premia in T-bills only affect the demand for short-term private assets, consistent with our earlier finding that only these assets are regarded as safe.

As another source of variation in the excess demand for safe assets, we use high-frequency (weekly) changes in the quantity of public assets. Indeed, short-term variations in T-bill issuance are unlikely to be driven by the safety premium itself or, more broadly, by changes in the demand for safety. Instead, these changes reflect unexpected fluctuations in the government's cash position. We find that when the aggregate supply of T-bills goes down, the quantity of new short-term CDs goes up. Given that short-term CDs are precisely the ones with a significant safety premium, this result is consistent with the view that the shortage of publicly issued safe asset creates demand for privately issued assets with safety attributes. We then exploit the panel structure of our data and show that the negative relationship between quantities of publicly and privately produced safe assets also holds with issuer fixed effects. Hence, the observed effects are unlikely to be explained by the selection of specific private issuers with respect to availability of T-bills. Furthermore, we also show that banks respond to the increased demand for private safe assets by shortening the maturity of new issues.

While our results indicate that quantities of private assets respond to excess demand for publicly issued safe assets, there may still remain concerns that this link is not causal. Indeed, our relationship of interest may be driven by omitted variables. To allow for a cleaner identification, we use additional tests. Specifically, using variation in bid-to-cover ratio–that is, the ratio between total demand and T-bills eventually allotted–we show that the quantity of privately issued safe assets increases with the excess demand for public safe assets. Changes in bid-to-cover ratio are a meaningful measure of the excess demand for public assets and are unlikely correlated with changes in issuance of safe assets by private sector, other than through the response to the change in the demand for private safety.

As an alternative strategy, we use a shock to ECB collateral rules in 2011-2012. We show that the safety premium on short-term CDs disappears when these assets lose their pledgeability status, and are thus likely to suffer from reduced demand. Notably, this result is not driven by changes in fundamentals of these issuers. Finally, we show that the relationship between issuance of T-bills and private assets disappears when we look at commercial paper issued by non-financial firms (CP). The differences in patterns between CD and CP can be interpreted as evidence that banks maintain relationships with investors and directly cater to their demand.

As a third step, we study the time-series and cross-sectional variations of our results. We find that the negative relationship between the issuance of public and private safe assets disappears when market stress is high. This result provides empirical support for claims in the macroeconomic literature that public and private safe assets are not perfect substitutes in periods of stress (Gorton and Ordonez, 2014). Notably, the short-term debt markets we study did not experience market freezes during our sample period, consistent with Pérignon et al. (2017). Therefore, the lack of relationship between public and private issuance of assets during periods of stress cannot be due to a collapse in the supply: banks continue to borrow in the CD market. Instead, it is more in line with a demand-driven mechanism: Investors no longer perceive CDs as substitutes for T-bills.

We also study how our main effect varies in the cross-section of issuers. We show that the relationship between the issuance of public and private safe assets is stronger for issuers with larger assets and equity values, and less impaired assets. This result is consistent with the view that investors seek information-insensitive securities and do not treat securities issued by low-quality issuers as a substitute for public safe assets. Notably, we show that during periods of market stress, CD issuers with the highest credit quality are more prevalent in the data.

Our paper belongs to the fast-growing literature on safe assets, recently surveyed by Gorton (2016). Theoretically, the demand for safe assets arises from information asymmetries about the quality of the traded assets (Gorton and Pennacchi, 1990; Dang et al., 2012). Relatedly, Holmstrom and Tirole (1998) model the link between the shortage of government bonds, the liquidity premium, and production of private substitutes. Stein (2012) argues that privately issued safe assets may exert negative externalities for financial stability, which justifies the use of public asset supply as a policy tool. Krishnamurthy and Vissing-Jorgensen (2015) model the response of financial intermediaries to a shortage of government safe assets and increased convenience yield. Empirically, the vast majority of the studies examine safety in government assets (e.g., Krishnamurthy and Vissing-Jorgensen (2012), Greenwood et al. (2015), and Greenwood et al. (2016)). A smaller literature analyzes privately issued assets. Gorton et al. (2012) show that government debt and privately produced safe assets in the United States are strongly negatively correlated. Sunderam (2015) studies the determinants of aggregate net issuance of U.S. ABCP contracts prior to the 2008 crisis. Lei (2012) and Carlson et al. (2014) examine the issuance of private debt in response to changes in expected safety premium on T-bills.

2 Hypotheses development

A key premise of the theory underlying our paper is the existence of non-pecuniary benefits associated with holding of certain assets. Such benefits arise from the information insensitivity of assets (Gorton and Pennacchi, 1990; Gorton, 2016). In this sense, safety is a valuable attribute for uninformed savers/investors who fear being adversely selected in markets for risky assets, that is, fear that informed investors will buy high-quality assets and that they will be left with lemons. The information insensitivity of assets implies that they have money-like features (e.g., can easily be pledged as collateral) and are good stores of value (Nagel, 2016).

The difference between the return on an asset providing such non-pecuniary benefits and a similar asset with no such benefits is called the *safety premium*. There is evidence that government-issued securities can benefit from a safety premium (Greenwood et al., 2015), but prior research also suggests that private agents can produce safe assets, e.g., through securitization (Sunderam, 2015). However, there is no existing evidence of a safety premium on privately issued assets, and the question whether such assets can be information insensitive has proved difficult to answer so far.

Our first hypothesis relates to the safety premium on privately issued assets.

Hypothesis 1. *Privately issued assets can benefit from a safety premium. This safety premium: (i) decreases with maturity and (ii) is lower than the premium on otherwise similar publicly issued securities.*

While publicly issued assets can benefit from a safety premium because they are backed by the taxing power of governments, privately issued assets can have a safety premium if they are backed by collateral (e.g., asset-backed securities). However, we also expect a safety premium on uncollateralized securities, such as CDs, if their maturity is short enough. Indeed, a short maturity implies that a security is *de facto* senior relative to all other debt claims issued by an agent. In this sense, there are similarities between the tranching process in securitization and the issuance of short-term debt: In both cases, the allocation of early cash flows implies that securities can be made safe. Safety should therefore increase as the maturity of new issues shortens, thus explaining part *(i)* of Hypothesis 1. Part *(ii)* follows from the fact that the ability of private agents to design safe securities may be limited. For example, private short-term assets may sometimes be sensitive to news or panics.

The existence of a demand for safety, which can be satisfied either by public or private issuance, leads us to formulate:

Hypothesis 2. *Due to a demand for safety, a decrease in the issuance of public safe assets is associated with (i) a higher issuance of private safe assets and (ii) a shorter maturity of new private issues.*

Testing Hypothesis 2 raises identification concerns, which can be addressed using granular data. In theory, a negative correlation between the supply of public and private debt can arise either from standard crowding-out effects of public debt (see, Barro, 1974) or from a specific demand for safety. Hypothesis 2 highlights a mechanism arising from safety demand: When the supply of public safe assets is low, part of the safety demand is unmet, and the safety premium increases. In response, private issuers find it optimal to issue additional safe debt, as part *(i)* of the hypothesis suggests. Alternatively, private issuers may cater to safety demand by shortening the maturity of new debt securities, as part *(ii)* indicates.

Taking this mechanism as given, our next two hypotheses explore heterogeneity in the ability of private issuers to supply safe assets, both over time and in the cross-section. Starting with heterogeneity in the time series, we formulate:

Hypothesis 3. *The private sector no longer supplies substitutes for public safe assets in times of aggregate market stress.*

This hypothesis should be true if investors seek information-insensitive assets to store value. Indeed, in this case, the release of negative aggregate news can imply that uninformed investors no longer buy privately issued short-term debt without concerns about the quality of issuers (Dang et al., 2012). Instead of re-pricing debt securities based on the new information, they may simply stop demanding these assets. If public and private assets are no longer perceived as substitutes, shocks to the supply of public safe assets may no longer be compensated by the private sector. While the collapse of securitization in 2007-2008 can be interpreted as supporting Hypothesis 3, evidence at the aggregate level remains ambiguous. For example, the pool of issuers may change between calm and stress periods, for reasons unrelated to safety demand. Furthermore, it is also unclear whether all private issuers stop providing safe assets in times of stress, or whether the aggregate effect is driven by a subset of issuers.

Finally, if the demand for information-insensitive assets is an economically important component of the safety demand, we should expect to find, at any given date, a cross-sectional heterogeneity in the ability of private agents to supply safe assets. This is the object of our last hypothesis.

Hypothesis 4. *Private issuers with high credit quality are better able to produce safe assets.*

Hypothesis 4 builds on the idea that investors may not accept to lend to some issuers without concerns about their creditworthiness. De facto, such issuers are not able to cater to safe asset demand, even though debt securities issued with a short enough maturity would arguably carry very limited credit risk. Whether an issuer can produce safe assets or not should depend on publicly observable information, easily interpreted by uninformed investors.

3 Data

We build a data set with information on the issuance quantities and prices of public and private debt securities, largely originating in France, between January 1, 2008 and December 31, 2014. Our primary sample of private assets includes CDs issued by European banks whereas our main sample of public assets includes French T-bills.

3.1 Certificate of deposit

Our analysis of private assets mainly relies on certificates of deposit (CD). We obtain daily issuance data on euro-denominated CDs from the Banque de France. CDs are unsecured short-term debt securities, with maturity ranging from one day to one year. Issuance in the primary market is over-the-counter (see, Pérignon, Thesmar, and Vuillemey, 2017, for a description of this market). Our data consist of the universe of CDs issued in the French market, and represent over 80% of the global market for euro-denominated CDs.[1] More than 90% of CDs are bought by money market funds; other buyers include pension funds or insurance companies. The sample covers 271 individual issuers.

Our data include a number of security characteristics, such as the issuance and maturity dates, issuers' names, and debt amount. We further match issuance data with balance sheet and credit rating data. We obtain balance sheet data for 263 issuers from Bankscope. We retrieve variables pertaining to the banks' activity, asset quality, profitability, and capital structure. The data set contains 1,360,272 observations on 819,318 individual securities (ISINs); the difference corresponds to re-issuances on the same ISIN.

We provide details on the sample of CD issuers in Table 1. In Panel A, we present the geographic distribution of all issuers. French banks account for a significant fraction

[1] The French market is the second largest market worldwide for CDs, behind the U.S market, but ahead of the London market. It is also the largest market worldwide for CDs denominated in euros (see Banque de France, 2013).

of the European CD market: 72.3% of all issuers and 72.8% of all issuances by volume. The second largest country by volume is the U.K. followed by the Netherlands. In Panel B, we provide information related to the balance sheets of issuers. Most issuers have high Tier-1 and total regulatory capital ratios, consistent with the view that CD issuers have on average safe balance sheets. Finally, Panel C shows that CDs make up an important part of banks' balance sheets, especially relative to equity and repo funding. In terms of total liabilities, the share remains significant 10% on average.

3.2 Treasury bill

We complement our data on CDs with data on publicly issued assets. We restrict our attention to securities with maturities below one year, that is, T-bills, in order to match them with comparable privately issued securities. In our baseline analysis, we focus on French T-bills (called *Bons du Trésor à taux fixe* or *BTFs*) for the following reasons. First, the French government is the largest issuer of T-bills in the Euro area.[2] Second, most issuers in the European CD market are French. Third, CDs and French T-bills share a common investor base, primarily composed of money market funds. Fourth, the French Treasury is the only major European Treasury authority to issue one-month T-bills, which are directly comparable to CDs in terms of their maturity at origination.

We append these data with 1,141 T-bill auction results between 2008 and 2014 obtained from the *Agence France Trésor*, the government authority in charge of the management of public debt in France. T-bills are auctioned every Monday for multiple maturities. For each auction day, we record the maturity and volume of each issue and also retrieve the bid-to-cover ratio, further discussed below. Finally, for additional tests, we collect similar T-bill data from other major European sovereign issuers: Germany (*Bubills*), Italy (*BOTs*), and Spain (*Letras del Tesoro*).

[2] As of year-end 2015, the outstanding amount of French T-bills was EUR 174 Bn. In contrast, the outstanding amounts of German, Italian, and Spanish T-bills were respectively EUR 19 Bn, 122 Bn, and 82 Bn. Data on these outstanding amounts are obtained from national Treasury administrations.

3.3 Issuance of securities

We provide summary statistics on the issuance of public and private securities. In Panel A of Figure 1, we show the time-series variation in the outstanding amount of CDs and T-bills over our sample period. We see that the CD market is significantly larger than the T-bill market (EUR 369 Bn versus 169 Bn on average between 2008 and 2014). The CD market started declining in size only towards the end of our sample period, when interest rates became negative. When breaking down volumes by maturity, in Panel B, we see that short-term CDs (below one month) exhibit significant variation in total volume over time. Furthermore, among short-term CDs, securities with maturity below or equal to one week are the most prevalent. For T-bills, most have a maturity below or equal to 3 months.

In Table 2, we report additional details on the distribution of aggregate amounts of T-bill and CD outstanding (Panel A) and net issuance (Panel B). The amount outstanding varies between EUR 249 Bn and EUR 466 Bn for CDs and between EUR 78 Bn and EUR 210 Bn for T-bills. These statistics point towards significant variation in aggregated quantities. Furthermore, issuance of CDs with maturities up to 1 week also displays a strong time-series variation at a weekly frequency: CD net issuance ranges from EUR -29 Bn to EUR 27 Bn.

Finally, Panel C, shows the distribution of maturities (in days) for each asset type. Aggregating across maturities for each day, we see that the median maturity equals 154 days for T-bills and 33 days for CDs. Figure 2 illustrates the distribution of maturities more precisely. We observe significant heterogeneity in maturities, with clustering at 7 days, 30 days, or 91 days for CDs and 91 days and 365 days for T-bills.

4 How safe are privately issued assets?

In this section, we evaluate the safety attributes of public and private assets. We define safety using the concept of safety premium and measure this premium for T-bills and CDs. We show the existence of a negative safety premium on privately issued assets and discuss its term-structure properties.

4.1 Measuring safety premia

Following Krishnamurthy and Vissing-Jorgensen (2012) and Sunderam (2015), we define the safety premium on a security s as the difference between the interest rate on s, denoted r_s, and a risk-free reference rate r_f, which does not incorporate any safety premium.

$$\text{Safety premium}_s = r_s - r_f \tag{1}$$

A security is said to bear a safety premium whenever this quantity is *negative*.

While r_s is observable for each asset, the choice of the reference rate r_f is critical. We use overnight interest rate swap rates for several reasons. First, credit risk on interest rate swaps is extremely low, since no cash is exchanged upfront, and the notional amount of a swap contract is never exchanged. Moreover, interest rate swaps are typically collateralized, which further reduces credit risk. Second, the interest-rate swap market is very liquid. Therefore, both credit and liquidity premia are close to zero. Finally, the swap rate is not a rate at which investors can save, and swap contracts cannot be pledged as collateral. For these reasons, overnight interest rate swap rates are risk free but they do not benefit from any safety premium.

Specifically, we use the Euro OverNight Index Average (Eonia) swap rate for the risk-free reference rate r_f. The Eonia swap rate is the European equivalent of the Overnight Indexed Swap (OIS) rate. While OIS rates are based on Libor, Eonia swap rates are based on Eonia, that is, the average rate on all actual overnight unsecured transactions within a sample of banks.[3] An Eonia swap is an interest rate swap in which one party agrees to receive or pay a fixed rate to another party, against paying or receiving Eonia. At a given maturity, the Eonia swap rate measures the market expectation of the average overnight unsecured rate.

To measure safety premia, we collect interest rate data for French T-bills at multiple

[3] In contrast with Libor, Eonia is based on actual transaction prices.

maturities (1m, 3m, 6m, 9m, 12m) from Bloomberg. We obtain weekly data on CD interest rates at issuance from the Banque de France. These data are available by rating-maturity buckets. Finally, data on Eonia swap rates are obtained from Bloomberg at all relevant maturities. To measure safety premia, we always match a security with the Eonia swap rate of the same maturity.

4.2 Safety premia on CDs and T-bills

We begin by showing safety premia on CDs and T-bills for various maturities in Panel A of Table 3.[4] We further illustrate time-series variation in safety premia in Figure 3.

The safety premium for CDs with a one-week maturity is negative for most of the sample period, and equals on average -8.1 basis points. This indicates that very short-term private assets, even if uncollateralized, can be treated as safe by investors. Therefore, issuers of these assets borrow at a rate below the risk-free rate. Furthermore, the magnitude of the safety premium on private assets is economically large. Indeed, the average level of the risk-free rate over our sample period equals 40 basis points.

For T-bills, we see an average premium of 15 basis points for one-month T-bills. The safety premium on T-bills is negative over the entire time period, but displays significant time-series variation. The absolute value of T-bill safety premium is highest level during the Lehman crisis and in the second half of 2011 during European sovereign debt crisis. In turn, it is relatively low in the second half of 2009 and from 2013 onwards.

The results in this section are in line with Hypothesis 1: Private assets can benefit from a safety premium, but this premium is lower than that on otherwise similar public assets.

4.3 The term structure of safety premia

Next, we show evidence of an upward-sloping term structure of the safety premium, for both T-bills and CDs. For T-bills, Panel A of Table 3 shows that the difference in premia

[4] One-week T-bill rates are unavailable due to the lack of liquidity of the T-bill market for near-maturity securities. Data for 12-month CDs are too limited to compute the moments of interest.

between the shortest and longest maturities equals 12.6 basis. For CDs, this difference reaches an economically large 46.1 basis points. This upward-sloping term structure of the safety premium is consistent with theory, and Hypothesis 1: Shorter-term securities are de facto more senior, and should therefore be more information-insensitive.

This term structure has an important implication: while T-bills benefit from a safety premium throughout the entire maturity spectrum, this is not the case for CDs. Specifically, the safety premium disappears for CDs with maturities beyond one week; that is, financial institutions borrow at a positive spread over the risk-free rate. Therefore, only short-term CDs can be considered as safe in an exact sense.

Next, we examine the term structure of safety premia over time. To this end, for each maturity bucket and asset type, we estimate a time-series regression model with the safety premium as a dependent variable and a set of indicator variables for each individual year as regressors. We report the estimated coefficients in Panel B. First, the previously reported upward-sloping safety premium can be observed for almost all years, both for T-bills and CDs. Second, we observe a significant time-series variation in the magnitude of the safety premium for each maturity and asset type.[5] For T-bills, the safety premium is generally larger around periods of stress (2008 and 2011) and significantly smaller in times of relative calm.

When we estimate the safety premium for CDs, we observe that the safety premium is present only for assets with the shortest maturity of one week. With the exception of 2008, the premium is statistically significant in all years. In turn, for all other maturities, the premium switches sign and is statistically significant. The biggest retrenchment from safety can be observed in 2008, which is exactly the same time when T-bills enjoy the largest safety premium. In summary, we show that only some short-term private assets enjoy the safety premium but even they do not enjoy it at all times.

[5]To assess whether the cross-sectional patterns in safety premia may be due to difference in respective Eonia swap rates, we separately investigate the time-series variation in the rates. Figure A1 shows no significant difference across swap rates with different maturities. Hence, we conclude that the patterns in the data cannot be explained by the variation in the swap rates.

5 Private production of safe assets

In this section, we test Hypothesis 2 and show that the issuance of private short-term debt responds to the excess demand for safe public assets. To establish causality, the main empirical challenge is to appropriately measure excess demand for safe assets. We use a variety of strategies all of which give consistent results.

5.1 Evidence from the T-bill safety premium

In this section, we rely on the idea that the magnitude of the safety premium on T-bills measures the aggregate demand for safety. Indeed, a larger safety premium should indicate a larger demand for the non-pecuniary services provided by public safe assets. If this is the case, the private sector should respond to a high T-bill safety premium by issuing more money-like assets. In order to identify demand from supply, however, the main assumption is that the safety premium on T-bills is unrelated to supply conditions in the private sector.

We estimate the following regression model:

$$\Delta \log(CD)_{i,t} = \beta \cdot \mathit{Safety}_{T\text{-}bill,t-1} + \gamma \cdot \mathit{Controls}_{i,t-1} + \mu_i + \mu_t + \epsilon_{i,t}, \quad (2)$$

where we use lagged values of the T-bill safety premium as a regressor, to account for the fact that prices and quantities may both be affected by confounding factors in a given period. The vector of control variables includes $\log(CD_{t-1})$, $\Delta \log(CD_{t-1})$, $\log(T\text{-}bills_{t-1})$, and $\Delta \log(T\text{-}bills_{t-1})$. We include issuer and year-quarter fixed effects.

We present the estimates in Table 4. Starting with the aggregate relationship, in Panel A, we see that the estimate of β is not different from zero in the full sample of all CDs (col. 1). However, when we focus on CDs with maturity below one week, we find that β is negative and statistically significant (col. 4). In turn, when we restrict the sample to longer-maturity CDs, in col. (7), the results become statistically insignificant. This result indicates that only short-term CDs can be considered as substitutes to public safe assets.

A potential concern with this test is that the safety premium on T-bills may be a poor measure of excess demand for safety. This is the case if the premium correlates with supply factors affecting CD issuers. To alleviate this concern, we re-estimate Equation (2) with the safety premium on CDs as independent variable. Indeed, the safety premium on CDs should capture supply conditions in the CD market more directly than the T-bill safety premium. Results, in col. (2), (5), and (8), indicate a much weaker response of private issuers to CD safety premium. When both premia are included in the same regression (in col. (3), (6), and (9)), the coefficients of Treasury bill premia retain their significance as before. This results gives reassurance that the T-bill safety premium is a reliable measure of safety demand.

Another question is whether our result holds within a given issuer over time, or holds in aggregate due to selection effects. In Panel B of Table 4, we revisit the relationship using panel data. We restrict our sample to short-term CDs. The panel approach allows us to control for time-invariant differences across issuers using issuer fixed effects, and to control for time-varying issuer characteristics. We cluster standard errors at the week level.[6] Again, we find a negative and statistically significant effect of T-bill safety premium on the issuance of private CDs. The magnitude of the effect is twice as large as the aggregate effect. Furthermore, the impact of the CD safety premium remains statistically insignificant. Overall, the results are consistent with the hypothesis that issuers of private safe assets respond positively to an increased demand for safety.

5.2 Evidence from T-bill issuance

To provide additional evidence that private issuers cater to safety demand, we now use variation in T-bill supply as a proxy for variation in excess safety demand. The idea is that short-term variation in T-bill supply is unlikely to be related to safety demand, and more likely to reflect fluctuations in the government's cash positions. Theoretically, a decrease in the supply of T-bills should drive up the marginal value of safe assets for investors. It should increase the safety premium, as well as the private sector's incentive

[6] We have estimated the same model with other dimensions of clustering, including clustering at the issuer level, month, quarter, and double clustering at issuer and week level. The clustering at the week level gives the most conservative standard errors.

to issue CDs. To test this hypothesis, we estimate the regression model:

$$\Delta \log(CD)_t = \beta \cdot \Delta \log(\textit{T-bills})_t + \gamma \cdot Controls_{t-1} + \mu_t + \epsilon_t. \tag{3}$$

Our coefficient of interest is β, which measures the response of changes in CDs outstanding to changes in the amount of T-bills outstanding. We present the results in Panel A of Table 5.

We first estimate equation (3) using CDs with all maturities. We find that the coefficient β is not statistically different from zero, both in the univariate and multivariate models. However, the results change when we focus on short-term CDs (that is, below one week). We find that β is negative and statistically significant across specifications. Moreover, the effect is economically large. A one-standard-deviation decrease in the issuance of T-bills is associated with an increase by about 5% in the issuance of CDs, which corresponds to about 70% of the weekly standard deviation. When focusing on longer-term CD contracts (that is, above one week), we find that the coefficient switches sign. These results corroborate our earlier findings on the substitutability between public assets and short-term (but not long-term) private assets. Therefore, in the remainder of the paper, we focus our analysis on *short-term CDs*, which we define as CDs with initial maturity below or equal to one week.

As in Section 5.1, we turn to panel data to alleviate concerns that the aggregate effect may be driven by selection. We estimate:

$$\Delta \log(\textit{Short-term CD})_{i,t} = \beta \cdot \Delta \log(\textit{T-bills})_t + \gamma \cdot Controls_{i,t-1} + \mu_i + \mu_t + \epsilon_{i,t}, \tag{4}$$

by focusing on short-term CDs. Our set of control variables includes total assets (*Size*), return on assets (*ROA*), gross level of loans over assets (*Loan/Assets*), total customer deposits over assets (*Deposits/Assets*), common equity over assets (*Book Equity/Assets*), and the level of gross impaired loans over total loans (*Impaired Loans/Loans*). We include issuer fixed effects to control for time-invariant differences across issuers that could drive differences in the demand for CDs. We report the results from the estimation in Panel B.

The results show a negative and statistically significant effect of T-bill issuance on CD issuance. The effect is also economically significant: a one-standard-deviation change in T-bill issuance is associated with about 8-10% change in CD issuance at the weekly level. The results are again consistent with the hypothesis that investors substitute into short-maturity CDs at times there are less public assets to be bought in the market.

We further explore the substitutability between public and private assets depends on T-bills issued are short-term and long-term T-bills (respectively, with maturity below and above 3 months). The results, in Table 6, show that the issuance of short-term CDs is a substitute to all types of T-bills. However, the magnitude of the reaction varies markedly with T-bill maturity: It is twice as large for short-term T-bills, which suggests that issuers of private assets react more to changes in assets with similar maturity.

There are two potential alternative explanations for our results. First, it can be the case that the negative relation between public and private asset issuance is driven by a standard crowding out mechanism. This is unlikely, however, since our effect is observed only at very short maturities. Instead, a crowding out effect should operate across the entire maturity spectrum. Second, our results also unlikely to be driven by a pure "gap-filling" mechanism (Greenwood et al., 2010). Indeed, the gap-filing theory should also explain substitution at all maturities, which we do not find. Our results suggest a special mechanism at very short maturities, consistent with safety demand. Finally, if there were a particular clientele for these one-week CDs, this clientele should not be a natural buyer of T-bills, which are longer in maturity (one month being the minimum, and 3 or 6 months the most common maturities).

To conclude, our results are consistent with Hypothesis 2: Short-term CDs exhibit strong similarities to T-bills in terms of their safety and as such they are substituted into by investors at times when the issuance of public asset goes down.

5.3 Supply and demand forces

While our previous tests consistently indicate that private issuers cater to investors' demand for safety, one may worry that independent supply forces contaminate our results.

In this section, we provide additional identification of the catering effect.

Treasury auctions. In our first test, we study the response of the private market to shocks to demand in T-bills. Our shock is based on the resolution of auctions for French T-bills. Specifically, we measure excess demand for public assets using the degree of oversubscription in auctions. We define the bid-to-cover ratio as the ratio between the amount of Treasuries bid in the auction (at competitive interest rates) and the amount that is eventually alloted to investors. Higher levels of the ratio indicate a larger excess demand for safe assets that is not met by supply. To the extent that additional Treasury assets cannot be acquired, investors demanding safety may substitute into short-term CDs. The identifying assumption of this test is that changes in bid-to-cover ratio are not correlated with changes in supply of CDs other than through forces implied by the demand for safety due to rationing of public safe asset. We consider this assumption quite natural, especially when applied to our high-frequency data.

Formally, we estimate the following regression model for short-term CD contracts:

$$\Delta \log(CD)_{i,t} = \alpha + \beta \cdot \textit{Bid-to-cover}_t + \gamma \cdot \textit{Controls}_{i,t-1} + \epsilon_{i,t}. \tag{5}$$

We use the same controls and fixed effects as in the previous section. We present the results in Table 7. We find that the coefficient β is positive and statistically significant at the 5% level of significance in all our specifications. This result is consistent with the view that banks cater to investors' demand for safety by issuing more CDs when investors' access to Treasury assets is limited.

Issuers' maturity choices. In our second test, we examine whether issuers internalize the investors' choices in their maturity decisions. To the extent that investors' demand for private assets increases in times when T-bills' issuance is reduced, one should expect that private issuers would shorten the maturities of their new issues exactly at these times to serve the increased demand for safety. We test this hypothesis by looking at the share of new CDs with short maturity (below one week) among all CD issues. The results, in Table 8, show that the share of short-term assets drops at times when the issuance of public safe assets goes up. This result provides additional support to Hypothesis 2: Issuers of private safe assets respond strategically to the void that is created by reduction in availability of public safe assets by shortening the maturities of their new issues.

Commercial paper market. In our third test, we provide additional evidence for the demand-for-safety hypothesis using evidence from the commercial paper (CP) market. We study whether the qualitative aspects of our results on CDs hold when we turn to issuances of CPs. While CPs and CDs are similar in all respects in Europe (maturity, absence of collateral, types of investors), in our sample they differ in that CPs are issued by non-financial firms. To the extent that demand for all short-term assets is driven by common macroeconomic forces outside of the demand-for-safety channel we aim to identify, one would expect that our previous results for CDs should hold for CPs as well. On the other hand, if the source of the demand is directly related to the demand for safety one could expect heterogeneity in response of quantities and prices across asset types. We contrast these two possibilities using the data on French CPs.

We obtain data on CPs from the Banque de France, covering all issuance and buyback activity at a weekly frequency over our sample period. Our sample includes 123 issuers and 157,910 firm-week observations. As seen in Panel A of Table A3, 101 of these issuers are French, 19 are from other European countries, and 3 are from the United States. We match CP data with balance sheet and market data from Bloomberg. Descriptive statistics on the size, profitability and leverage of CP issuers are displayed in Panel B. Furthermore, Panel C shows that CP represents, on average, 34% of firms' short-term debt and 10% of their total debt. Furthermore, the median maturity of CP issues at a weekly frequency, weighted by volume, is 38 days, as seen in Panel A of Table 9.

In our first test, in Panel B of Table 9, we quantify the safety premium for CPs by maturity. Over the entire sample period, we find a statistically significant safety premium for one-week CPs contracts only. Its magnitude, -2.5 basis points, is smaller than that for CDs (-8.1 basis points). Further, we find a positive slope in the term structure of the CP safety premium, consistent with our results on CDs. In Panel C, we estimate the value of the premium for each year and maturity bucket between 2010 and 2014.[7] We observe a negative and statistically significant CP safety premium most of the time. We also observe an upward-sloping term structure of the safety premium in all years.

Given the small magnitude of the premium on CPs, we next study whether investors substitute into safe CPs when the public supply of safe assets goes down. We estimate the time-series and pooled regression models, similar to the ones in equations (3) and (4). In Panel A of Table 10, we report the coefficients from a time-series regression, and find no evidence of the substitutability effect previously reported for CDs. This is true even when we restrict our sample to CPs with maturity below one week (columns 3 and 4). If anything, CP demand tends to go down when the availability of T-bills goes down. We further corroborate the results using a pooled regression model, in Panel B.

In sum, although the short-maturity CPs seem to enjoy a safety premium, investors do not consider them as a substitute when the availability of T-bills decreases. The differences in patterns between CD and CP can be interpreted as evidence that banks maintain relationships with investors and directly cater to their demand. We conclude that the intermediation channel may also play an important role in the demand for safety.

The ECB collateral policy. In our final test, we shed more light on the mechanism through which private assets acquire their safety status. One of the benefits of the ownership of a safe asset is its ability to serve as collateral. The demand for pledgeability may increase the safety premium of the asset. We consider a quasi-natural experiment in which assets' collateral pledgeability function is shocked to trace its effect on the value of safety premium. Specifically, we exploit changes to the collateral policy of the ECB. While, historically, CDs in our sample have been eligible as collateral for refinancing operations of the Eurosystem, our sample period contains two important changes to the policy.

Starting in 2007, securities issued in the short-term European paper (STEP) market, including our sample CDs, have been accepted as collateral in the refinancing operations

[7] In contrast to CD rates, CP rates are not available before 2010.

of the Eurosystem.[8] Over our sample period, we observe two important changes to the ECB collateral framework. Staring from January 1, 2011, the ECB announced the debt instruments issued by credit institutions which do not trade on regulated markets (including most of our CDs) would no longer be eligible as collateral. In September 2011, the ECB reversed the policy and announced that these securities would again become eligible as collateral from January 1, 2012.

Interestingly, these policies can be considered as exogenous with respect to the CD market. Indeed, they are part of a broader revision of the ECB collateral policy. Therefore, CDs were not targeted as such, but only because they were part of "debt instruments issued by credit institutions, which are traded on the accepted non-regulated markets". Moreover, the change was not motivated by an increase in the riskiness of CD issuers, and was described only as a broader goal of making the ECB position even safer.[9] Finally, the fact that this particular aspect of the policy was repealed indicates that the CD market was not directly targeted by the policy. Instead, other reforms the ECB "General documentation" (that contains eligibility requirements), implemented on the same date, have not been repealed.

We first document the impact of these changes on the number of eligible CDs in Panel A of Figure 4. The first shock leads to a dramatic decrease in eligible CDs, which is then followed by the equal-size reversal when the policy changed again. Hence, we conclude the ECB shock is economically significant.

Subsequently, we examine changes to CD safety premium in response to these regulatory changes. In Panel B of Figure 4, we plot a time series of the CD safety premium, together with that of T-bills. We observe a strong divergence between the two quantities during the period in which eligibility was suspended. The CD premium disappears completely for most of the ineligibility period. This premium becomes again negative when eligibility as collateral is restored. In turn, the safety premium on T-bills becomes more

[8] Practically, not all STEP securities are eligible as collateral. They must also comply with additional eligibility requirements, as specified in the ECB General Documentation.

[9] See the official press release "*ECB introduces graduated valuation haircuts for lower-rated assets in its collateral framework as of 1 January 2011*" (8 April 2010) as well as the "Introductory statement with Q&A" by Jean-Claude Trichet and Lucas Papademos (ECB website).

negative in line with the increased demand for such assets at times of reduction in eligible private assets. These findings are consistent with the hypothesis that safety premium in uncollateralized private safe assets can be partly attributed to their pledgeability function.

A potential concern with the interpretation of this result is that the dynamics in safety premium may reflect the deterioration in issuers' credit quality during the same period. To address this concern, we plot in Panel C the average values of fundamentals around the policy changes. We focus on two metrics of quality: the weighted average book equity and the value of impaired loans of issuers. The results show no markedly different levels of issuers' credit quality when the ECB policy was in place. Hence, we conclude that differences in credit quality are unlikely to explain differences in safety premia. Instead, the collateral forces are a more likely explanation of the dynamics in safety premia, which suggests that apart from being informationally insensitive safe assets are also valued for their moneyness, as argued by Nagel (2016).

Overall, our findings indicate that privately issued assets can be perceived as safe by investors. When the excess demand for safety is large, banks cater to this demand either by increasing the supply of CDs or by shortening the maturity of new CDs.

6 Time-series and cross-sectional variation

The granularity of our data enables us to explore several dimensions of heterogeneity in the relation between public and private assets. In this section, we study whether investors' perception that both public and private assets have safety attributes varies over time and across issuers. We show significant heterogeneity along both dimensions, thus providing novel evidence on the issuance of safe assets.

6.1 Time-series variation

We start by examining the time-series variation in the ability of private assets to serve as a substitute for public assets. This test provides a direct evaluation of Hypothesis 3.

As a first step, we estimate equation (4) after including interactions of $\Delta \log(T\text{-}bills)$

with year indicator variables. We estimate this model using a pooled regression without a constant. The results, in Table 11, indicate a significant time-series variation in the relationship between public and private assets' issuance. The effect is negative and statistically significant in 2010 and from 2012 to 2014. However, the effect is insignificant in 2008, 2009, and 2011. Notably, the latter three years are periods of the high market turmoil, suggesting that the safety attributes of privates assets vanish in periods of stress.

We evaluate this option directly by estimating equation (4) with interaction terms between $\Delta \log(\textit{T-bills})$ and indicators of market stress. We classify periods of market stress using option implied market volatility (VIX), past returns on Euro stoxx 50 index, or Euribor-Eonia swap spread. To account for different levels of stress, we divide each measure of market stress into quartiles, based on its own conditional distribution in our sample. Our sample also covers periods of unconditionally high market stress. We report the results in Table 12.

Consistent with Hypothesis 3, we find that the relationship between changes in issuance of T-bills and issuance of CDs is most negative during periods of low market stress. In turn, the relationship is close to zero in times of high market stress, regardless of the measure used. This result suggests that privately issued safe assets are considered close substitutes to T-bills mostly at times of low aggregate market uncertainty. Notably, the CD market on which we focus did not freeze during our sample period (see Figure 1). Hence, our results cannot be attributed to a collapse in the supply of CDs. Instead, they are more consistent with a demand-driven explanation: Banks are still issuing CDs, but these securities are no longer seen by investors as a good substitute for public assets. This finding is consistent with models in which public and private safe assets are not perfect substitutes in periods of stress (Gorton and Ordonez, 2014).

6.2 Cross-sectional variation

Next, we test Hypothesis 4, that is, we study whether the relationship between public and private assets depends on the characteristics of private issuers. We focus on the following characteristics, all measured at the issuer level: asset size, equity, deposits, impaired loans, ROA, credit rating, and short-term debt. We split the distribution of each conditioning variable into quartiles to account for the possibility that the effect may be nonlinear with respect to issuer characteristics. Formally, we estimate equation (4) with interaction terms between the respective quartiles and changes in T-bill issuance.

Our results, in Table 13, indicate that the substitution effects exhibit very limited cross-sectional variation across issuers with different characteristics. Most interaction terms are insignificant. The only exception is the negative and statistically significant effect for issuers with highest level of equity, indicating that well-capitalized issuers respond more to safety demand.

In our subsequent test, we further examine whether the effect of balance sheet characteristics varies in the time series. For example, it can be that balance sheet characteristics become more relevant in times of high market stress. Therefore, we estimate the previous model by splitting our sample into observations with high and low levels of uncertainty, measured by a level of the VIX above or below its sample median. Our results, in Table 14, show that the effect of bank characteristics on the substitution between public and private assets is economically and statistically important in periods of low uncertainty (Panel A) and irrelevant in periods of high uncertainty (Panel B). In particular, we find that issuers with larger asset size, equity, ROA, and credit rating are more likely to experience the demand from investors in times of reduced T-bill demand. Furthermore, issuers with higher percentages of impaired loans exhibit significantly smaller demand than issuers for which the quantity is low. These findings are consistent with the hypothesis that investors discriminate among issuers and select those with better balance sheets, especially at times when the substitution effect is stronger. More broadly, this result suggests that studies of safe assets should focus more strongly on the underlying heterogeneity across issuer types. At a given point in time, not all issuers are considered equally safe.

Relatedly, we asses how changes in the pool of issuers changes with issuers' fundamentals. If investors know about the differences in fundamentals, we expect them to favor assets with better fundamentals, especially in periods of high market stress. We assess this hypothesis by dividing short-term CD issuers into quartiles according to following fundamentals: size, equity, percentage of impaired assets, and ROA. We further interact each quartile with two measures of market stress: VIX and Euribor-Eonia swap spread. We estimate a model with these interaction terms as regressors and $\log(1 + CD_{it})$ as dependent variable, that is, we study how the composition of the pool of issuers changes over time. We present the results in Table 15.

Our results are consistent with the hypothesis that investors shun assets with poor fundamentals during periods of high market stress, consistent with Pérignon et al. (2017). We observe that issuers with smaller assets and higher values of impaired loans tend to enjoy lower issuance at times of higher volatility. The opposite, however, is true for issuers with low equity values and low ROA. In turn, good fundamentals do not decrease issuance in periods of high market stress. While the results are not robust across all specifications, they indicate that investors do not consider private assets as equally safe at all times. Therefore, the findings lend support to Hypothesis 4.

6.3 Robustness

In this section, we provide various robustness tests. Our tests rely on the fact that the safety premium on an asset captures a demand for safety. An potential alternative interpretation could be that safety premia reflect time-varying differences in assets' liquidity. While the direct measurement of liquidity premia is beyond the scope of our paper and data, an indirect test we employ is to relate safety premia to the quantity of assets outstanding. Since the quantity of issued assets correlates with their liquidity, we expect the liquidity premia to subsequently decrease. If safety premia capture liquidity premia, they should also decrease. We test this possibility separately for T-bills, CDs, and CPs, and present the results in Table A4. Across all specifications, we do not find a statistically significant effect of asset liquidity on safety premia. Thus, while liquidity may explain part of the magnitude of the premia, it is unlikely to be the sole driver of our results.

Next, we provide robustness checks based on alternative samples and with additional controls. First, all our bank-level results hold after including time-varying measures of balance sheet quality as regressors. Second, our results also hold when restricting attention to French banks only, which dominate CD issuances in our sample (see, Appendix Table A5). Our results also continue to hold if we include German T-bills, which also bear a safety premium, in our measure of the supply of public safe assets (see, Appendix Table A6). Instead, we show that the negative relation between the supply of public and private safe assets does not prevail when using as independent variable the supply of Italian or Spanish T-bills, which do not bear a safety premium.[10] This result gives further reassurance that the effects we identify are due to safety demand rather than a more general gap-filling or crowding-out mechanism.

7 Conclusion

We study the private production of safe assets. We show that privately issued securities can benefit from a safety premium if their maturity is very short. Consistent with the existence of a demand for safe stores of value, we show that the private sector issues more safe securities when the supply of public safe assets is lower. Importantly, we study the heterogeneity in the relation between public and private issuance of safe assets, both over time and in the cross-section. Studying heterogeneity is useful to distinguish between two potential drivers of safety demand–the demand for money-like instruments versus the demand for information-insensitive stores of value. We show that the private production of safe assets breaks down in times of high market stress. Finally, we show that the production of safe assets is driven by banks, not by non-financial firms. Among banks, high-quality institutions are more likely to provide safe assets. Overall, these results are consistent with investors seeking information-insensitive stores of value.

Our results offer potentially important policy implications. The finding that the private production of safe assets can break down in periods of stress implies that public and private safe assets are not perfect substitutes. Thus, one can observe an over-production of private safe assets in good times. The reliance on the financial system on such assets

[10]In Panel C of Figure 3, we show safety premia for T-bills originating in Germany (left panel), Italy, and Spain (right panel). German T-bills benefit from a large safety premium while the other two T-bills carry a risk premium over most of our sample period.

becomes problematic when supply of public safety vanishes. As outlined by Greenwood et al. (2015), the Treasury can correct externalities associated with the private production of safe assets by tilting issuances towards short maturities. Monetary policy can also play a role, and thereby contribute to a greater financial stability, as Stein (2012), Gourinchas and Jeanne (2012) and Greenwood et al. (2016) argue. Finally, our results can shed some light on the response of the private sector to changes in safe asset supply due to launching or tapering monetary easing programs.

References

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*.

Barro, R. J. (1974). Are government bonds net wealth? *Journal of Political Economy 82*, 1095–1117.

Bernanke, B. S., C. Bertaut, L. Pounder De Marco, and S. Kamin (2011). International capital flows and the returns to safe assets in the United States, 2003-2007. *Working paper*.

Caballero, R. J. (2006). On the macroeconomics of asset shortages. *Working paper*.

Caballero, R. J. and E. Farhi (2017). The safety trap. *Review of Economic Studies* (forthcoming).

Carlson, M., B. Duygan-Bump, F. Natalucci, W. Nelson, M. Ochoa, J. Stein, and S. Van den Heuvel (2014). The demand for short-term, safe assets, and financial stability: Some evidence and implications for central bank policies. *International Journal of Central Banking 2014-102*.

Dang, T. V., G. Gorton, and B. Holmström (2012). Ignorance, debt and financial crises. *Working paper*.

Gennaioli, N., A. Shleifer, and R. W. Vishny (2013). A model of shadow banking. *Journal of Finance 68*, 1331–1363.

Gorton, G. (2016). The history and economics of safe assets. *Working paper*.

Gorton, G., S. Lewellen, and A. Metrick (2012). The safe-asset share. *American Economic Review Papers & Proceedings 102*, 101–106.

Gorton, G. and G. Ordonez (2014). Collateral crises. *American Economic Review 104*, 343–378.

Gorton, G. and G. Pennacchi (1990). Financial intermediaries and liquidity creation. *Journal of Finance 45*, 49–71.

Gourinchas, O. and O. Jeanne (2012). Global safe assets. *Working paper*.

Greenwood, R., S. G. Hanson, and J. C. Stein (2010). A gap-filling theory of corporate debt maturity choice. *Journal of Finance 65*, 993–1028.

Greenwood, R., S. G. Hanson, and J. C. Stein (2015). A comparative-advantage approach to government debt maturity. *Journal of Finance 70*, 1683–1722.

Greenwood, R., S. G. Hanson, and J. C. Stein (2016). The Federal Reserve's balance sheet as a financial-stability tool. *Working paper*.

Holmstrom, B. and J. Tirole (1998). The private and public supply of liquidity. *Journal of Political Economy 106*, 1–40.

Krishnamurthy, A. and A. Vissing-Jorgensen (2012). The aggregate demand for treasury debt. *Journal of Political Economy 120*, 233–267.

Krishnamurthy, A. and A. Vissing-Jorgensen (2015). The impact of treasury supply on financial sector lending and stability. *Journal of Financial Economics 118*, 571–600.

Lei, X. (2012). The seasons of money: ABS/MBS issuance and the convenience yield. *Working paper*.

Nagel, S. (2016). The liquidity premium on near-money assets. *Quarterly Journal of Economics* (forthcoming).

Pérignon, C., D. Thesmar, and G. Vuillemey (2017). Wholesale funding dry-ups. *Journal of Finance* (forthcoming).

Stein, J. C. (2012). Monetary policy as financial stability regulation. *Quarterly Journal of Economics 127*, 57–95.

Sunderam, A. (2015). Money creation and the shadow banking system. *Review of Financial Studies 28*, 939–977.

Table 1 – Description of the sample of CD issuers

This table describes the sample of CD issuers. Panel A shows the share of issuers and CD amounts issued by country. Panel B provides descriptive statistics on the distribution of balance sheet characteristics of CD issuers. Means and quantiles are as of end of December of each year and are computed from the pooled sample over the period from 2008 to 2014. Panel C 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.

Panel A: Geographic description of issuers

	Banks		Banking groups		% Issued	
	# issuers	% Issuers	# issuers	% Issuers	amount	Largest issuer
All	271	100.00	128	100.00	100.00	—
Austria	2	0.74	2	1.56	0.20	Oesterreich. Kontrollbank
Belgium	2	0.74	2	1.56	6.26	Dexia Credit Local
Denmark	3	1.11	3	2.34	0.56	Jyske Bank
France	196	72.32	53	41.41	72.83	BNP Paribas
Germany	12	4.43	12	9.38	1.08	HypoVereinsbank
Ireland	7	2.58	7	5.47	0.48	Allied Irish Banks
Italy	14	5.17	14	10.94	3.18	Unicredit
Netherlands	8	2.95	8	6.25	5.42	Rabobank
Spain	2	0.74	2	1.56	0.58	BBVA
Sweden	4	1.48	4	3.13	0.89	Svenska Handelsbanken
Switzerland	2	0.74	2	1.56	0.44	UBS
UK	11	4.06	11	8.59	7.36	HSBC
Others	8	2.95	8	6.25	1.12	—

Panel B: Balance sheet characteristics

	10th	25th	Mean	Median	75th	90th	Std.	Obs.
Size (log Total assets)	20.82	22.07	23.50	23.34	24.71	26.70	2.09	1,449
Loans / Assets	0.27	0.48	0.63	0.69	0.82	0.88	0.23	1,445
Customer deposits / Assets	0.03	0.20	0.37	0.35	0.57	0.66	0.23	1,422
Short-term debt / Assets	0.05	0.13	0.29	0.24	0.48	0.60	0.21	1,422
ROA (%)	-0.20	0.15	0.32	0.40	0.74	1.04	1.15	1,443
ROE (%)	-3.88	2.52	3.57	5.42	8.32	13.27	12.36	1,443
Net interest margin / Assets	0.00	0.01	0.01	0.01	0.02	0.03	0.01	1,411
Impaired loans / Loans (%)	1.04	2.24	5.42	3.91	6.59	11.89	5.08	1,056
Impaired loans / Equity (%)	8.46	17.33	58.72	38.39	73.17	135.54	64.34	1,071
Equity / Assets	0.03	0.04	0.08	0.07	0.11	0.13	0.05	1,449
Tier 1 capital (%)	7.60	9.20	13.07	11.20	14.30	18.25	7.29	458
Total regulatory capital (%)	9.90	11.60	16.12	13.70	16.91	21.4	10.27	486

Panel C: Size of CD funding

	10th	25th	Mean	Median	75th	90th	Std.	Obs.
CD / Equity	0.01	0.05	1.17	0.21	0.69	2.25	0.33	971
CD / (CD + Repo)	0.01	0.05	0.34	0.22	0.61	0.85	0.39	218
CD / Short-term debt	0.00	0.01	0.16	0.05	0.18	0.49	0.23	971
CD / Total liabilities	0.00	0.01	0.09	0.03	0.09	0.22	0.10	1,007

Table 2 – Descriptive statistics on short-term debt securities

This table describes our data on the issuance of short-term debt securities. The universe of assets includes T-bills issued by the French Treasury and CDs issued by European banks. Panel A shows the amount of securities outstanding. Panel B shows net issuances, defined as the change in outstanding amounts between Fridays of two consecutive weeks. Panel C shows the maturity of new issues, measured in days, both unweighted and weighted by the amount of the issue. Unweighted moments are computed based on the sample of all issuances. Weighted moments are computed as averages by day. Short-term CDs are defined as those with maturity below or equal to 7 days at issuance.

Panel A: Aggregate T-bill and CD amounts outstanding (in EUR Billion)

	Min	10pc	25pc	Median	Mean	75pc	90pc	Max	Std.	Obs.
Total T-bill outstanding	78.4	111.6	165.6	174.6	167.4	183.4	196.4	209.9	29.7	365
Total CD outstanding	248.9	285.3	340.2	373.8	369.7	412.2	433.0	465.9	52.5	365
Short-term CD outstanding	1.0	9.1	19.1	31.2	30.8	40.9	50.6	75.2	15.7	365

Panel B: Aggregate T-bill and CD net issuance (in EUR Billion)

	Min	10pc	25pc	50pc	Mean	75pc	90pc	Max	Std.	Obs.
Total T-bill net issuance	-15.2	-1.3	-0.5	0.0	0.3	1.2	2.3	5.9	1.8	364
Total CD net issuance	-29.0	-7.0	-3.7	-0.3	-0.4	3.0	7.1	26.9	6.5	364
Short-term CD net issuance	-28.4	-7.7	-4.2	-0.1	-0.2	3.8	7.1	29.6	7.2	364

Panel C: Maturity of new issues (in days)

	Min	10pc	25pc	50pc	Mean	75pc	90pc	Max	Std.	Obs.
Pooled data										
T-bill	7	84	91	154	185	337	357	365	111	1,145
CD	1	2	13	33	66	92	181	367	76	841,636
Volume weighted (daily)										
T-bill	53	129	154	164	161	173	182	227	23	359
CD	5	13	18	26	40	39	79	365	44	2,185

Table 3 – Safety premium on T-bills and CDs

This table displays the safety premium on T-bills and CDs with maturities between one week and one year. The safety premium is defined by equation (1). In Panel A, the safety premium is computed over the whole sample period (2008-2014) for each maturity. In each sub-panel, the last column shows the difference between the safety premium at the longest and at the shortest available maturity. In Panel B, we regress the safety premium on a set of indicator variables for each individual year. Standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Whole sample period

	T-bills					CD				
	1m	3m	6m	12m	12m - 1m	1w	1m	3m	6m	6m - 1w
	-0.150***	-0.120***	-0.068***	-0.023***	0.126***	-0.081***	0.115***	0.239***	0.374***	0.461***
	(0.007)	(0.007)	(0.005)	(0.005)	(0.007)	(0.005)	(0.036)	(0.024)	(0.025)	(0.025)
Obs.	338	338	338	338	338	338	338	338	338	338

Panel B: By year

	1m	3m	6m	12m	12m - 1m	1w	1m	3m	6m	6m - 1w
2008	-0.168***	-0.162***	-0.077***	-0.029***	0.138***	0.040***	0.372***	0.639***	1.216***	1.196***
	(0.014)	(0.015)	(0.010)	(0.011)	(0.016)	(0.014)	(0.112)	(0.069)	(0.072)	(0.074)
2009	-0.089***	-0.039***	0.010	0.030***	0.120***	-0.164***	0.072	0.318***	0.394***	0.558***
	(0.014)	(0.015)	(0.010)	(0.011)	(0.016)	(0.011)	(0.088)	(0.054)	(0.050)	(0.050)
2010	-0.151***	-0.138***	-0.097***	-0.072***	0.078***	-0.115***	0.048	0.089	0.197***	0.312***
	(0.014)	(0.015)	(0.010)	(0.011)	(0.016)	(0.011)	(0.088)	(0.054)	(0.050)	(0.050)
2011	-0.278***	-0.220***	-0.133***	-0.049***	0.229***	-0.059***	0.374***	0.352***	0.404***	0.464***
	(0.014)	(0.015)	(0.010)	(0.011)	(0.016)	(0.011)	(0.088)	(0.054)	(0.050)	(0.050)
2012	-0.189***	-0.161***	-0.113***	-0.047***	0.142***	-0.091***	0.010	0.237***	0.443***	0.535***
	(0.014)	(0.015)	(0.010)	(0.011)	(0.016)	(0.011)	(0.088)	(0.054)	(0.050)	(0.050)
2013	-0.077***	-0.056***	-0.039***	-0.003	0.074***	-0.058***	-0.024	0.054	0.108**	0.167***
	(0.014)	(0.015)	(0.010)	(0.011)	(0.016)	(0.011)	(0.088)	(0.054)	(0.050)	(0.050)
2014	-0.042**	-0.007	0.012	0.031**	0.073***	-0.072***	-0.020	0.044	0.231***	0.303***
	(0.019)	(0.021)	(0.013)	(0.015)	(0.022)	(0.016)	(0.126)	(0.076)	(0.069)	(0.051)
R^2	0.735	0.615	0.599	0.232	0.584	0.604	0.068	0.361	0.627	0.673
Obs.	338	338	338	338	338	338	338	338	338	338

Table 4 – CD issuance and T-bill safety premium

In this table, we regress changes in the natural logarithm of CDs outstanding on either the T-bill or the CD safety premium. Panel A estimates time-series regressions, where issuances are aggregated across issuers, while Panel B uses panel data. The T-bill and CD safety premia are computed using Equation (1), where we use the Eonia swap rate as the risk-free rate r_f. Observations are at a weekly frequency. Short-term (resp. long-term) CDs are defined as having a maturity below or equal to (resp. above) 7 days at issuance. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Time-series evidence

	Dependent variable: $\Delta\log(\text{CD}_t)$								
	All CD issues			Short-term CDs			Long-term CDs		
$\text{Safety}_{\text{T-bill},t-1}$	-0.013		-0.011	-0.263***		-0.210***	0.004		0.005
	(0.012)		(0.012)	(0.069)		(0.073)	(0.018)		(0.018)
$\text{Safety}_{\text{CD},t-1}$		0.000	0.003		-0.070	-0.012		0.006	0.004
		(0.033)	(0.033)		(0.318)	(0.324)		(0.906)	(0.052)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.278	0.289	0.292	0.221	0.229	0.236	0.231	0.240	0.240
Obs.	336	336	336	336	336	336	336	336	336
FE	YQ	YQ	YQ	YQ	YQ	YQ	YQ	YQ	YQ

Panel B: Panel evidence

	Dependent variable: $\Delta\log(\text{Short-term CD}_{i,t})$						
$\text{Safety}_{\text{T-bill},t-1}$	-0.254***	-0.272*	-0.321**	-0.276*	-0.328**		-0.339**
	(0.077)	(0.150)	(0.160)	(0.152)	(0.164)		(0.166)
$\text{Safety}_{\text{CD},t-1}$						0.262	0.335
						(0.330)	(0.332)
Controls	No	No	Yes	No	Yes	Yes	Yes
R^2	0.001	0.002	0.003	0.002	0.003	0.004	0.004
Obs.	16,091	16,091	14,349	16,091	14,349	14,349	14,349
FE	-	YQ	YQ	I, YQ	I, YQ	I, YQ	I, YQ

Table 5 – CD issuance and T-bill issuance

In this table, we regress the change in log CDs outstanding on the change in log T-bills outstanding. The data are at a weekly frequency. Short-term (resp. long-term) CDs are defined as having a maturity below or equal to (resp. above) 7 days at issuance. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The data in Panel A aggregate CD issuances of all sample banks in a given week. The time period is from January 2008 to July 2014. Robust standard errors (Panel A) and standard errors clustered at the week level (Panel B) are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Time-series evidence

	Dependent variable: $\Delta\log(\text{CD}_t)$					
	All CD		Short-term CD		Long-term CD	
$\Delta\log(\text{T-bills}_t)$	0.073	0.085	-2.696**	-2.832***	0.482**	0.370**
	(0.116)	(0.132)	(1.128)	(0.868)	(0.197)	(0.179)
$\log(\text{CD}_{t-1})$		-0.176***		-0.515***		-0.212***
		(0.031)		(0.090)		(0.033)
$\Delta\log(\text{CD}_{t-1})$		0.268***		0.117		0.119**
		(0.055)		(0.095)		(0.052)
$\log(\text{T-bills}_{t-1})$		-0.133		-0.658**		-0.039
		(0.115)		(0.824)		(0.125)
$\Delta\log(\text{T-bills}_{t-1})$		-0.057**		-1.562*		-0.073
		(0.029)		(0.257)		(0.044)
R^2	0.132	0.276	0.031	0.221	0.109	0.234
Obs.	342	341	342	341	342	341
FE	YQ	YQ	YQ	YQ	YQ	YQ

Panel B: Panel evidence

	Dependent variable: $\Delta\log(\text{Short-term CD}_{i,t})$					
$\Delta\log(\text{T-bills}_t)$	-2.772***	-3.732***	-4.534***	-3.599***	-4.208***	-5.076***
	(0.817)	(1.043)	(1.109)	(1.284)	(1.340)	(1.424)
Size				0.046	-0.004	0.051
				(0.102)	(0.108)	(0.108)
ROA				-0.163	-0.039	-0.119
				(0.192)	(0.199)	(0.199)
Loans / Assets				0.316	0.074	0.306
				(0.285)	(0.290)	(0.290)
Deposits / Assets				-0.404	-0.034	-0.156
				(0.227)	(0.249)	(0.249)
Book equity / Assets				-1.894	-0.206	-1.441
				(1.748)	(1.852)	(1.854)
Impaired loans / Loans				0.001	0.001	0.004
				(0.011)	(0.012)	(0.012)
Controls	No	No	Yes	Yes	No	Yes
R^2	0.001	0.004	0.003	0.002	0.005	0.006
Obs.	16,083	16,083	16,007	9,870	9,906	9,870
FE	I	YQ	I, YQ	I	I, YQ	I, YQ

Table 6 – CD issuance and T-bill issuance by maturity

In this table, we regress changes in log CDs outstanding on changes in log T-bills outstanding. We break down the supply of CD and T-bills in two maturity buckets. Observations are at a weekly frequency and aggregate CD issuances of all sample banks. Short-term (resp. long-term) CDs are defined as having a maturity below or equal to (resp. above) 7 days at issuance. Short-term (resp. long-term) T-bills are defined as having a maturity below or equal to (resp. above) 3 months at issuance. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable:			
	$\Delta\log(\text{Short-term CD}_{i,t})$		$\Delta\log(\text{Long-term CD}_{i,t})$	
$\Delta\log(\text{T-bills Short-term}_t)$	-1.048***		0.284***	
	(0.251)		(0.071)	
$\Delta\log(\text{T-bills Long-term}_t)$		-0.540**		0.008
		(0.035)		(0.029)
Controls	Yes	Yes	Yes	Yes
R^2	0.004	0.009	0.002	0.003
Obs.	16,007	16,007	16,007	16,007
FE	I, YQ	I, YQ	I, YQ	I, YQ

Table 7 – CD issuance and T-bill bid-to-cover ratio

In this table, we regress changes in log short-term CDs outstanding at the bank level on the weighted average bid-to-cover ratio for French T-bills. Observations are at the bank-week level. Short-term CDs are defined as having a maturity below or equal to 7 days at issuance. Control variables include: $\log(\text{CD}_{i,t-1})$, $\Delta\log(\text{CD}_{i,t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\Delta\log(\text{Short-term CD}_{i,t})$				
Bid-to-cover_t	0.043**	0.052**	0.046**	0.053**	0.048**
	(0.018)	(0.022)	(0.022)	(0.022)	(0.022)
Controls	No	No	Yes	No	Yes
R^2	0.000	0.003	0.004	0.003	0.004
Obs.	15,506	15,506	15,506	15,430	15,430
FE	-	YQ	YQ	I, YQ	I, YQ

Table 8 – CD maturity and T-bill issuance

In this table, we regress the share of CDs issued with maturity below one week on changes in log T-bills outstanding. Observations are at the bank-week level. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects, respectively. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: Share of CDs issued with maturity below 1 week				
$\Delta\log(\text{T-bills}_t)$	0.115	-0.467**	-0.507**	-0.468***	-0.509***
	(0.164)	(0.214)	(0.227)	(0.148)	(0.157)
Controls	No	No	Yes	No	Yes
R^2	0.000	0.010	0.010	0.027	0.027
Obs.	45,046	45,046	44,695	45,046	44,695
FE	-	YQ	YQ	I, YQ	I, YQ

Table 9 – Descriptive statistics and safety premium on CPs

This table shows descriptive statistics on issuance in the CP market and on the CP safety premium. Panel A shows the amount of securities outstanding, net issuances, and the maturity of new issues, measured in days. These moments are defined as in Table 2. Panel B and C describe the safety premium on CP, defined by Equation (1). Short-term CDs are defined as those with maturity below or equal to 7 days at issuance. Standard errors are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: CP amounts outstanding, net issuance and maturity

	Min	10pc	25pc	Median	Mean	75pc	90pc	Max	Std.	Obs.
Aggregate amount outstanding										
Total (in Bn)	29.8	37.7	40.4	44.1	50.8	52.9	80.3	89.7	15.3	365
1-week (in Bn)	0.1	0.2	0.5	1.5	3.3	4.3	8.8	19.2	4.1	365
Aggregate net issuance										
Total (in Bn)	-32.7	-1.6	-0.6	0.06	-0.0	0.78	1.4	31.3	2.8	364
1-week (in Bn)	-10.5	-1.3	-0.4	-0.0	-0.0	0.3	1.3	8.3	1.5	364
Maturity of new issues										
Pooled data	1	2	7	25	60	70	150	365	76	157,909
Volume-weighted	9	21	28	38	42	55	68	120	19	502

Panel B: Safety premium - whole sample period

	1w	1m	3m	6m	6m - 1w
	-0.025***	0.159***	0.201***	0.157***	0.180***
	(0.006)	(0.011)	(0.008)	(0.020)	(0.020)
R^2	0.069	0.445	0.728	0.204	0.247
Obs.	233	233	233	233	233

Panel C: Safety premium - by year

	1w	1m	3m	6m	6m - 1w
2010	-0.007	0.103***	0.182***	0.101**	0.108***
	(0.012)	(0.024)	(0.015)	(0.042)	(0.043)
2011	-0.041***	0.190***	0.286***	0.128***	0.162***
	(0.012)	(0.024)	(0.015)	(0.042)	(0.043)
2012	-0.043***	0.203***	0.216***	0.174***	0.217***
	(0.012)	(0.024)	(0.015)	(0.042)	(0.043)
2013	-0.023*	0.139***	0.130***	0.156***	0.180***
	(0.012)	(0.024)	(0.015)	(0.042)	(0.043)
2014	0.007	0.158***	0.178***	0.288***	0.281***
	(0.017)	(0.034)	(0.021)	(0.049)	(0.061)
R^2	0.091	0.461	0.777	0.215	0.254
Obs.	233	233	233	233	233

Table 10 – CP issuance and T-bill issuance

In this table, we regress changes in log CPs outstanding on changes in log T-bills outstanding. Observations are at a weekly frequency and aggregate CP issuances of all sample firms. One-week CPs are defined as having a maturity below or equal to 7 days at issuance. Control variables include: $\log(\text{CP}_{t-1})$, $\Delta\log(\text{CP}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. YQ denotes year-quarter fixed effects. The time period is from January 2008 to July 2014. Robust standard errors (Panel A) and standard errors clustered at the week level (Panel B) are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Time-series evidence

	Dependent variable: $\Delta\log(\text{CP}_t)$					
	All CP		Short-term CP		Long-term CP	
$\Delta\log(\text{T-bills}_t)$	2.014	4.990*	7.019	2.378	2.098	8.717***
	(3.065)	(2.547)	(4.276)	(3.075)	(4.713)	(3.104)
$\log(\text{CP}_{t-1})$		-0.820***		-0.523***		-1.001***
		(0.088)		(0.079)		(0.071)
$\Delta\log(\text{CP}_{t-1})$		0.111*		-0.043		0.183***
		(0.063)		(0.071)		(0.057)
$\log(\text{T-bills}_{t-1})$		-0.840		0.118		-1.508**
		(2.398)		(3.537)		(2.679)
$\Delta\log(\text{T-bills}_{t-1})$		-2.630		2.316		-2.258
		(0.547)		(0.742)		(0.699)
R^2	0.019	0.397	0.030	0.289	0.023	0.486
Obs.	342	341	342	341	342	341
FE	YQ	YQ	YQ	YQ	YQ	YQ

Panel B: Panel evidence

	Dependent variable: $\Delta\log(\text{Short-term CP}_{i,t})$				
$\Delta\log(\text{T-bills}_t)$	2.552	4.107	2.469	5.026***	3.398*
	(2.116)	(2.502)	(2.708)	(1.647)	(1.850)
Controls	No	No	Yes	No	Yes
R^2	0.001	0.007	0.027	0.008	0.028
Obs.	2,063	2,063	2,051	2,063	2,051
FE	-	YQ	YQ	I, YQ	I, YQ

Table 11 – CD issuance and T-bill issuance by year

In this table, we regress changes in log CDs outstanding on changes in log T-bills outstanding. Observations are at a weekly frequency and in the pooled sample of CD issuers. Short-term CDs are defined as having a maturity below or equal to 7 days at issuance. Control variables include: $\log(CD_{t-1})$, $\Delta\log(CD_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\Delta\log(\text{Short-term } CD_{i,t})$		
$\Delta\log(\text{T-bills}_t) * 2008$ dummy	-2.430**	-2.084	-3.750**
	(1.171)	(1.634)	(1.787)
$\Delta\log(\text{T-bills}_t) * 2009$ dummy	-0.498	-2.704	-2.605
	(1.580)	(2.141)	(2.149)
$\Delta\log(\text{T-bills}_t) * 2010$ dummy	-7.626***	-9.989***	-10.242***
	(2.617)	(3.016)	(3.016)
$\Delta\log(\text{T-bills}_t) * 2011$ dummy	0.951	2.082	1.491
	(3.069)	(4.017)	(4.029)
$\Delta\log(\text{T-bills}_t) * 2012$ dummy	-3.241**	-3.972**	-3.520**
	(1.328)	(1.425)	(1.134)
$\Delta\log(\text{T-bills}_t) * 2013$ dummy	-6.168**	-6.786**	-7.739**
	(2.112)	(2.147)	(2.158)
$\Delta\log(\text{T-bills}_t) * 2014$ dummy	-9.787**	-9.656**	-9.849***
	(3.790)	(3.658)	(3.811)
Controls	No	No	Yes
R^2	0.001	0.004	0.005
Obs.	16,083	16,083	16,007
FE	I	I, YQ	I, YQ

Table 12 – CD issuance and T-bill issuance conditional on measures of stress

In this table, we regress changes in log short-term CDs outstanding at the bank level on changes in log T-bills outstanding, interacted with measures of market stress. Short-term CDs are defined as having a maturity below or equal to 7 days at issuance. Observations are at the bank-week level. The baseline coefficients are for "Low stress" periods, defined as a VIX, 50-days past stock returns on the Euro stoxx 50, or the Euribor-Eonia swap spread in their first quartile over the sample period. Other interaction terms are for the three top quartiles. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. Each regression also includes fixed effects associated with quartiles of the market stress variable used to construct interaction terms. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\Delta\log(\text{Short-term CD}_{i,t})$					
	VIX		Past returns Euro stoxx 50		Euribor - Eonia swap spread	
$\Delta\log(\text{T-bills}_t)$	-11.188***	-11.891***	-7.477***	-8.179***	-6.861**	-7.403**
	(3.263)	(3.295)	(2.060)	(2.076)	(3.099)	(3.097)
$\Delta\log(\text{T-bills}_t)$ ∗ Mid-low stress	2.666	2.927	-2.970	-2.108	-2.219	-1.728
	(4.548)	(4.544)	(3.355)	(3.363)	(3.969)	(3.969)
$\Delta\log(\text{T-bills}_t)$ ∗ Mid-high stress	7.218**	7.096**	4.584*	4.357	3.651	3.640
	(3.663)	(3.660)	(2.754)	(2.772)	(3.646)	(3.670)
$\Delta\log(\text{T-bills}_t)$ ∗ High stress	10.322***	10.074***	7.459***	7.359***	4.568	3.875
	(3.568)	(3.573)	(2.587)	(2.631)	(3.371)	(3.386)
Controls	No	Yes	No	Yes	No	Yes
R^2	0.004	0.005	0.004	0.006	0.004	0.005
Obs.	16,083	16,007	16,083	16,007	15,901	15,825
FE	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ

Table 13 – CD issuance and T-bill issuance, interacted with balance sheet quartiles

In this table, we regress changes in log short-term CDs outstanding at the bank level on changes in log T-bills outstanding, interacted with balance sheet characteristics. Observations are at the bank-week level. Short-term CDs are defined as having a maturity below or equal to 7 days at issuance. Bank-level control variables include: Size, Net income / Assets, ROA, Loans / Assets, Deposits / Assets, Total equity / Assets, and Impaired loans / Total loans. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. Each regression also includes fixed effects associated with quantiles (above or below median) of the balance sheet variable used to construct interaction terms. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\Delta\log(\text{Short-term CD}_{i,t})$						
Independent variable:	Size	Equity	Deposits	Impaired	ROA	Rating	ST debt
$\Delta\log(\text{T-bills}_t)$	-5.312	-4.575**	-5.190**	-4.836**	-3.998*	-4.694*	-4.308*
	(3.324)	(1.903)	(2.459)	(1.939)	(2.168)	(2.483)	(2.302)
$\Delta\log(\text{T-bills}_t) * \text{Q2}$	1.711	1.009	0.283	0.697	-0.449	-0.936	-0.072
	(4.145)	(2.477)	(3.135)	(2.899)	(2.784)	(2.818)	(2.835)
$\Delta\log(\text{T-bills}_t) * \text{Q3}$	-2.664	-0.708	-0.990	-0.786	-1.789	-11.926	0.478
	(3.873)	(3.361)	(2.926)	(2.775)	(2.832)	(7.902)	(2.872)
$\Delta\log(\text{T-bills}_t) * \text{Q4}$	1.385	-6.819*	2.857	-1.014	-3.634	-8.281	-9.294**
	(3.541)	(4.022)	(3.523)	(3.510)	(4.020)	(12.915)	(4.304)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.007	0.007	0.007	0.007	0.007	0.008	0.007
Obs.	9,870	9,870	9,870	9,870	9,870	7,629	9,870
FE	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ

Table 14 – CD issuance and T-bill issuance, interacted with balance sheet quartiles: High and low VIX periods

In this table, we regress changes in log short-term CDs outstanding at the bank level on changes in log T-bills outstanding, interacted with balance sheet characteristics. In Panels A and B, we restrict attention to, respectively, low VIX and high VIX periods. "Low VIX" and "High VIX" are defined as levels of the VIX above or below the sample median. Observations are at the bank-week level. Short-term CDs are defined as having a maturity below or equal to 7 days at issuance. Bank-level control variables include: Size, Net income / Assets, ROA, Loans / Assets, Deposits / Assets, Total equity / Assets, and Impaired loans / Total loans. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. Each regression also includes fixed effects associated with quartiles of the balance sheet variable used to construct interaction terms. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable: $\Delta\log(\text{Short-term CD}_{i,t})$

Panel A: Low VIX periods only

	Size	Equity	Deposits	Impaired	ROA	Rating	ST debt
$\Delta\log(\text{T-bills}_t)$	-0.953	-10.739***	-9.624**	-13.268***	-9.871**	-11.181***	-10.404**
	(9.408)	(3.797)	(4.855)	(3.748)	(4.818)	(4.283)	(5.006)
$\Delta\log(\text{T-bills}_t) * Q2$	0.048	6.091	-5.270	9.974**	2.145	1.025	-0.880
	(10.820)	(5.430)	(6.616)	(6.036)	(6.102)	(4.526)	(6.440)
$\Delta\log(\text{T-bills}_t) * Q3$	-15.450	2.046	1.546	-2.993	-0.288	-1.837	7.282
	(10.559)	(7.648)	(6.044)	(6.544)	(6.331)	(5.527)	(6.330)
$\Delta\log(\text{T-bills}_t) * Q4$	-10.763	-18.288**	2.717	13.475	-10.587	-4.699	-14.718*
	(9.811)	(9.339)	(8.830)	(8.216)	(9.766)	(13.798)	(8.467)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.016	0.016	0.016	0.016	0.015	0.022	0.016
Obs.	4,930	4,930	4,930	4,930	4,930	3,307	4,930
FE	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ

Panel B: High VIX periods only

	Size	Equity	Deposits	Impaired	ROA	Rating	ST debt
$\Delta\log(\text{T-bills}_t)$	-5.662	-3.715	-2.684	-2.716	-3.529	-1.802	-3.825
	(3.756)	(2.358)	(3.034)	(2.433)	(2.580)	(3.313)	(2.738)
$\Delta\log(\text{T-bills}_t) * Q2$	1.583	0.290	-0.665	-2.559	0.074	-2.571	0.117
	(4.761)	(2.909)	(3.745)	(3.445)	(3.293)	(3.589)	(3.309)
$\Delta\log(\text{T-bills}_t) * Q3$	-0.603	-0.781	-4.162	-1.227	-1.150	2.147	-0.300
	(4.402)	(3.896)	(3.504)	(3.254)	(3.338)	(5.421)	(3.369)
$\Delta\log(\text{T-bills}_t) * Q4$	3.119	-3.912	0.810	-3.771	-2.884	-3.124	-3.944
	(4.023)	(4.749)	(4.089)	(4.085)	(4.675)	(7.415)	(5.315)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Obs.	4,940	4,940	4,940	4,940	4,940	4,940	4,940
FE	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ	I, YQ

Table 15 – T-bill volume and bank characteristics

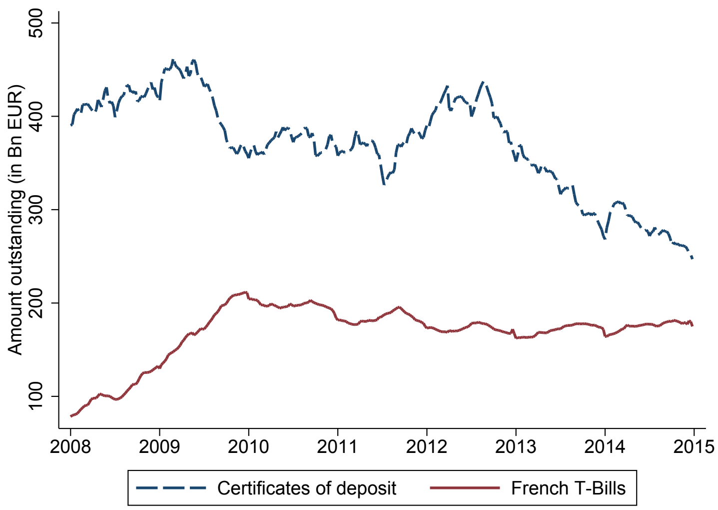
In this table, we regress the natural logarithm of 1 plus the amount of short-term CDs outstanding on measures of market stress interacted with dummy variables equal to one if a certain balance sheet characteristic is with the first, second, third or fourth quartile of its distribution. Measures of stress include the VIX and the Euribor-Eonia swap spread. Observations are at the bank-week level. Short-term CDs are defined as having a maturity below or equal to 7 days at issuance. In columns (3) to (8), we include size as an additional control variable. Y denotes year fixed effects. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\log(1 + CD_{it})$							
	Size		Equity		Impaired		ROA	
Q1*VIX	-0.027***		0.070***		0.023***		0.012***	
	(0.004)		(0.004)		(0.005)		(0.004)	
Q2*VIX	-0.001		0.025***		0.061***		0.044***	
	(0.004)		(0.004)		(0.005)		(0.004)	
Q3*VIX	0.034***		0.011***		0.058***		0.043***	
	(0.004)		(0.004)		(0.005)		(0.004)	
Q4*VIX	0.118***		0.015***		-0.024***		0.024***	
	(0.004)		(0.004		(0.005)		(0.004)	
Q1*Spread		-5.120***		-0.348		1.121		-0.233
		(0.547)		(0.537)		(0.685)		(0.542)
Q2*Spread		-1.436***		1.670***		1.121***		1.042*
		(0.550)		(0.539)		(0.691)		(0.538)
Q3*Spread		4.122***		0.217		6.463***		3.135***
		(0.550)		(0.542)		(0.688)		(0.537)
Q4*Spread		11.116***		6.934***		-3.304***		4.618***
		(0.551)		(0.546)		(0.697)		(0.537)
Size control	No	No	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.249	0.281	0.315	0.317	0.322	0.321	0.313	0.316
Obs.	61,724	58,292	61,724	58,292	45,032	42,068	61,724	58,292
FE	Y	Y	Y	Y	Y	Y	Y	Y

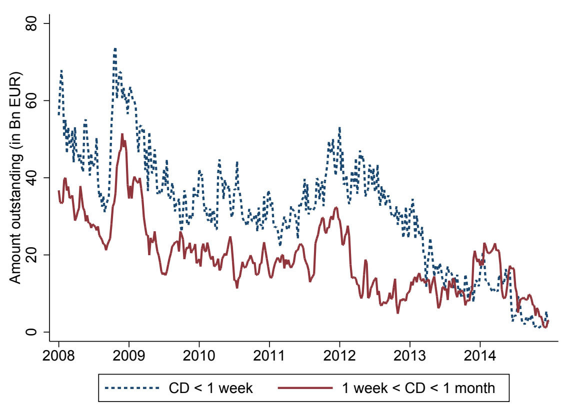
Figure 1 – Outstanding amounts of safe securities

This figure plots the outstanding amounts of safe securities in the European market. We plot certificates of deposit issued by European banks and T-bills issued by the French government. Panel A plots amounts aggregated over all maturities, and Panel B a breakdown across maturities.

Panel A: Aggregate amounts



Panel B: Breakdown by maturity



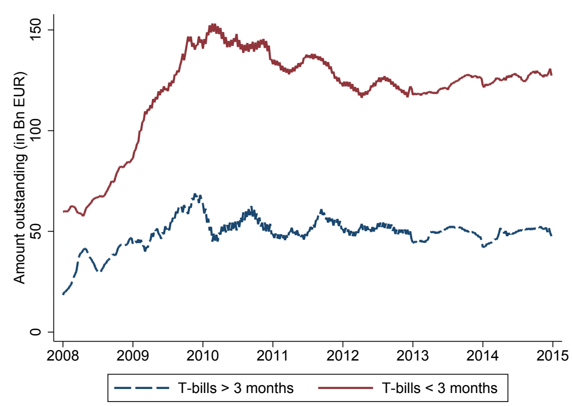
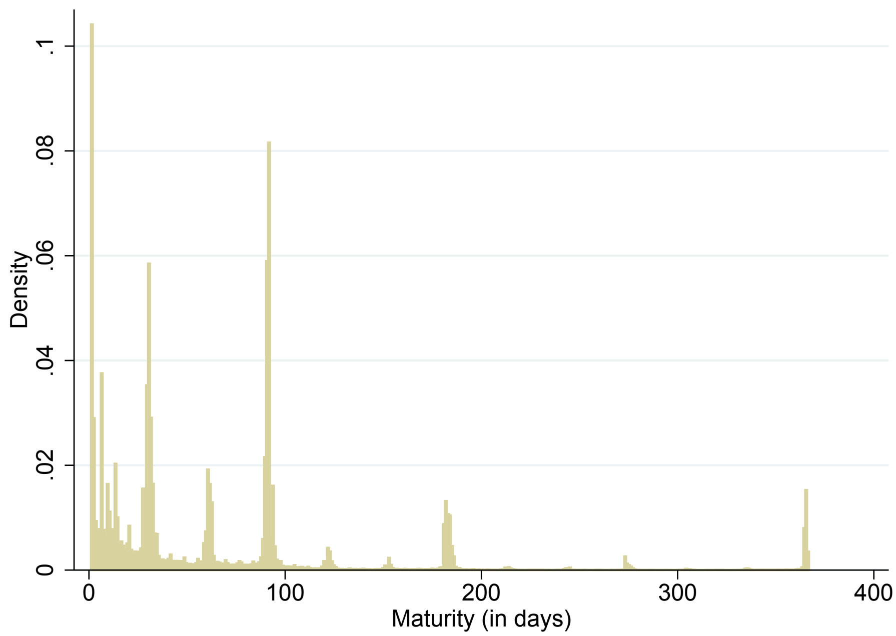


Figure 2 – Distribution of the maturity of short-term debt securities

This figure plots histograms of the maturity at issuance of short-term securities in the European debt market. We consider certificates of deposit issued by European banks (Panel A) and T-bills issued by the French government (Panel B).

Panel A: Certificates of deposit



Panel B: T-Bills

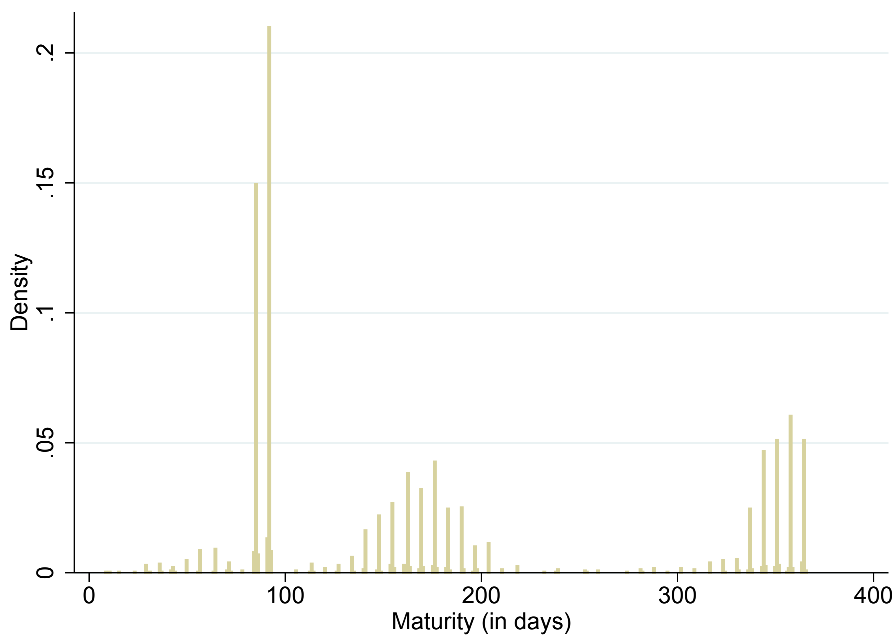
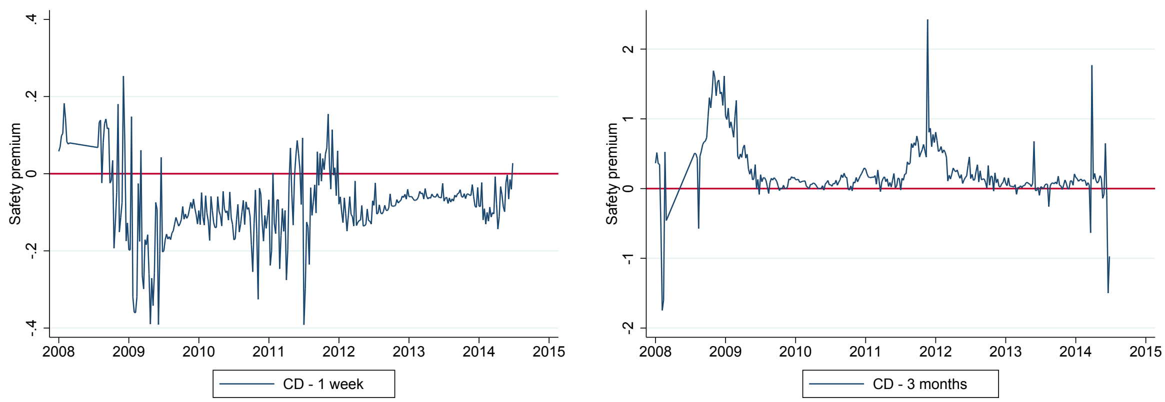


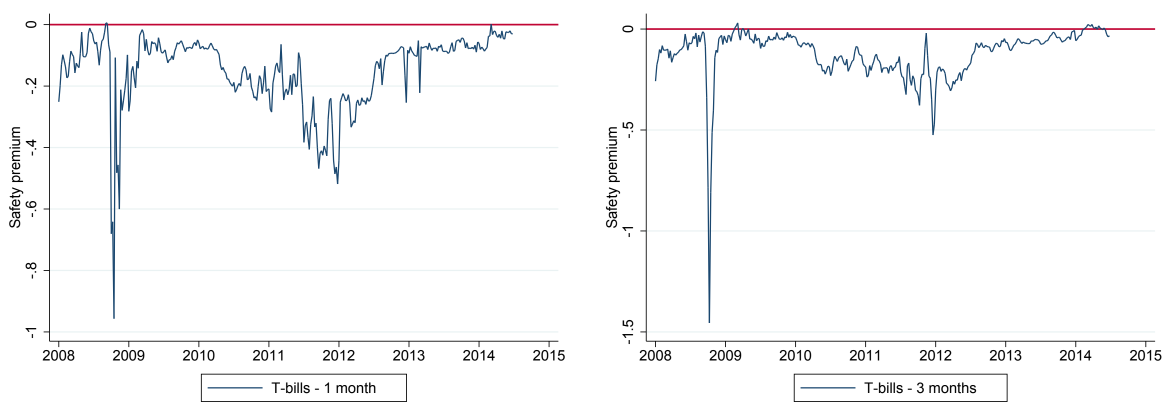
Figure 3 – Safety premium across maturities

This figure plots the safety premium on safe securities in the European market. We plot the safety premium for certificates of deposit issued by European banks and T-bills issued by the French, German, Italian and Spanish governments.

Panel A: Certificates of deposit



Panel B: T-Bills (France)



Panel C: T-Bills (Germany, Italy, Spain)

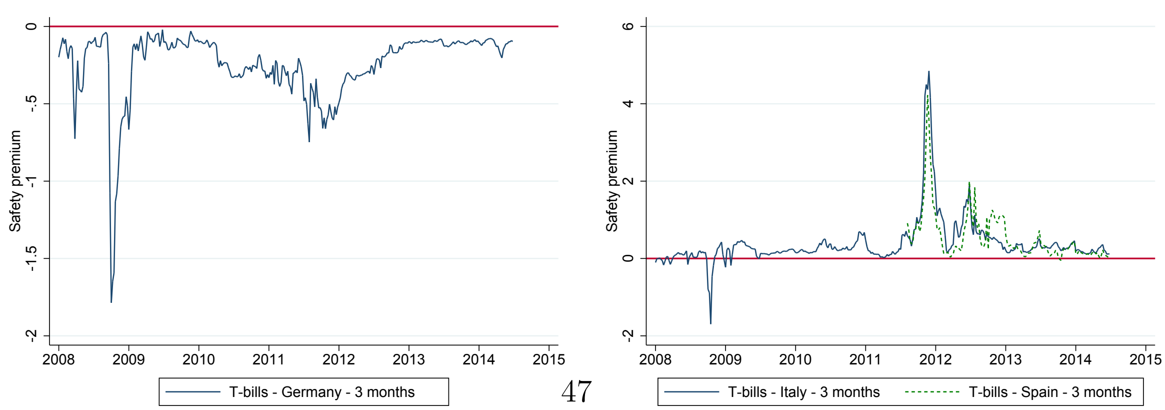
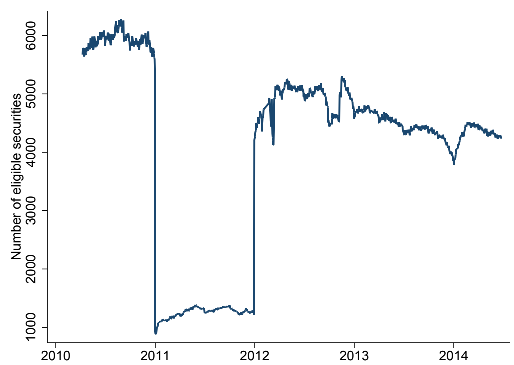


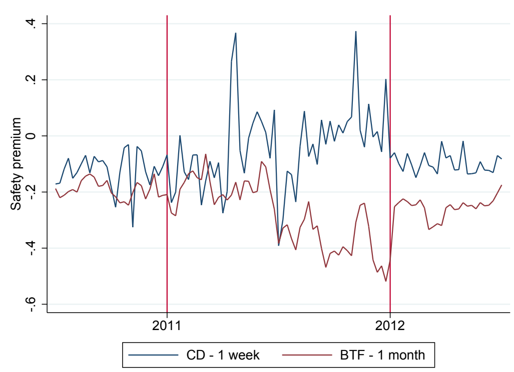
Figure 4 – Safety premia around suspension of eligibility as collateral

In Panel A, we plot the number of CDs eligible as collateral at the ECB over the period from 2010 to 2014. One CD corresponds to one distinct ISIN code. The drop in eligible securities in January 2011 corresponds to a decision of the ECB not to accept anymore securities that benefit from the STEP label. The rebound in January 2012 corresponds to the date when these securities become eligible again. In Panel B, we plot the one-week safety premium on CDs and the one-month safety premium on T-bills over the period from July 2010 to end-June 2012. The two vertical bars correspond to the two decisions by the ECB to suspend and to re-accept STEP securities at collateral for its main refinancing operations. In Panel C, we plot the average book equity (left panel) and impaired loans to assets (right panel) of issuers in the CD markets. These averages are based on weekly issuances and weighted by issuance volume in one-week CDs.

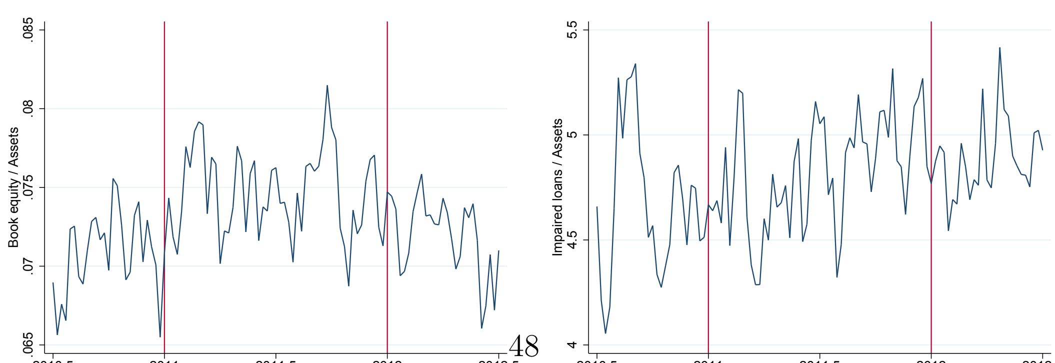
Panel A: Number of CDs eligible as ECB collateral



Panel B: CD and T-bill safety premia



Panel C: Issuer characteristics



Online appendix - Not for publication

Table A1 – Variable definitions

This table defines the variables used in the empirical analysis, for both CD and CP issuers. The "id" code is the index number in Bankscope or to the variable tickers in Bloomberg. Variables related to issuer profitability and asset quality are winsorized at the 1st and 99th percentiles. We also provide the source for macroeconomic data.

Variable	Definition	Data source
	Data on CD issuers	
Assets	Total assets (id: 11350).	Bankscope
Book equity	Common Equity (id: 11800).	Bankscope
Loans	Gross loans (id: 11100).	Bankscope
Customer deposits	Total customer deposits: Current + Savings + Term (id: 11550).	Bankscope
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
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
	Data on CP issuers	
Assets	Total assets (id: *BS_TOT_ASSET*).	Bloomberg
Equity	Total equity (id: *TOTAL_EQUITY*).	Bloomberg
Total debt	Short-term debt (id: *BS_ST_BORROW*) + Long-term debt (id: *BS_LT_BORROW*).	Bloomberg
Net debt	Net debt (id: *NET_DEBT*).	Bloomberg
ROA	Net income (id: *NET_INCOME*) divided by total assets.	Bloomberg
ROE	Net income (id: *NET_INCOME*) divided by total equity.	Bloomberg
	Macroeconomic data	
VIX	CBOE Volatility Index: VIX (id: *VIXCLS*)	FRED
Eonia swap rates	Eonia swap rates at all maturities between 1 week and 1 year	Bloomberg
Euribor - Eonia swap spread	Euribor from EMMI minus Eonia swap rate, both with 1 month maturity	European Money Market Institute (EMMI)
Eurostoxx 50	Eurostoxx 50 Index	Bloomberg

Table A2 – T-bill volume and CD volume: Time-series evidence

In this table, we regress the log of the outstanding amount of CDs on the log of the outstanding amount of T-bills. Observations are at a weekly frequency and aggregate CD issuances of all sample banks. One-week CDs are defined as having a maturity below or equal to 7 days at issuance. Control variables include: $\log(CD_{t-1})$, and $\log(\text{T-bills}_{t-1})$. YQ denotes year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors are in parentheses. Robust standard errors are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\log(CD_t)$					
	All CD		Short-term CD		Long-term CD	
$\Delta \log(\text{T-bills}_t)$	0.050	0.086	-1.503***	-3.059***	0.217**	0.359**
	(0.067)	(0.132)	(0.254)	(0.867)	(0.080)	(0.179)
$\log(CD_{t-1})$		0.858***		0.565***		0.809***
		(0.032)		(0.115)		(0.031)
$\log(\text{T-bills}_{t-1})$		-0.151		2.403***		-0.337*
		(0.131)		(0.884)		(0.177)
R^2	0.964	0.990	0.896	0.925	0.929	0.977
Obs.	343	342	343	342	343	342
FE	YQ	YQ	YQ	YQ	YQ	YQ

Table A3 – Description of the sample of CP issuers

This table describes the sample of CP issuers. Panel A shows the share of issuers and CP amounts issued by country. Panel B provides descriptive statistics on the distribution of balance sheet characteristics of CP issuers. Means and quantiles are as of end of December and are computed from the pooled sample over the period from 2008 to 2014. Panel C 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 CP outstanding. All variables are defined in Table A1.

Panel A: Description of issuers

	N. issuers	% Issuers	% Issued	Largest issuer
All	123	100.00	100.00	—
France	101	82.11	82.69	Engie
Netherlands	6	4.88	0.89	Aegon NV
Switzerland	4	3.25	1.16	Holcim
Germany	3	2.44	4.12	BMW Finance
United States	3	2.44	8.75	General Electric
Luxembourg	2	1.63	2.02	ArcelorMittal
Others	4	3.25	0.37	—

Panel B: Balance sheet characteristics

	10th	25th	Mean	Median	75th	90th	Std.	N. Obs.
Size (log Total assets)	21.18	22.23	23.35	23.27	24.36	25.35	1.64	915
Equity / Assets	0.12	0.22	0.34	0.34	0.45	0.57	0.18	914
Total debt / Assets	0.09	0.17	0.28	0.25	0.38	0.50	0.16	889
Net debt / Assets	-0.04	0.04	0.17	0.15	0.26	0.44	0.19	892
ROA (%)	-0.01	0.00	0.01	0.01	0.03	0.04	0.03	915
ROE (%)	-0.02	0.02	0.04	0.05	0.08	0.11	0.07	894

Panel C: Size of CP funding in balance sheets

	10th	25th	Mean	Median	75th	90th	Std.	N. Obs.
CP / Short-term debt	0.02	0.07	0.34	0.22	0.45	0.74	0.41	677
CP / Total debt	0.01	0.02	0.10	0.05	0.12	0.22	0.13	671
CP / Total assets	0.00	0.00	0.02	0.01	0.02	0.05	0.03	808

Table A4 – Safe asset supply and safety premia: Time-series evidence

In this table, we regress the safety premium on French T-bills (Panel A), on CDs (Panel B) and on CPs (Panel C) on the aggregate quantity of these securities. Observations are at a weekly frequency. We consistently use the safety premium on the shortest-term securities, respectively 1 month for T-bills and 1 week for CDs and CPs. Safety premia are computed using Equation (1), where we use the Eonia swap spread as the risk-free rate r^f. For T-bills, we use the 1-month safety premium. For CDs and CPs, we use the 1-week safety premium. Control variables include: $\log(\text{CD}_{t-1})$. YQ denotes year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors are in parentheses. Robust standard errors are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: Safety premia					
	T-bills		CD		CP	
$\log(\text{T-bill}_t)$	0.750	-0.542				
	(0.579)	(0.645)				
$\log(\text{CD}_t)$			0.155	0.212		
			(0.144)	(0.388)		
$\log(\text{CP}_t)$					0.233*	0.258
					(0.119)	(0.240)
Controls	No	Yes	No	Yes	No	Yes
R^2	0.675	0.681	0.490	0.488	0.148	0.149
Obs.	338	337	338	337	338	337
FE	YQ	YQ	YQ	YQ	YQ	YQ

Table A5 – T-bill volume and CD issuance in French banks only: Panel evidence

In this table, we regress changes in log CDs outstanding at the bank level on changes in log T-bills outstanding. Observations are at the bank-week level. One-week CDs are defined as having a maturity below or equal to 7 days at issuance. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors are in parentheses. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\Delta\log(\text{CD}_{i,t})$				
$\Delta\log(\text{T-bills}_t)$	-3.279***	-4.285***	-5.125***	-4.108***	-5.168***
	(0.873)	(1.144)	(1.215)	(0.864)	(1.171)
Controls	No	No	Yes	No	Yes
R^2	0.001	0.003	0.005	0.003	0.005
Obs.	14,110	14,110	14,044	14,110	14,044
FE	-	YQ	YQ	I, YQ	I, YQ

Table A6 – T-bill volume and CD issuance with other European T-bills: Panel evidence

In this table, we regress changes in log CDs outstanding at the bank level on changes in log T-bills outstanding. Observations are at the bank-week level. One-week CDs are defined as having a maturity below or equal to 7 days at issuance. Control variables include: $\log(\text{CD}_{t-1})$, $\Delta\log(\text{CD}_{t-1})$, $\log(\text{T-bills}_{t-1})$, $\Delta\log(\text{T-bills}_{t-1})$. I and YQ denote issuer and year-quarter fixed effects. The time period is from January 2008 to July 2014. Standard errors clustered at the week level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: $\Delta\log(\text{CD}_{i,t})$					
	France + Germany			Italy + Spain		
$\Delta\log(\text{T-bills}_t)$	-2.285***	-3.605***	-4.456***	-0.492	-0.127	-0.225
	(0.779)	(1.045)	(1.078)	(0.849)	(0.911)	(0.949)
Controls	No	No	Yes	No	No	Yes
R^2	0.001	0.003	0.005	0.000	0.002	0.003
Obs.	16,083	16,083	16,007	16,083	16,083	16,007
FE	I	I, YQ	I, YQ	I	I, YQ	I, YQ

Figure A1 – Eonia swap rate

The main variable is Eonia swap rate measured over the 2008-2014 period, in percentage points. We consider Eonia swap rates with 1-week, 1-month, 3-months, 6-month, and 12-month maturities. See Table A1 for details on the data.