Liability Structure and Risk-Taking: Evidence from the Money Market Fund Industry*

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We exploit a change in regulation of money market funds to investigate how the structure of liabilities impacts financial intermediaries' asset holdings. We show that following a change in regulation, which has made prime money market funds' liabilities less money-like, safer funds exited the industry. The remaining funds have increased the riskiness of their portfolios, possibly in response to an increase in the sensitivity of flows to performance. As a result, issuers with lower risk of default have less access to funding from US money market funds. These findings support theories highlighting that in the absence of government interventions the private sector may be unable to create liquid assets.
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Money market funds (MMFs) provide short-term funding to corporate, financial, and governmental issuers. As of February 2018, the total assets of US MMFs amounted to $2.8 trillion.[1] MMFs have typically been regarded by investors as profitable substitutes for deposits and other "money-like" securities, such as Treasury bills. While MMFs do not benefit from explicit deposit guarantees, investors could expect to redeem their investment at par value and to obtain a safe stream of dividends. This expectation was reinforced by the fact that MMFs practically guaranteed their investors a constant net asset value of one dollar for a one-dollar investment. Despite this, a MMF may "break the buck," a rare situation where the marked-to-market value of the fund's net assets falls to 99.5 cents or less per dollar. In such a case, a MMF may experience a run. The most recent example is the Reserve Primary Fund, which due to its large holdings of Lehman's commercial paper experienced a large drop in the market value of the short-term securities it held and suffered a run in September 2008.

While in 2008 the government ultimately guaranteed the value of any investment in MMFs to stave off runs on their assets, the money market industry has subsequently been at the center of sweeping regulatory efforts aiming to improve financial stability. In particular, new regulations, which were announced in July 2014, and became effective in October 2016, aim to decrease the possibility of runs on MMFs by decreasing the liquidity of their liabilities. Under the new regulatory regime, prime and tax-exempt MMFs, which primarily invest in short-term corporate and municipal debt, respectively, can no longer guarantee the value of investor claims but have to trade at their actual net asset value if they are marketed to institutional investors. In addition, all prime and tax-exempt MMFs, including those targeted at retail investors, can impose liquidity fees and redemption gates (i.e., suspend redemptions temporarily) in times of market

[1] Retrieved from the Investment Company Institute at https://www.ici.org/research/stats/mmf/mm_02_15_18.

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stress.

The new regulations strengthened investors' incentives to acquire information on the value of MMFs' liabilities in all states of the world. This may have changed the nature of MMFs' liabilities because the securities issued by an intermediary are considered to be liquid and a good substitute for money only to the extent that they can be traded by uninformed agents (Pennacchi and Gorton, 1990). For these reasons, the changes in regulation provide an ideal setting to investigate how the structure of an investor's liabilities impacts its asset holdings as implied by largely untested theories that highlight critical synergies between the assets and liabilities of financial intermediaries (Hanson, Shleifer, Stein, and Vishny, 2015).

In theory, MMFs could have attempted to circumvent the effects of the regulation. Holmström and Tirole (2011) show that when there is demand for liquid assets, the private sector may attempt to generate liquidity by investing in appropriate projects. In the case of MMFs, this would imply an attempt to increase the liquidity and safety of the investments, in order to limit variation in the marked-to-market net asset value (NAV) and the probability of having to impose gates and redemption fees. If successful, MMFs could provide investors assets that are nearly as safe and liquid as before the reform.

Holmström and Tirole (2011) also highlight that commitment and pledgeability problems hamper the private sector's ability to create liquidity in the absence of government intervention and regulation. In the case of MMFs, it may be difficult to commit to not imposing redemption gates ex post. Thus, after the announcement of the 2014 reforms, investors' incentives to monitor MMFs' liabilities may have increased, making MMFs less substitutable for money-like securities. In addition, some agents may consider the cost of information acquisition prohibitive and, consequently, may not invest any longer in prime and tax-exempt MMFs.

Even more importantly, more assiduous monitoring may have favored MMFs' investors

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search for yield. These effects may have been reinforced by behavioral motives if investors reclassified MMFs' assets from "safe" to "slightly risky," thus monitoring more and seeking higher yields (Gennaioli, Shleifer and Vishny, 2012).[2]

Changes in the sensitivity of flows to performance after the implementation of the new regulations may in turn have affected the portfolio decisions of MMFs' managers (Chevalier and Ellison, 1997; Sirri and Tufano, 1998). MMFs facing a competitive environment in which flows are more strongly responsive to performance may have stronger incentives to invest in higher-yielding, riskier securities. MMFs' incentives to take on risk and invest in high-yielding, less liquid securities may also have been reinforced by the funds' possibility of imposing gates and redemption fees, which decrease the probability of runs following poor performance (Stein, 2005).

We show that the "money-likeness" of investments in prime MMFs has decreased after the announcement and implementation of the 2014 regulation. After the reform, MMFs' assets under management are significantly less correlated with proxies for the aggregate demand for money-like securities. To be specific, we find that the aggregate net assets under management of MMFs are no longer negatively associated with the spread of four-week Treasury bills over the four-week overnight indexed swap (OIS) rate, which is typically thought to be low when the demand for money-like securities is high (Sunderam, 2015). This change in the relation between MMFs' net assets under management and the Treasury bill spread corresponds to a large drop in demand for prime and tax-exempt MMFs, with investors investing in government MMFs instead.

Further, we find that many prime MMFs exited the industry or converted into government MMFs, whose claims are unaffected by the change in regulation. Importantly, MMFs with less

[2] This channel may have affected retail investors for behavioral reasons. Some institutional investors having to mark to market their MMFs' holdings may also have stopped considering them as cash.

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risky portfolios were more likely to exit. In addition, following the announcement and especially after the implementation of the reform, flows into MMFs have become more sensitive to performance. This effect is not simply driven by the fact that MMFs whose investors were more responsive to performance were less likely to exit: we show using a balanced panel that the flow-performance sensitivity increases for MMFs that remain active after the implementation of the reform.

Importantly, the increase in flow-performance sensitivity is particularly pronounced for MMFs that sell predominantly to institutional investors. Institutional investors have been more affected by the 2014 reform because their claims have become sensitive to the NAV of MMFs. Therefore, this evidence supports the conjecture that investors have started to monitor more once the payoffs of their claims have become more sensitive to the value of the underlying assets.

The increased sensitivity of flows to performance has given MMFs stronger incentives to reach for yield. We find that the portfolios of MMFs have become riskier following the implementation of the regulations. Not only has the yield of their portfolios increased, but MMFs have also decreased the proportion of their portfolios invested in safe securities while increasing investment in riskier assets. These increases in risk-taking have primarily manifested in MMFs with an institutional investor base, that is, the funds experiencing a larger increase in flow-performance sensitivity after the reform. In addition, we show that the effects are largely driven by surviving funds that change their behavior after the reform.

The change in behavior of MMFs has had important consequences on the availability of short-term financing to different types of borrowers. Issuers with lower default risk have become less likely to have outstanding liabilities with US MMFs. At the same time, the value of the outstanding liabilities towards MMFs has increased for issuers with high risk of default in comparison to that of other issuers. The relative increase is particularly pronounced for liabilities

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towards MMFs marketed to institutional investors. By contrast, the external liabilities of Euro area MMFs have increased while their portfolio spreads have decreased after the reform. This suggests that offshore funds may have at least partially substituted US funds in the provision of funding to the safest corporate borrowers.

Our results are consistent with theories arguing that financial intermediaries' assets and liabilities are jointly determined (Hanson, Shleifer, Stein and Vishny, 2015). In particular, intermediaries appear unable to undo a decrease in the money-likeness of their claims imposed by regulation. As soon as the claims of MMFs have become more sensitive to the value of their assets, investors' incentives to monitor MMFs' portfolios and performance have strengthened. This has effectively made MMFs more similar to bond mutual funds.

This paper is related to a small but growing strand of literature exploring the shadow banking system, and, in particular, MMFs. A large part of the literature describes the behavior of MMFs during the global financial crisis. Kacperczyk and Schnabl (2013) show that MMFs sponsored by financial intermediaries with more money market fund business took on more risk during the 2007 – 2008 period. Di Maggio and Kacperczyk (2017) report that the zero lower bound policy of the Fed led money market funds to exit the industry and increased the risk taking of the remaining funds. La Spada (2017) argues that these effects arose from increased competitive pressure in a low interest rate environment. Schmidt, Timmermann, and Wermers (2016) document that institutional investors withdrew to a larger extent from MMFs than retail investors in 2008, presumably because they have better monitoring capabilities. Gallagher, Schmidt, Timmerman, and Wermers (2016) show that institutional investors were most responsive to cross-sectional heterogeneity in funds' exposures to Eurozone securities. While Cipriani, La Spada and Mulder (2017) document outflows from prime and muni funds into government funds of the same family, to the best of our knowledge, we are the first to exploit the

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2014 reform to investigate how intermediaries match assets and liabilities.

1. Institutional Background

MMFs perform an important role in short-term credit intermediation. They purchase short-term money market instruments, such as commercial paper, asset-backed securities, and bank obligations, and issue shares to investors, including institutions and retail investors. Because they used historical cost accounting to assess the value of their holdings, MMFs had a constant net asset value, typically $1 per share. This allowed them to offer securities which could be purchased and redeemed on demand and that were considered nearly as safe as demand deposits, even if they were not subject to deposit insurance.

In 2008, US prime MMFs experienced an investor run, triggered by the collapse of Lehman Brothers on September 15, 2008. On September 16, 2008, due to its large holdings of Lehman's commercial paper, the Reserve Primary Fund experienced a large drop in the market value of the short-term securities it held and "broke the buck." To stave off runs on the assets of other MMFs, the government guaranteed the value of any investment in MMFs until September 18, 2009.

Since then the money market industry has been at the center of strong regulatory efforts aiming to improve financial stability (Hanson, Scharfstein and Sunderam, 2014). In 2010, changes to Rule 2a-7 under the Investment Company Act of 1940 imposed on MMFs the requirement to maintain daily liquid assets of at least 10% of total assets and weekly liquidity equal to at least 30% of portfolio value.[3] In addition, MMFs were required to provide detailed portfolio holdings disclosure. Furthermore, the 2014 amendments to Rule 2a-7 mandate that

[3] Daily liquid assets are, e.g., cash, US government debt, and certain receivables. Weekly liquid assets include daily liquid assets, certain receivables, and government notes with maturity less than 60 days.

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starting in 2016, MMFs marketed to institutional investors, unless they are classified as government MMFs, must trade at a price equal to their actual net asset value. In addition, all non-government MMFs, including those targeted at retail investors, are entitled to impose liquidity fees or redemption gates to stave off runs in times of market stress (when weekly liquidity drops below 30%).[4] The SEC's press release referring to these amendments is dated July 23, 2014; MMFs were required to comply with the new rules starting from October 14, 2016.

In addition to the regulations that fundamentally changed the liability structure of non-government MMFs, the SEC removed any references to NRSRO credit ratings in Rule 2a-7 and Form N-MFP (the form that MMFs use to report monthly information on their portfolio holdings to the SEC) to comply with the Dodd-Frank Act. While prior to the rule change, eligible securities were determined based on NRSRO ratings, under the amended rule, an "eligible security" is a security that the MMF's board determines to present "minimal credit risk."[5]

In what follows, we exploit the changes in regulation announced in 2014 to evaluate how a change in the nature of liabilities affects financial intermediaries' assets and risk taking.

2. Data

We obtain data on MMFs from iMoneyNet. This dataset provides weekly share class and portfolio level data on net assets and various characteristics of the underlying portfolios,

[4] The 2014 reform also mandated more frequent disclosure of the funds' liquidity and holdings on MMFs' websites. Since most of the effects we uncover emerge already in the period between the announcement and the implementation of the reforms, that is, before any new information was disclosed, our results cannot be driven by an increase in the frequency of disclosure. The reform also mandated enhanced diversification for all MMFs, independently from whether they were marketed to institutional and retail investors. Any changes affecting both types of MMFs cannot drive our findings in the difference-in-difference tests (see Tables 6, 8, and 9B).

[5] These rules do not prohibit the use of ratings; the amended Form N-MFP contains a section where the fund can disclose "any NRSRO rating that the fund's board of directors (or its delegate) considered in making its minimal credit risk determination for that particular security, as well as the name of the agency providing the rating." The regulations concerning the ratings were initially proposed in March 2011, then again in July 2014. They became effective on October 26, 2015 with compliance date October 14, 2016.

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including percentage of holdings invested in different asset classes, percentage maturing in 7 days, sponsor, yields, expenses (charged and incurred), and inception date. From iMoneyNet, we also obtain information on monthly holdings, on whether the share classes are marketed to institutions or retail investors, and on the fund's bank affiliation. We obtain Treasury bill and CPI data from FRED and the overnight indexed swap rates from Bloomberg. Finally, we obtain one-month default probabilities at monthly frequency for issuers of money market securities from the NUS-RMI Credit Research Initiative. Our final sample covers the period from January 2005 to November 2017 and includes 1,108 distinct share classes of prime funds and 383 distinct prime funds.

Table 1 provides variable definitions. Table 2 reports summary statistics for the various samples employed in our analyses. Panel A describes the weekly time series of aggregate total net asset under management (TNA) of different share categories of prime and tax-exempt MMFs, respectively. Aggregate TNA are obtained by adding up the net assets under management in a given category every week.[6] We use these variables in the money-likeness tests.

Panel B reports summary statistics for the different share classes of the MMFs in our sample. The same fund may have different share classes, with different fee structures, for retail investors and institutional investors. Since regulations have a differential effect on share classes marketed to institutional investors and retail investors, respectively, in the "closure" tests we explore whether MMFs were more likely to close some of their share classes. We consider intra-fund conversions of share class type or mergers as closure events.

Panel C describes the weekly fund level dataset, which we use to explore how funds' incentives changed after the 2014 reform. In these tests, we define the funds that have at least one

[6] We aggregate the share classes from share class data. Total assets are reported as of Tuesday of each week and are discounted using the CPI.

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institutional share class as institutional.

Panel D reports summary statistics for the issuer-level dataset. We manually match issuers of money market securities held by the MMFs in our sample to the NUS-RMI dataset of corporate default probabilities. Since default probability data are available for the period August 2011 until October 2017, the issuer-level dataset is limited to this period. It includes 735 unique issuers. For each issuer, we compute the outstanding liabilities in a given month by adding up the MMFs' holdings from iMoneyNet. In this way, we also identify whether an issuer starts or stops borrowing from US MMFs.[7]

Finally, Panel E reports summary statistics on fund portfolios for Euro area MMFs. The data have weekly frequency and are from iMoneyNet.

3. Changes in Liability Structure

3.1 Money-likeness of MMFs' liabilities

First, we explore whether the announcement of the 2014 regulation has affected the way in which different types of investors perceive the liabilities issued by MMFs. In particular, we conjecture that two salient features of the regulation may have affected negatively the extent to which money market investments are considered a substitute for other money-like securities, such as Treasury bills: (i) the possibility of imposing liquidity fees or redemption gates, and (ii) the fact that institutional MMFs are no longer traded at a fixed NAV of one.

To assess this, we adopt the methodology of Sunderam (2015). His key insight is that the shadow banking system responds to investors' demand for money by issuing "money-like"

[7] We note that we do not consider an issuer to stop borrowing from MMFs when the issuer's securities are held by MMFs until the last month of the sample period. Similarly, an issuer whose securities are already held by MMFs in the first month of our sample period is not considered to have started borrowing from MMFs in that month (but rather, at some earlier time preceding the start of our sample).

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securities, such as asset-backed commercial paper. He argues that low Treasury bill–OIS spreads are a proxy for high money demand and provides evidence that low spreads are correlated with high quantities of various money-like claims, such as reserves and deposits in the banking sector, the dollar volume of transactions going over the Fedwire Funds payment system, and assets under management of MMFs.

Because MMFs are open-ended, the amount of their outstanding assets is determined by investor demand. Therefore, a negative correlation between total net assets under management and the Treasury bill spread—as documented by Sundaram (2015)—suggests that MMF's liabilities are indeed considered by investors as money-like securities. If this relation became weaker after the announcement and implementation of the 2014 reforms, we would be able to infer that the regulation has decreased the liquidity of MMFs' liabilities.

Table 3 explores this relation. Following Sunderam (2015),[8] we run regressions of the form

$$Ln(Total\ net\ assets)_t = \alpha + \beta \cdot \left(T\text{-}bill - OIS\right)_t + \varepsilon_t \tag{1}$$

where the dependent variable measures the assets under management by prime MMFs, and *T-bill – OIS* denotes the spread between the Treasury bill yield and the overnight indexed swap (OIS) rate as the explanatory variable of interest. This spread captures the liquidity premium for money-like securities, such as Treasury bills, and, unlike the Treasury bill yield, is unaffected by changes in policy interest rates. Because errors may be serially correlated in these time-series regressions, we report Newey-West standard errors and allow for up to four periods correlation.

Column 1 shows that, on average, during our sample period spanning the years 2005 to 2017, there was a negative relation between the Treasury bill spread and the TNA of prime MMFs. This suggests that MMFs' liabilities were considered money-like by investors, which is

[8] See Table 7 in Sundaram (2015).

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consistent with Sunderam (2015). This relation however changed following the July 2014 announcement of the reform affecting MMFs (column 2), as captured by the dummy variable *Post*, which takes a value equal to one after July 23, 2014, and zero otherwise. Indeed, we find that the interaction coefficient between *Post* and *T-bill – OIS* is positive suggesting that after the reform, investors do no longer view MMFs' liabilities as money-like securities. In fact, the large positive coefficient on the interaction term suggests that investors' redemptions from prime MMFs and an increase in the demand for government MMFs may have lowered Treasury bill spreads.

Such an interpretation, which is consistent with our conjecture that prime MMFs' liabilities are less money-like after the reform, is further explored in columns 3 to 5, where we distinguish the period between the announcement and the implementation of the regulation (indicated by the variable *Post [2014]*, which takes a value equal to one during this interval and zero otherwise) from the post-implementation period (indicated by the variable *Post [2016]*). Column 3 shows that prime MMFs experienced redemptions in both periods, but particularly so in the period after the regulation became effective. In column 4, we allow the relation between the Treasury bill spread and TNA of MMFs to vary during the *Post [2014]* and *Post [2016]* periods. Starting with the announcement of the reforms in mid-2014, the relation seems to have become positive, suggesting that investors have stopped considering MMFs as a substitute for money. The interaction between the Treasury bill spread and MMFs' TNA is particularly large in the period between the announcement and the implementation of the new regulation. This implies that during the weeks with a low spread on Treasury bills, when the demand for money was particularly large, MMFs were experiencing large redemptions. Irrespective of whether the increase in the demand for money and the consequent lower spread on Treasury bills were an effect of the redemptions from prime MMFs following the reform, the change in correlation

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supports our conjecture that prime MMFs' liabilities ceased to be money-like.

Finally, column 5 contrasts the effects of the 2014 reform with two other periods of historical relevance for MMFs: (i) the 2008 global financial crisis (captured by the dummy variable *Post [2008]*); and (ii) the period following the 2010 reforms, which introduced additional liquidity requirements and transparency rules for MMFs (captured by the dummy variable *Post [2010]*). In particular, the dummy *Post [2008]* takes value one between September 16, 2008, when the Reserve Primary Fund "broke the buck" as a result of the Lehman bankruptcy, and September 18, 2009, when the US Treasury's guarantee for MMF investments ended. *Post [2010]* is equal to one between the announcement of the reforms on January 27, 2010, and the day prior to the announcement of the 2014 reforms.

In the fall of 2008, investors became aware of the risks of MMFs. It is therefore unsurprising that the correlation between the Treasury bill spread and TNA of prime MMFs was positive. The effect is however smaller than the one associated with the announcement of the 2014 reform, possibly because in 2008 the US Treasury guaranteed MMFs' liabilities to stop the run. During the period between the announcement and the implementation of the 2014 reforms, a one-standard-deviation increase in the spread of Treasury bills is associated with a drop in the TNA of MMFs of 70%. A similar change in the spread during the year after September 2008 corresponds to a drop in TNA of around 3%, which is similar to the change in the sensitivity of MMFs' TNA to the Treasury bill spread in the period following the implementation of the 2014 reform (when *Post [2016]* takes a value equal to one).

The 2010 reform increased the transparency of MMFs' asset holdings and forced MMFs to hold more liquid assets. While the latter intervention should have made MMFs safer, the increased availability of information on funds' assets has been found to give institutional investors in MMFs stronger incentives to monitor (Schmidt, Timmermann, and Wermers, 2016)

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and may therefore have made this asset class less liquid (Gorton and Pennacchi, 1990; Dang, Gorton and Holmström, 2015). The estimates in column 5 suggest that the two effects offset each other, as the net effect of the 2010 reforms is zero (as captured by the interaction of the Treasury bill spread with the dummy *Post [2010]*).[9] Importantly, taking into account other relevant episodes affecting MMFs, we find that our conclusion that prime MMFs are perceived as less money-like following the 2014 reforms remains valid.[10]

In sum, Table 3 suggests that following the 2014 regulation, investors stopped considering prime (and tax exempt) MMFs as a substitute for money-like securities. These changes in the nature of MMFs' liabilities may have had profound changes on the MMF industry. Consistent with this, Figure 1 shows that following the effective date of the new regulation (October 2016), TNA under management of prime and municipal MMFs declined by over 70% compared to the period before the regulation. Interestingly, as shown in Figure 2, the drop in the assets of prime MMFs was much more significant for institutional investors than for retail investors. Furthermore, the figures show that the assets of government MMF—the funds not affected by the regulation—expanded commensurably. As can be seen from the graph, such a substitution between prime and government MMFs also occurred during the 2008 financial crisis. However, consistent with our findings in Table 3, the effects of the 2014 regulation appear to be twice as large.

This empirical evidence indicates that the fact that prime MMFs' institutional share classes had to trade at their actual net asset value impacted institutional investors' willingness to

[9] While it is possible that the *Post [2014]* and *Post [2016]* variables (and their interactions with the Treasury bill spread) may also pick up the effects of the 2010 reform, such an explanation would require an implausibly late onset of the 2010 reform's effects.

[10] In tests not reported for the sake of brevity (available upon request), we consider tax exempt MMFs, which hold municipal (tax exempt) securities and are affected by the regulation similarly to prime MMFs. The patterns that emerge are consistent with Table 3 and suggest a lower elasticity of substitution between MMFs and money-like claims after the 2014 regulation.

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hold MMFs' liabilities. Other contemporaneous changes, such as the elimination of references to NRSRO credit ratings, should have impacted retail share classes equally or to an even larger extent, because retail investors are presumably less capable of monitoring the liabilities of MMFs.

3.2 Fund Closures

Table 4 explores whether in concurrence with the drop in TNA, prime MMFs shut down, or, more relevantly, converted to government MMFs. We refer to both occurrences as MMFs' "closures" and distinguish between different share classes of the same fund. Panel A shows that prime MMFs exited the industry after the 2014 regulatory change. Closures were concentrated in the period between the announcement and the implementation of the reform (*Post [2014]*), thus coinciding with the period during which investors rebalanced their portfolios. The probability that a fund exits in any given month during the sample period is 0.35 percentage points. Thus, column 2 suggests that this probability is nearly doubled to 0.6 percentage points in the period following the announcement and preceding the implementation of the reform. The effect is invariant if we control for fund characteristics and fund flows in particular (columns 3 and 4). This suggests that funds were not necessarily forced to shut down by investor redemptions, and that, instead, intermediaries anticipated less demand for prime MMFs following the reform.

Column 5 compares the effect of the 2014 reform on funds' closures with the effect of the 2008 global financial crisis and the 2010 reform. MMFs' closures following the 2014 reform were more likely than during the global financial crisis. Interestingly, prime MMFs' closures were somewhat less frequent in the aftermath of the 2010 reform, which forced MMFs to hold more liquid assets and to disclose their holdings at monthly frequency.

Finally, in columns 6 and 7, we explore which MMFs were more prone to close following

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the 2014 reform. In column 6, it appears that closures affected institutional and retail share classes similarly. Bank-affiliated MMFs also exited as often as non-bank-affiliated MMFs (column 7). Thus, unlike in 2008, the reputation of financial conglomerates did not seem to be sufficient to guarantee prime MMFs' business.

Panel B examines other characteristics of prime MMFs to determine which funds were more likely to exit following the implementation of the reform. In particular, we consider how predetermined characteristics of a fund's portfolio affect the probability that the fund is closed.[11] Columns 1 and 2 show that funds with higher portfolio spreads and more *Holding risk* —defined following Di Maggio and Kacperczyk (2017) as the difference in fund weights in the riskiest (bank obligations) and the safest (Treasury bills and repos) asset classes— were less likely to exit after the 2014 reforms. Similarly, MMFs with more *Safe holdings* (column 3) and a higher fraction of assets with one-week maturity, which we label *Liquid share*, (column 4) were more likely to exit. Somewhat surprisingly, larger funds were more likely to close following the 2014 reform (column 5). These results continue to hold when all interactions are included together in one regression (column 6), although some of the point estimates are less precise. Overall, it appears that funds' closures were concentrated among the safest funds. This contrasts with what happened during 2008 when riskier funds were more likely to close.[12]

These results suggest that funds with safer strategies expecting a larger drop in investor demand exited the industry. The results also suggest that the changes in the structure of liabilities may have affected MMFs' incentives to take risk. In what follows, we design some tests to explicitly take this possibility into account.

[11] In the estimates we present, we consider fund characteristics at t to explain closure at t+1. Results are qualitatively and quantitatively invariant if we average fund characteristics over a six-month period prior to t+1.

[12] In column 6 it also appears that during 2008 funds with more safe securities and assets maturing in seven days were more likely to close. However, this is probably because MMFs planning to close increased the holdings of liquid assets to reimburse investors during a period with particularly illiquid markets.

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3.3 Flow-Performance Sensitivity

Fund managers' incentives to provide high returns to investors and to take risk depend on the structure of managerial compensation. Because the latter is ultimately determined by fees (which are charged as a percentage of assets), the sensitivity of flows to performance has crucial importance (Chevalier and Ellison, 1997; Sirri and Tufano, 1998).

Table 5 explores whether the reform has affected the sensitivity of flows to performance of prime MMFs. We consider alternative measures of performance. In particular, in columns 1 – 4, we use the spread, while in columns 5 – 10, we consider the funds' relative performance each period, by employing their fractional rank (i.e., the fund return's percentile ranking relative to other funds). A higher value of the fund's fractional rank implies relatively better performance.

It emerges that the sensitivity of flows to performance has increased after the 2014 reform. The results are robust to the use of alternative measures of performance and to the inclusion of controls for funds' characteristics.

One may wonder whether only funds whose investors were already monitoring more before the reform and were therefore already more sensitive to performance survived or if, instead, the flow-performance sensitivity increased even for the surviving funds. To answer this question, in column 11, we re-estimate the flow-performance relation in a balanced panel, excluding any MMFs that exited during the sample period and, in particular, following the reform. The positive and significant coefficient of *FRANK·Post* indicates that the flow-performance sensitivity has increased for the surviving funds.

The increase in flow-performance sensitivity appears permanent and not limited to the period between the announcement and the implementation of the reform: the interaction term between the *Post [2016]* dummy and the fund's performance measure is positive and significant

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in all relevant specifications. The effects are economically significant. Based on the estimates reported in column 1, before the announcement of the reform, an increase in the spread by 10 percentage points (approximately the average fund's spread) increased a fund's flows by 7% (=(0.007*0.1)/0.01) for a fund with flows of 0.01, which roughly corresponds to the 75th percentile in the sample. Following the reform, the effect has increased to 18% (=((0.007+0.011)*0.1)/0.01).

In Table 6, we explore variations of the specifications considering the funds' fractional rank. In column 1, we distinguish the effect of flows on performance for funds in the bottom, middle, and top terciles because investors may react differently to extreme performance. We define the variables FRANK1=min(FRANK, 1/3), FRANK2=min(FRANK-FRANK1, 1/3), and FRANK3= min(FRANK-FRANK1-FRANK2, 1/3), to break the overall fractional rank, captured by the variable FRANK, into three segments.

The results in column 1 indicate that funds have particularly strong incentives to reach for yield following the reform announcement if they are in the top two terciles for performance, as they are more likely to attract flows. The interaction between FRANK and the dummy *Post* is not statistically significant when we consider MMFs that sell predominantly to retail investors (column 2). Instead, we find that the increase in the sensitivity of flows to performance is driven by MMFs that sell predominantly to institutional investors (column 3). This difference in the post-reform effects between retail and institutional share classes is statistically significant at the 5% level (column 4). This is consistent with the fact that institutional share classes have been more affected by the reform. Also, thanks to their organizational capabilities, institutional investors are likely to be more apt at monitoring than retail investors. There is no differential effect of the reform on MMFs that are affiliated with financial conglomerates, suggesting that the reputation of the financial conglomerate has not shielded these funds' liabilities (column 5).

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4. Risk-Taking

4.1 Time-series evidence

The changes in flow-performance sensitivity suggest that MMFs' incentives to take risk should have increased following the announcement and implementation of the 2014 reform. This subsection provides some preliminary evidence on this possibility by considering alternative proxies for risk taking. Subsection 4.2 presents difference-in-difference tests.

Table 7 reports coefficients from regressions of the following type:

$$Fund\ risk_{i,t} = \alpha + \beta \cdot Post[2014]_t + \gamma \cdot Post[2016]_t + X_{i,t-1}{}'\delta + \varepsilon_{i,t} \qquad (2)$$

where *i* denotes the fund and *t* the year. *Fund risk* is one of the following measures of fund risk: *Spread*, *Safe holdings*, *Holding risk*, and *Liquid share*. Matrix *X* includes various control variables, including sponsor fixed effects. The specifications reported in Table 7 also include year fixed effects, which enables us to control for changes in the funds' macro environment, including their investment opportunity set, the Fed's interest policy, changes in the slope of the yield curve, etc. This implies that the "Post" coefficients in regression equation (2) are measuring changes in risk taking during the announcement and implementation years of the reforms (2014 and 2016, respectively), but not in other years. As we employ weekly data, this estimation strategy permits us to focus on the immediate reaction of MMFs to the reforms and to isolate any changes in investment strategies from changes in the funds' macro environment.

Table 7 reports the results. Column 1 shows that the average spread of the securities in MMFs' portfolios has increased after the announcement of the reform. The increase is not limited to the interim period (between announcement and implementation) but is, if anything, more pronounced after the implementation of the reform. While the coefficients reported in column 1 are based on a regression that includes sponsor and year fixed effects, the specification reported

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in column 2 additionally includes a host of time-varying fund-level control variables. The results are qualitatively and quantitatively unchanged by the inclusion of these variables. Furthermore, the results are not driven by the fact that the safer MMFs exited (see Section 3.2), as the estimates are qualitatively and quantitatively invariant if we restrict the sample to funds that are active during the whole sample period (column 3). In terms of magnitudes, after the implementation of the reform, prime MMFs' spreads have increased by 8 basis points compared to the period prior to the passage of the regulation (based on coefficient estimates reported in columns 1 and 2). This is a large effect, given the average spread of 9 basis points over the 2005 – 2017 period.

A possible limitation of the analysis so far is that we measure portfolio risk using the *Spread*. It is conceivable that MMFs' investment opportunity set may have changed in a way that has increased the risk in their portfolios even though the funds did not intend to increase their risk taking. This alternative explanation is unlikely to explain our results reported in columns 1 – 3 of Table 7 for two reasons. First, even in a risky market environment, funds can limit the risk in their portfolios by holding more cash. Second, as we document in Figure 3, the spreads of various money market instruments, which typically account for a large fraction of prime MMFs' assets, were on average *lower* after the announcement of the reform in 2014 than in the period before. In particular, an alternative explanation based on a change in investment opportunities cannot explain why we find an increase in MMFs' spreads following the reform implementation in 2016 as that period coincides with a further decrease in the spreads of money market instruments.

Nevertheless, to address the concern that using the *Spread* as a measure of risk taking may conflate changes in market prices of securities with active portfolio rebalancing decisions, we employ alternative measures of portfolio risk in columns 4 – 6 that better reflect deliberate changes in investment strategies, such as *Safe holdings* and *Holding risk*. We find evidence that prime MMFs have actively changed the composition of their portfolios towards riskier securities

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after the reforms. For instance, MMFs have decreased the proportion of safe holdings, defined as the percentage of the fund portfolio invested in Treasury/agency debt and repos (column 4). At the same time, MMFs appear to have increased their portfolios' holding risk —that is, those with a higher proportion of riskier claims relative to the safer ones— (column 5). However, possibly to face the higher redemption risk associated with high flow-performance sensitivity, MMFs also appear to have increased the proportion of securities in their portfolios that matures within seven days (column 6).

4.2 Difference-in-differences evidence

The tests reported in Table 7 aim to identify changes in MMFs' risk taking using time-series variation. The regressions include a host of fund-level control variables and take into account possible changes in the macro environment during the sample period through year fixed effects. Despite this, we cannot rule out that unobserved confounding factors (simultaneously correlated with risk-taking and the timing of the law changes) may be affecting our inference. Therefore, in this section, we implement an estimation strategy that additionally exploits cross-sectional variation. This permits us to identify the effect of the law changes on fund risk-taking using a difference-in-differences test design, which ensures that time-varying unobservables are not impacting our inference as long as all prime funds are equally affected by such factors.

The test exploits the insight that MMFs primarily selling to institutional investors have plausibly been more affected by the 2014 reform because their claims have become sensitive to the NAV of MMFs, that is, their claims must trade at a price equal to their actual NAV. Because the flow-performance sensitivity has increased to a larger extent in funds predominantly sold to institutional investors (Table 6), we expect these funds to have stronger incentives to reach for

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yield and increase their assets under management. This insight lends itself to the following difference-in-differences test:

$$Fund\ risk_{i,t} = \alpha + \beta \cdot Post[2014]_t \cdot Institutional_{i,t-1} + \gamma \cdot Post[2016]_t \cdot Institutional_{i,t-1} + X_{i,t-1}{}'\delta + \varepsilon_{i,t} \quad (3)$$

where *i* denotes the fund and *t* the year. *Fund risk* is one of the following measures of fund risk: *Spread*, *Safe holdings*, *Holding risk*, and *Liquid share*. The matrix *X* includes a set of control variables.

In Table 8, we investigate differences in risk taking between prime MMFs targeted primarily at institutional investors and those marketed predominantly to retail investors. Consistent with our conjectures, the increase in the riskiness of the portfolios appears to be more pronounced for prime MMFs that cater mostly to institutional investors: the spread and holding risk are higher, and the fraction of safe holdings lower. Furthermore, once we additionally distinguish between the interim period (*Post [2014]*) and the implementation period (*Post [2016]*), we find that after the implementation of the reform, MMFs also decrease the proportion of assets maturing within seven days (considered safer than assets with longer maturity). These effects are present in the interim period, but have become quantitatively larger after the implementation of the reform. In addition, the estimates are qualitatively and quantitatively invariant if we exclude any funds that exited during the sample period from the sample (columns 9 and 10).[13]

Overall, these results suggest that a change in financial intermediaries' liabilities imposed by regulators affects those intermediaries' asset composition. In particular, lower liquidity and higher information-sensitivity of the intermediaries' claims appear to lead to more risk taking.

[13] The estimates are similarly invariant if we include fund fixed effects instead of sponsor fixed effects.

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5. Unintended Consequences of the Regulation

By changing the behavior of MMFs, the reform may have affected the availability of short-term financing and the composition of the outstanding short-term liabilities. In particular, given their search for yield, US MMFs may have started to supply less funding to the safest borrowers. While the latter may have switched to foreign MMFs, it is interesting to explore how the 2014 reform has affected the composition of the US MMFs' clients both on the extensive and the intensive margins.

To address this issue, Table 9 explores how the value of the outstanding liabilities of an issuer and the probability that an issuer stops or starts selling its short-term securities to an US MMF varies after the reform for issuers with different default risk. Panel A shows that the value of the outstanding short-term liabilities of issuers with higher default probability increases following the reform announcement in 2014 (column 1). The increase is particularly pronounced following the reform implementation (column 2). It also appears that US MMFs stop holding the securities issued by the safest borrowers (columns 3 and 4).

Panel B explores whether there are any differences in the availability of funding to a given borrower from institutional and retail MMFs, respectively. These tests serve two purposes. First, they allow us to test whether institutional MMFs have decreased funding to safe borrowers to a larger extent, which would be consistent with our conjecture that the changes in funding composition arise from MMFs' stronger incentives to take risk following the reform.

Second, in these specifications, the unit of observation is issuer, time, MMF funding type so that for each issuer and date we can distinguish between liabilities outstanding with institutional and retail funds. This allows us to absorb differences in demand for funding by different issuers by including interactions of issuer fixed effects and time fixed effects.

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Panel B shows that the funding provided by institutional MMFs has decreased after the reform implementation, which is consistent with the large shrinkage in their liabilities. However, the interaction term *Inst. Funding·Post·PD* is positive and significant (column 1) indicating that institutional MMFs supply relatively more funding to the riskier borrowers, as is consistent with their stronger risk-taking incentives. We observe similar effects in column 2, which reports estimates for a specification that splits the post reform period into the period after announcement and the one after the implementation of the reform. Finally, the specifications reported in columns 3—6 examine MMFs' lending decisions at the extensive margin. These results show that safe issuers are less likely to receive funding from institutional MMFs (compared to funding provision by retail MMFs) after the reform.

In sum, the 2014 reform has led to an increase in the risk of US MMFs' liabilities as an unintended consequence. This has decreased the supply of short-term funding by US MMFs to safer borrowers. The question naturally arises to what extent this translated into higher costs of funding (and reduced funding) for the safest borrowers, or if lending by other intermediaries, notably foreign MMFs, may have at least partially substituted for US MMFs.

A deep exploration of this question is beyond the scope of this paper. However, we observe that following the reform, Euro area MMFs have steadily increased their holdings of assets issued by institutions from outside the Euro area, including US borrowers (Figure 4). Table 10 shows that the average spread in Euro MMFs' portfolios has decreased after the 2014 reform (columns 1 – 3), even though Euro area funds do not seem to decrease the risk of their portfolios along other dimensions (columns 4 – 6).[14] We note that the European Central Bank decreased the deposit facility rate on several occasions in recent years (the last change took place in March

[14] For instance, Euro area funds reduce their holdings of safe assets while increasing their holdings of bank obligations relative to Treasuries, suggesting higher appetite for risk in columns 4 and 5 of Table 10, respectively. Euro area funds have also decreased their holdings of assets maturing in seven days (column 6).

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2016). These changes are unlikely to account for our finding of a decrease in Euro area funds' spreads following the US MMF reforms for two reasons. First, the spread controls for the average level of the interest rate by definition and similar to our methodology applied in Table 7, we include year fixed effects in all specifications in Table 10. The year fixed effects permit us to control for changes in the macro environment, including changes in the central bank policy rate, and allows us to identify immediate changes in risk-taking around the announcement and implementation of the SEC reforms using weekly data. Second, according to Di Maggio and Kacperczyk (2017), in a low interest rate environment there should be an increase in MMF risk taking (as we find in column 4 – 6) and therefore also an increase in the spread. This makes even more surprising that our estimates indicate that the spread of European MMFs decreased to a larger extent after October 2016, when the reform of US MMFs was implemented.

Because these changes are associated with an increase in external assets, one plausible explanation is that the decrease in Euro MMFs' portfolio spreads is driven by an increase in the holdings of securities issued by low risk US corporations, which are spurned by US MMFs. While we do not have information on security-level holdings for offshore funds and cannot rule out that these time-series patterns are driven by other contemporaneous factors, the evidence provided in Figure 4 and Table 10 suggests that Euro area and more in general offshore MMFs may have at least partially substituted their US counterparts in the provision of funding to safe US borrowers.

6. Conclusion

We exploit a change in regulation of the US money market fund industry to investigate how the structure of liabilities impacts financial intermediaries' asset holdings. We show that following a regulatory change, which has made MMFs' liabilities more information-sensitive,

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less risky prime MMFs exited the industry. In addition, the remaining MMFs have increased the riskiness of their portfolios, possibly in response to an increase in the sensitivity of their flows to performance. As a consequence of these changes, US MMFs provide less funding to safe corporate borrowers. At the same time, Euro area MMFs' holdings of external assets have increased while their portfolio spreads have decreased, which may suggest that offshore MMFs have substituted for US MMFs in funding low risk US corporations.

To the best of our knowledge, our paper provides the first evidence in support of theories highlighting that financial intermediaries' assets and liabilities are jointly determined. It also suggests that changes in domestic regulation may have significant spillovers on the risk of offshore MMFs as well as on the availability of funding to domestic borrowers.

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Table 1: Variable definitions

This table presents the definitions of the variables (in alphabetic order) used in this paper. Unless specified, the data are from iMoneyNet.

Variable	**Definition**
Affiliated fund	Takes the value of one if a fund/share class is affiliated with a bank; a fund is classified as affiliated if at least one of its share classes is flagged as bank-affiliated
Age	Number of years since the inception date of the share class; age of the oldest share class for fund portfolio-level observations
Closure	Takes the value of one in a given month if the share class closes or merges into another fund or share class during the following month, i.e., there is no end-of-month observation in the data for the given share class anymore
Expenses	Annual expense ratio, percent per annum; asset-weighted across share classes for fund portfolio-level observations
FRANK	A fund's percentile rank in week *t* among all prime funds based on the weekly gross yield for week *t*-1; higher rank implies better performance
FRANK [1]	First tercile of FRANK, equal to *min(FRANK,1/3)*
FRANK [2]	Second tercile of FRANK, equal to *min(FRANK-FRANK[1],1/3)*
FRANK [3]	Third tercile of FRANK, equal to *min(FRANK-FRANK[1]-FRANK[2],1/3)*
Fund flow	Return-adjusted change in net assets; computed as $(TNA_t - (1+R_t)TNA_{t-1}))/TNA_{t-1}$, where R denotes the weekly gross return
Fund flow volatility	Standard deviation of *Fund flow* over the previous 12 weeks
Holding risk	Fraction of the fund portfolio invested in bank obligations, net of investments in Treasury/agency debt and repos
Institutional	Takes the value of one if the share class is marketed to institutional investors; a fund is classified as institutional if it offers at least one institutional share class
Inst. funding	Takes the value of one (zero) if the amount of the money-market securities of a given issuer refers to the portion held by institutional (retail) prime MMFs
Issuer entry	Dummy variable that takes the value of one in the month that the issuer enters the sample for the first time; it takes a value of zero otherwise. To avoid false classifications, an issuer that is in the sample from the beginning of our sample period is not defined as an "entrant."
Issuer exit	Dummy variable that takes the value of one in the month that the issuer is in the sample for the last time; it takes a value of zero otherwise. To avoid false classifications, an issuer that is in the sample until the end of our sample period is not classified as having "exited" in that month.
Ln(Family size)	Natural logarithm of the sum of fund family (i.e., fund complex) assets in million USD
Ln(Fund size)	Natural logarithm of the share class/fund portfolio outstanding assets in million USD
Ln(Total net assets)	Natural logarithm of total outstanding assets (deflated to January 2005 values and in million USD) of US prime money market funds. Data on money market fund assets is from iMoneyNet. CPI for the inflation adjustment is obtained from FRED
Ln(Value)	Natural logarithm of (one plus) the total value of securities issued by a given firm that are held by prime MMFs, in millions USD
Liquid share	Fraction of the fund portfolio maturing in 7 days (since MMF reforms adopted in 2010, the SEC defines as "illiquid" any security that cannot be sold or disposed of within seven days at carrying value).
PD	One-month probability of default, for a given issuer and month, based on a forward intensity model, obtained from the Credit Research Initiative (CRI) at the Risk Management Institute (RMI) of the National University of Singapore (NUS)
Post	Takes the value of one after July 23, 2014 (the date of adoption of the amendments to Rule 2a-7), and is zero otherwise

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Post [2008]	Takes the value of one after September 16, 2008 but before 18 September, 2009 (during the time the Fed guaranteed MMF investments), and is zero otherwise
Post [2010]	Takes the value of one after January 27, 2010 but before July 23, 2014 (after announcement of MMF reforms in 2010 until the next regulation announcement), and is zero otherwise
Post [2014]	Takes the value of one after July 23, 2014 but before October 14, 2016 (the date the 2014 rules became effective), and is zero otherwise
Post [2016]	Takes the value of one after October 14, 2016 (the date the 2014 rules became effective), and is zero otherwise
Safe holdings	Fraction of the fund portfolio invested in Treasury/agency debt and repos
Spread	Net return minus the one-month constant maturity T-bill rate (T-bill rate is from FRED), percent per annum
T-bill – OIS	Difference between the one-month constant maturity T-bill rate (obtained from FRED) and the one-month overnight indexed swap (OIS) rate (obtained from Bloomberg), percent per annum

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Table 2: Summary statistics

This table reports summary statistics for the various subsamples used in the analysis. The sample period is January 2005 to November 2017 in all panels except for panel D, in which the sample period is August 2011 to October 2017. Variables are defined in Table 1. All continuous variables in panels B and C are winsorized at 0.5% and 99.5% levels.

Panel A: Summary statistics for the money-likeness test (Table 3)

	Obs.	Mean	Std. Dev.	Min.	Max.
Ln(Total net assets)	673	13.959	0.438	12.592	14.418
T-bill – OIS	673	-0.186	0.243	-1.730	0.213

Panel B: Summary statistics for the MMFs' closure tests (Table 4), class level observations

	Obs.	Mean	Std. Dev.	Min.	Max.
Closure	87,890	0.004	0.059	0	1
Spread	87,886	0.067	0.584	-1.485	2.593
Holding risk	87,890	-0.060	0.277	-1	0.570
Safe holdings	87,890	0.225	0.203	0	1
Liquid share	86,675	0.367	0.167	0.040	1
Institutional	87,890	0.488	0.500	0	1
Affiliated fund	87,890	0.458	0.498	0	1
Ln(Family size)	87,890	9.917	2.182	4.177	13.055
Ln(Fund size)	87,890	5.375	2.706	-2.303	10.841
Expenses	87,646	0.397	0.315	0.040	1.720
Age	87,792	13.227	8.877	0.167	38.833
Fund flow	86,788	0.009	0.212	-0.733	1.885
Fund flow volatility	75,475	0.270	1.412	0	17.609

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Panel C: Summary statistics for the flow-performance-sensitivity (Tables 5 and 6) and risk-taking tests (Table 7 and 8), fund portfolio level observations

	Obs.	Mean	Std. Dev.	Min.	Max.
Spread	133,132	0.094	0.529	-1.030	2.340
Holding risk	133,132	-0.075	0.275	-1	0.530
Safe holdings	133,132	0.23	0.207	0	1
Liquid share	131,041	0.366	0.179	0.030	1
Institutional	133,132	0.552	0.497	0	1
Affiliated fund	133,132	0.405	0.491	0	1
Ln(Family size)	132,749	9.586	2.367	3.630	13.050
Ln(Fund size)	132,749	7.341	1.917	2.303	11.668
Expenses	132,749	0.351	0.24	0.010	1.183
Age	132,682	19.535	9.202	0.589	40.885
Fund flow	132,749	-0.001	0.045	-0.222	0.227
Fund flow volatility	128,195	0.036	0.042	0.002	0.307

Panel D: Summary statistics for issuer-level tests (Table 9)

	Obs.	Mean	Std. Dev.	Min.	Max.
Ln(Value)	22,343	5.128	2.839	0.000	11.135
PD	22,343	0.008	0.045	0.000	1.387
Issuer exit	22,343	0.023	0.151	0	1
Issuer entry	22,343	0.019	0.135	0	1

Panel E: Summary statistics for Euro area MMFs (Table 10)

	Obs.	Mean	Std. Dev.	Min.	Max.
Spread	61,653	0.340	1.085	-2.290	4.590
Holding risk	61,653	0.412	0.326	-0.860	1
Safe holdings	61,653	0.093	0.146	0	0.890
Liquid share	27,573	0.342	0.131	0.060	0.870
Ln(Family size)	61,494	9.211	1.498	4.251	12.060
Ln(Fund size)	61,287	7.501	1.750	2.667	11.188
Expenses	61,494	0.200	0.174	0	1.184
Age	61,494	10.937	6.252	0.290	30.197
Fund flow	61,287	0.002	0.071	-0.269	0.351
Fund flow volatility	59,397	0.067	0.064	0.008	0.610

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Table 3: Prime MMFs' assets and Treasury bill yields

This table reports the following regressions:

$$Ln(Total\ net\ assets)_t = \alpha + \beta \cdot (T\text{-}bill - OIS)_t + \varepsilon_t$$

To explore the impact of regulation, we interact the spread with indicators for specific sample periods: *Post*, *Post [2008]*, *Post [2010]*, *Post [2014]*, and *Post [2016]*. All variables are defined in Table 1. The sample has weekly frequency and covers the period from January 2005 to November 2017. Newey-West standard errors estimated with four lags are reported below coefficients. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1)	(2)	(3)	(4)	(5)
			Ln(Total net assets)		
(T-bill – OIS)	-0.250***	-0.178***		-0.178***	-0.168***
	(0.056)	(0.032)		(0.032)	(0.041)
(T-bill – OIS) · Post		6.174***			
		(1.208)			
Post		0.153			
		(0.179)			
(T-bill – OIS) · Post [2014]				3.034***	3.024***
				(0.903)	(0.906)
(T-bill – OIS) · Post [2016]				0.274***	0.263**
				(0.105)	(0.109)
Post [2014]			-0.269***	0.083	0.067
			(0.047)	(0.076)	(0.081)
Post [2016]			-1.461***	-1.408***	-1.423***
			(0.021)	(0.033)	(0.043)
(T-bill – OIS) · Post [2008]					0.269***
					(0.061)
(T-bill – OIS) · Post [2010]					0.104
					(0.187)
Post [2008]					0.212***
					(0.033)
Post [2010]					-0.057*
					(0.034)
Constant	13.913***	14.095***	14.132***	14.095***	14.110***
	(0.040)	(0.015)	(0.014)	(0.015)	(0.030)
Observations	673	673	673	673	673

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Table 4: Prime MMFs' closures

This table reports the following regressions:

$$Closure_{i,t} = \alpha + \beta \cdot Post_t + X_{i,t}{}'\gamma + \varepsilon_{i,t}$$

The matrix *X* includes the following control variables: *Institutional*, *Affiliated fund*, *Spread*, *Ln(Family size)*, *Ln(Fund size)*, *Expenses*, *Age*, *Fund flow*, *Fund flow volatility*. We explore the impact of regulation using the following indicator variables: *Post*, *Post [2008]*, *Post [2010]*, *Post [2014]*, and *Post [2016]*. Further, we interact the post-regulation indicators with various fund characteristics to study cross-sectional effects. The variables are defined in Table 1. The sample has monthly frequency and covers the period from January 2005 to November 2017. Heteroskedasticity-robust standard errors, clustered by month, are reported below the coefficients. All continuous variables are winsorized at 0.5% and 99.5%. Share class level data are from iMoneyNet. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

Panel A: Basic Findings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:				Closure			
Post	0.005**		0.005**				
	(0.002)		(0.002)				
Post [2014]		0.006**		0.006**	0.005**	0.007**	0.007**
		(0.002)		(0.002)	(0.003)	(0.004)	(0.003)
Post [2016]		-0.001**		0.000	-0.001	0.000	-0.001
		(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
Post [2014] · Institutional						-0.004	
						(0.002)	
Post [2016] · Institutional						-0.001	
						(0.002)	
Post [2014] · Affiliated fund							-0.003
							(0.003)
Post [2016] · Affiliated fund							0.002
							(0.002)
Post [2008]					0.003***	0.002*	0.005***
					(0.001)	(0.001)	(0.002)
Post [2010]					-0.001*	-0.001	-0.002**
					(0.001)	(0.001)	(0.001)
Post [2008] · Institutional						0.002	
						(0.002)	
Post [2010] · Institutional						0.000	
						(0.001)	
Post [2008] · Affiliated fund							-0.003*
							(0.002)

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Table 4, panel A (continued)

Post [2010] · Affiliated fund							0.002**
							(0.001)
Institutional			0.001**	0.001***	0.001**	0.002*	0.001**
			(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Affiliated fund			0.000	0.000	0.000	0.000	0.000
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Spread			0.000	0.000	-0.001**	-0.001**	-0.001**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Family size)			-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Fund size)			-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Expenses			-0.002**	-0.001	-0.003***	-0.003*	-0.003***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age			0.000***	0.000***	0.000***	0.000***	0.000***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Flow			-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Flow volatility			0.000	0.000	0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.003***	0.003***	0.015***	0.014***	0.015***	0.014***	0.015***
	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	87,890	87,890	75,213	75,213	75,213	75,213	75,213
Adjusted R-squared	0.001	0.001	0.005	0.005	0.005	0.005	0.005

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Panel B: Closures based on portfolio riskiness

	(1)	(2)	(3)	(4)	(5)	(6)
				Closure		
Post [2014]	0.005**	0.004***	-0.008***	-0.017***	-0.016***	-0.021***
	(0.002)	(0.002)	(0.003)	(0.005)	(0.006)	(0.006)
Post [2016]	0.000	-0.001	0.000	-0.004	0.001	-0.002
	(0.001)	(0.001)	(0.002)	(0.006)	(0.007)	(0.007)
Spread	0.000				0.001**	0.000
	(0.000)				(0.000)	(0.000)
Post [2014] · Spread	-0.043**				-0.030*	-0.031*
	(0.018)				(0.018)	(0.018)
Post [2016] · Spread	0.009				0.011	0.010
	(0.008)				(0.008)	(0.009)
Holding risk		-0.010***			0.003	0.000
		(0.002)			(0.002)	(0.002)
Post [2014] · Holding risk		-0.043***			-0.016*	-0.013
		(0.015)			(0.008)	(0.008)
Post [2016] · Holding risk		-0.004			-0.011	-0.008
		(0.009)			(0.009)	(0.009)
Safe holdings			0.015***		0.012***	0.001
			(0.003)		(0.003)	(0.004)
Post [2014] · Safe holdings			0.059***		0.036**	0.048***
			(0.020)		(0.015)	(0.015)
Post [2016] · Safe holdings			0.003		-0.006	0.004
			(0.012)		(0.013)	(0.013)
Liquid share				0.022***	0.018***	0.015***
				(0.004)	(0.003)	(0.004)
Post [2014] · Liquid share				0.049***	0.007	0.011
				(0.014)	(0.013)	(0.013)
Post [2016] · Liquid share				0.001	-0.008	-0.005
				(0.013)	(0.011)	(0.011)
Ln(Fund size)	-0.000***	0.000	0.000	0.000	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Post [2014] · Ln(Fund size)					0.001***	0.001***
					(0.000)	(0.000)
Post [2016] · Ln(Fund size)					0.000	0.000
					(0.000)	(0.000)
Post [2008]						-0.009**
						(0.004)
Post [2010]						-0.007**
						(0.003)

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Table 4, panel B (continued)

Post [2008] · Spread						0.001
						(0.001)
Post [2010] · Spread						0.001
						(0.011)
Post [2008] · Ln(Fund size)						-0.001*
						(0.001)
Post [2010] · Ln(Fund size)						0.000
						(0.000)
Post [2008] · Holding risk						0.010***
						(0.004)
Post [2010] · Holding risk						0.007**
						(0.003)
Post [2008] · Safe holdings						0.035***
						(0.011)
Post [2010] · Safe holdings						0.017***
						(0.006)
Post [2008] · Liquid share						0.032***
						(0.011)
Post [2010] · Liquid share						0.004
						(0.007)
Institutional	0.002***	0.002***	0.002***	0.000	0.001***	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Affiliated fund	0.000	0.000	0.000	-0.001**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln(Family size)	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Expenses	-0.002	0.001	0.002**	0.001	0.004***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fund flow	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Fund flow volatility	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.014***	0.004*	0.005**	0.004	-0.001	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	75,213	75,213	75,213	74,272	74,272	74,272
Adjusted R-squared	0.006	0.016	0.017	0.012	0.020	0.022

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Table 5: Flow-performance relationship

This table reports the following regressions:

$$Fund\ flow_{i,t} = \alpha + \beta \cdot Post_t \cdot Return_{i,t-1} + X_{i,t-1}{}'\gamma + \varepsilon_{i,t}$$

Return is a measure of one-period lagged fund performance. In specifications 1-4, *Return* indicates the fund's *Spread*, in the rest of the specifications, *Return* denotes the fractional rank of the fund (*FRANK*). The matrix X includes the following control variables (lagged by one period): *Ln(Fund size)*, *Ln(Family size)*, *Expenses*, *Age*, *Fund flow*, *Fund flow volatility*, and *Institutional*. Finally, the matrix of controls *X* includes sponsor and week fixed effects. All variables are defined in Table 1. The sample has weekly frequency and covers the period from January 2005 until November 2017. Column 11 repeats the tests considering a balanced sample of MMFs. Heteroskedasticity-robust standard errors, clustered by week, are reported below coefficients. All continuous variables are winsorized at 0.5% and 99.5%. Share class level data are from iMoneyNet, observations are aggregated at the fund portfolio level. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Return measure:	Spread	Spread	Spread	Spread	FRANK	FRANK	FRANK	FRANK	FRANK	FRANK	FRANK
Dependent variable:						Fund flow					
Return $_{t-1}$	0.007***	0.007***	0.012***	0.012***	0.006***	0.006***	0.007***	0.007***	0.006***	0.006***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Post · Return $_{t-1}$	0.011***		0.011***		0.005***		0.006***				0.009**
	(0.004)		(0.004)		(0.002)		(0.002)				(0.003)
Post [2014] · Return $_{t-1}$		0.002		-0.001		0.005**		0.006***	0.005**	0.007***	
		(0.007)		(0.007)		(0.002)		(0.002)	(0.002)	(0.002)	
Post [2016] · Return $_{t-1}$		0.016***		0.019***		0.007*		0.007*	0.007*	0.008**	
		(0.004)		(0.004)		(0.004)		(0.004)	(0.004)	(0.004)	
Post [2008] · Return $_{t-1}$									0.004*	0.006**	
									(0.002)	(0.003)	
Post [2010] · Return $_{t-1}$									-0.001	0.001	
									(0.001)	(0.001)	
Ln(Family size) $_{t-1}$			0.000	0.000			0.000	0.000		0.000	
			(0.000)	(0.000)			(0.000)	(0.000)		(0.000)	

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Table 5 (continued)

Ln(Fund size) $_{t-1}$			0.000	0.000			-0.000**	-0.000**		-0.000**	
			(0.000)	(0.000)			(0.000)	(0.000)		(0.000)	
Expenses $_{t-1}$			0.006***	0.006***			-0.007***	-0.007***		-0.007***	
			(0.002)	(0.002)			(0.001)	(0.001)		(0.001)	
Age $_{t-1}$			-0.000***	-0.000***			-0.000***	-0.000***		-0.000***	
			(0.000)	(0.000)			(0.000)	(0.000)		(0.000)	
Fund flow $_{t-1}$			-0.101***	-0.101***			-0.101***	-0.101***		-0.101***	
			(0.009)	(0.009)			(0.009)	(0.009)		(0.009)	
Fund flow volatility $_{t-1}$			-0.022***	-0.022***			-0.022***	-0.021***		-0.022***	
			(0.007)	(0.007)			(0.007)	(0.007)		(0.007)	
Institutional $_{t-1}$			0.001*	0.001*			0.001**	0.001**		0.001**	
			(0.000)	(0.000)			(0.000)	(0.000)		(0.000)	
Sponsor and week F.E.	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	132,749	132,749	128,152	128,152	132,749	132,749	128,152	128,152	132,749	128,152	37,577
Adjusted R-squared	0.029	0.029	0.041	0.041	0.029	0.029	0.041	0.041	0.029	0.041	0.068

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Table 6: Flow-performance relationship by fund type

This table further explores the model specified in Table 5. The fractional rank variable (*FRANK*) is split into terciles and interactions are added to study cross-sectional effects. In columns 2 and 3, the sample is split into retail and institutional funds. A fund is classified as institutional if it offers at least one institutional share class.

	(1)	(2)	(3)	(4)	(5)
Share classes included in sample:	all	retail	institutional	all	all
Dependent variable:			Fund flow		
FRANK		0.003***	0.010***	0.003***	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)
Post · FRANK		0.001	0.007***	0.004**	0.004**
		(0.001)	(0.002)	(0.002)	(0.002)
FRANK1	0.009***				
	(0.003)				
FRANK2	0.005***				
	(0.002)				
FRANK3	0.007***				
	(0.002)				
Post · FRANK1	-0.005				
	(0.006)				
Post · FRANK2	0.010**				
	(0.005)				
Post · FRANK3	0.009*				
	(0.005)				
Institutional $_{t-1}$	0.001**	-0.047**	-0.092***	-0.002***	-0.002**
	(0.000)	(0.021)	(0.029)	(0.001)	(0.001)
Post · Institutional $_{t-1}$				-0.005***	-0.005***
				(0.002)	(0.002)
FRANK ·Institutional $_{t-1}$				0.006***	0.005***
				(0.001)	(0.001)
Post · FRANK · Institutional $_{t-1}$				0.005**	0.005**
				(0.002)	(0.002)
Affiliated fund $_{t-1}$					-0.001
					(0.001)
Post · Affiliated fund $_{t-1}$					-0.000
					(0.002)
FRANK · Affiliated fund $_{t-1}$					0.003***
					(0.001)
Post · FRANK · Affiliated fund $_{t-1}$					-0.002
					(0.003)

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Table 6 (continued)

Ln(Fund size)$_{t-1}$	-0.000**	0.000	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Family size)$_{t-1}$	0.000	-0.000*	0.001*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Expenses$_{t-1}$	-0.007***	-0.004***	-0.009***	-0.006***	-0.006***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Age$_{t-1}$	-0.000***	-0.000***	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fund flow$_{t-1}$	-0.101***	-0.026*	-0.131***	-0.101***	-0.101***
	(0.009)	(0.014)	(0.009)	(0.009)	(0.009)
Fund flow volatility$_{t-1}$	-0.022***	-0.030***	-0.017**	-0.020***	-0.021***
	(0.007)	(0.010)	(0.009)	(0.007)	(0.007)
Sponsor and week F.E.	yes	yes	yes	yes	yes
Observations	128,152	57,231	70,920	128,152	128,152
Adjusted R-squared	0.041	0.046	0.06	0.042	0.042

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Table 7: Fund risk taking after change in regulation

This table reports the following regressions:

$$Fund\ risk_{i,t} = \alpha + \beta \cdot Post[2014]_t + \gamma \cdot Post[2016]_t + X_{i,t-1}{}'\delta + \varepsilon_{i,t}$$

where *Fund risk* denotes one of the following measures of fund risk: *Spread*, *Safe holdings*, *Holding risk*, and *Liquid share*. The matrix *X* includes the same control variables as in Table 4. All variables are defined in Table 1. The sample has weekly frequency and covers the period from January 2005 until November 2017. Column 3 uses a balanced sample of MMFs. All continuous variables are winsorized at 0.5% and 99.5%. Share class level data are from iMoneyNet, observations are aggregated at the fund portfolio level. Heteroskedasticity-robust standard errors, clustered by week, are reported below coefficients. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Spread	Spread	Spread	Safe holdings	Holding risk	Liquid share
Post [2014]	0.007	0.005	0.007	-0.010***	0.015***	0.000
	(0.005)	(0.005)	(0.005)	(0.003)	(0.005)	(0.002)
Post [2016]	0.075***	0.081***	0.065***	-0.097***	0.071***	0.036**
	(0.017)	(0.018)	(0.019)	(0.008)	(0.013)	(0.015)
Ln(Family Size) $_{t-1}$		0.014***	0.076***	-0.010***	0.019***	-0.005***
		(0.001)	(0.007)	(0.001)	(0.001)	(0.001)
Ln(Fund size) $_{t-1}$		0.013***	0.003***	-0.019***	0.035***	-0.014***
		(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Expenses $_{t-1}$		-0.813***	-0.720***	-0.039***	0.072***	-0.066***
		(0.021)	(0.023)	(0.003)	(0.006)	(0.003)
Age $_{t-1}$		-0.000***	-0.001***	0.001***	-0.001***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fund flow $_{t-1}$		0.065	0.106*	0.018	-0.033*	-0.018
		(0.051)	(0.063)	(0.012)	(0.018)	(0.017)
Fund flow volatility $_{t-1}$		0.206***	0.191**	0.548***	-0.660***	0.556***
		(0.051)	(0.075)	(0.017)	(0.022)	(0.015)
Institutional $_{t-1}$		0.007***	0.021***	0.007***	-0.008***	0.020***
		(0.002)	(0.004)	(0.001)	(0.001)	(0.001)
Affiliated fund $_{t-1}$		-0.034***	0.015**	0.032***	-0.058***	0.020***
		(0.002)	(0.006)	(0.002)	(0.003)	(0.002)
Sponsor and year F.E.	yes	yes	yes	yes	yes	yes
Observations	133,132	128,152	36,773	128,152	128,152	126,197
Adjusted R-squared	0.544	0.618	0.645	0.534	0.52	0.527

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Table 8: Heterogeneity in risk taking after the change in regulation

This table reports the following regressions:

$$Fund\ risk_{i,t} = \alpha + \beta \cdot Post[2014]_t \cdot Institutional_{i,t-1} + \gamma \cdot Post[2016]_t \cdot Institutional_{i,t-1} + X_{i,t-1}{}'\delta + \varepsilon_{i,t}$$

where *Fund risk* denotes one of the following measures of fund risk: *Spread*, *Safe holdings*, *Holding risk*, and *Liquid share*. The matrix *X* includes the same control variables as in Table 4. All variables are defined in Table 1. The sample has weekly frequency and covers the period from January 2005 until November 2017. Column 9 and 10 repeat the tests considering a balanced sample of MMFs. All continuous variables are winsorized at 0.5% and 99.5%. Share class level data are from iMoneyNet, observations are aggregated at the fund portfolio level. Heteroskedasticity-robust standard errors, clustered by week, are reported below coefficients. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable:	Spread	Safe holdings	Holding risk	Liquid share	Spread	Safe holdings	Holding risk	Liquid share	Spread	Spread
Post [2014] · Institutional $_{t-1}$	-0.017***	-0.035***	0.030***	0.003	-0.008***	-0.034***	0.029***	0.003	-0.042***	-0.023***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.002)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)
Post [2016] · Institutional $_{t-1}$	0.030***	-0.056***	0.049***	-0.022***	0.028***	-0.057***	0.051***	-0.022***	0.021***	0.021***
	(0.006)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)	(0.007)	(0.005)
Post [2014]	0.015***	0.010***	-0.003	-0.001					0.035***	
	(0.005)	(0.003)	(0.005)	(0.003)					(0.006)	
Post [2016]	0.068***	-0.071***	0.048***	0.046***					0.060***	
	(0.018)	(0.008)	(0.013)	(0.015)					(0.019)	
Ln(Family Size) $_{t-1}$	0.014***	-0.009***	0.019***	-0.005***	0.009***	-0.009***	0.019***	-0.005***	0.077***	0.034***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)	(0.001)
Ln(Fund size) $_{t-1}$	0.013***	-0.020***	0.035***	-0.014***	0.010***	-0.020***	0.035***	-0.014***	0.004***	0.003***
	(0.001)	0.000	(0.001)	0.000	0.000	0.000	(0.001)	0.000	0.000	0.000
Expenses $_{t-1}$	-0.810***	-0.037***	0.070***	-0.067***	-0.899***	-0.047***	0.088***	-0.072***	-0.707***	-0.826***
	(0.021)	(0.003)	(0.006)	(0.003)	(0.007)	(0.003)	(0.005)	(0.003)	(0.024)	(0.007)
Age $_{t-1}$	-0.000***	0.001***	-0.001***	-0.000***	-0.001***	0.001***	-0.001***	-0.000***	-0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

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Table 8 (continued)

Fund flow $_{t-1}$	0.064	0.017	-0.032*	-0.017	0.050***	0.023*	-0.040**	0.007	0.103	0.114***
	(0.051)	(0.012)	(0.018)	(0.017)	(0.015)	(0.012)	(0.017)	(0.013)	(0.063)	(0.018)
Fund flow volatility $_{t-1}$	0.204***	0.553***	-0.665***	0.558***	-0.187***	0.520***	-0.615***	0.516***	0.187**	-0.199***
	(0.051)	(0.017)	(0.023)	(0.015)	(0.018)	(0.017)	(0.023)	(0.013)	(0.075)	(0.023)
Institutional $_{t-1}$	0.008***	0.014***	-0.015***	0.020***	0.003***	0.013***	-0.013***	0.020***	0.027***	0.022***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)
Affiliated fund $_{t-1}$	-0.034***	0.031***	-0.057***	0.020***	-0.022***	0.032***	-0.058***	0.021***	0.013**	-0.013***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.006)	(0.002)
Sponsor and year F.E.	yes	yes	yes	yes					yes	
Sponsor and week F.E.					yes	yes	yes	yes		yes
Observations	128,152	128,152	128,152	126,197	128,152	128,152	128,152	126,197	36,773	36,773
Adjusted R-squared	0.618	0.535	0.521	0.527	0.932	0.541	0.527	0.543	06463	0.951

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Table 9: Issuer default risk, MMF holdings, and issuer entry and exit

Panel A of this table reports coefficients from regressions of the following type:

$$Y_{i,t} = \alpha \cdot Post[2014]_t \cdot PD_{i,t} + \beta \cdot Post[2016]_t \cdot PD_{i,t} + \Psi_{i,t} + \varepsilon_{i,t}$$

where *Y* denotes one of the following dependent variables: *Ln(Value), Issuer exit,* or *Issuer entry*. *PD* is the one-month default probability of the issuer. Matrix Ψ denotes issuer and month fixed effects. The observations are at the issuer-month level. In the regressions reported in Panel B, the unit of observation is the issuer, month, MMF type (institutional or retail). Thus, we have two observations for each issuer and date. This permits us to include issuer-month fixed effects (one dummy variable per issuer and month) in the regressions. In Panel B, *Inst. funding* is a dummy variable that takes the value of one (zero) if the amount of the money-market securities of a given issuer refers to the portion held by institutional (retail) prime MMFs. The other variables are defined in Table 1. The sample has monthly frequency and covers the period from August 2011 until October 2017. There are 735 unique issuers in the sample. Heteroskedasticity-robust standard errors, clustered by issuer, are reported below coefficients. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

Panel A

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(value)		Issuer exit		Issuer entry	
PD · Post	4.694***		-0.189***		0.096	
	(1.385)		(0.063)		(0.063)	
PD · Post [2014]		4.548***		-0.171***		0.097
		(1.350)		(0.055)		(0.062)
PD · Post [2016]		9.769**		-0.821***		0.049
		(4.239)		(0.262)		(0.120)
PD	2.533***	2.613***	0.032	0.022	-0.109***	-0.110***
	(0.832)	(0.832)	(0.037)	(0.036)	(0.028)	(0.028)
Issuer and month F.E.	yes	yes	yes	yes	yes	yes
Observations	22,343	22,343	22,343	22,343	22,343	22,343
Adjusted R-squared	0.890	0.890	0.223	0.223	0.213	0.213

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Panel B

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Value)		Issuer exit		Issuer entry	
Inst. funding · Post · PD	10.899***		-0.135***		0.005	
	(3.703)		(0.037)		(0.031)	
Inst. funding · Post	-0.513***		0.009***		-0.001	
	(0.080)		(0.002)		(0.002)	
Inst. funding · Post [2014] · PD		7.879**		-0.167***		0.003
		(3.194)		(0.046)		(0.032)
Inst. funding · Post [2016] · PD		25.252***		0.037		0.007
		(9.097)		(0.081)		(0.044)
Inst. funding · Post [2014]		-0.132*		0.012***		-0.001
		(0.074)		(0.002)		(0.002)
Inst. funding · Post [2016]		-1.806***		-0.004		-0.002
		(0.146)		(0.004)		(0.002)
Inst. funding · PD	1.186*	1.186*	-0.010**	-0.010**	-0.042	-0.042
	(0.606)	(0.606)	(0.004)	(0.004)	(0.026)	(0.026)
Inst. funding	0.855***	0.855***	0.003***	0.003***	0.004***	0.004***
	(0.087)	(0.087)	(0.001)	(0.001)	(0.001)	(0.001)
Issuer – month F.E.	yes	yes	yes	yes	yes	yes
Observations	44,686	44,686	44,686	44,686	44,686	44,686
Adjusted R-squared	0.728	0.741	0.297	0.298	0.407	0.407

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Table 10: Risk Taking of MMFs in the Euro Area

This table reports the following regressions for Euro area MMFs:

$$Fund\ risk_{i,t} = \alpha + \beta \cdot Post[2014]_t + \gamma \cdot Post[2016]_t + X_{i,t-1}{}'\delta + \varepsilon_{i,t}$$

where *Fund risk* denotes one of the following measures of MMFs' portfolio riskiness: *Spread*, *Safe holdings*, *Holding risk*, and *Liquid share*. The matrix *X* includes the same control variables as in Table 4. All variables are defined in Table 1. The sample has weekly frequency and covers the period from January 2005 until November 2017. Column 3 uses a balanced sample of Euro area MMFs. All continuous variables are winsorized at 0.5% and 99.5%. Share class level data are from iMoneyNet, observations are aggregated at the fund portfolio level. Heteroskedasticity-robust standard errors, clustered by week, are reported below coefficients. * denotes estimates that are significantly different from zero at the 10% level, ** at the 5% level, and *** at the 1% level.

	(1) Spread	(2) Spread	(3) Spread	(4) Safe holdings	(5) Holding risk	(6) Liquid share
Post [2014]	0.000	-0.004	-0.002	0.003	0.002	-0.019***
	(0.005)	(0.005)	(0.005)	(0.002)	(0.002)	(0.004)
Post [2016]	-0.080***	-0.079***	-0.080***	-0.017***	0.008**	-0.023***
	(0.023)	(0.023)	(0.023)	(0.003)	(0.004)	(0.006)
Ln(Family Size) $_{t-1}$		-0.022***	-0.003	-0.033***	0.056***	0.017***
		(0.005)	(0.010)	(0.001)	(0.002)	(0.001)
Ln(Fund size) $_{t-1}$		0.043***	-0.018***	-0.011***	0.011***	-0.029***
		(0.003)	(0.004)	(0.001)	(0.001)	(0.001)
Expenses $_{t-1}$		-0.457***	0.088	0.007	0.004	0.020***
		(0.046)	(0.055)	(0.005)	(0.010)	(0.006)
Age $_{t-1}$		-0.002	0.002	0.004***	-0.011***	0.011***
		(0.002)	(0.002)	0.000	0.000	(0.000)
Fund flow $_{t-1}$		-0.234***	-0.160*	0.013	-0.024	0.040***
		(0.080)	(0.082)	(0.008)	(0.015)	(0.012)
Fund flow volatility $_{t-1}$		0.06	0.497***	-0.001	-0.193***	0.199***
		(0.056)	(0.071)	(0.015)	(0.023)	(0.017)
Sponsor and year F.E.	yes	yes	yes	yes	yes	yes
Observations	61,653	59,397	35,858	59,397	59,397	27,336
Adjusted R-squared	0.546	0.566	0.565	0.354	0.541	0.494

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Figure 1: Money market fund assets

The graph depicts the weekly aggregate outstanding value of money market fund assets (in billion USD) by fund type and in total. The vertical lines represent significant dates: September 2008 when the Reserve Primary Fund "broke the buck," January 2010 when the first regulatory changes related to money funds were announced, July 2014 when the amendments to Rule 2a-7 were adopted, and October 2016 when the new rules came into effect.

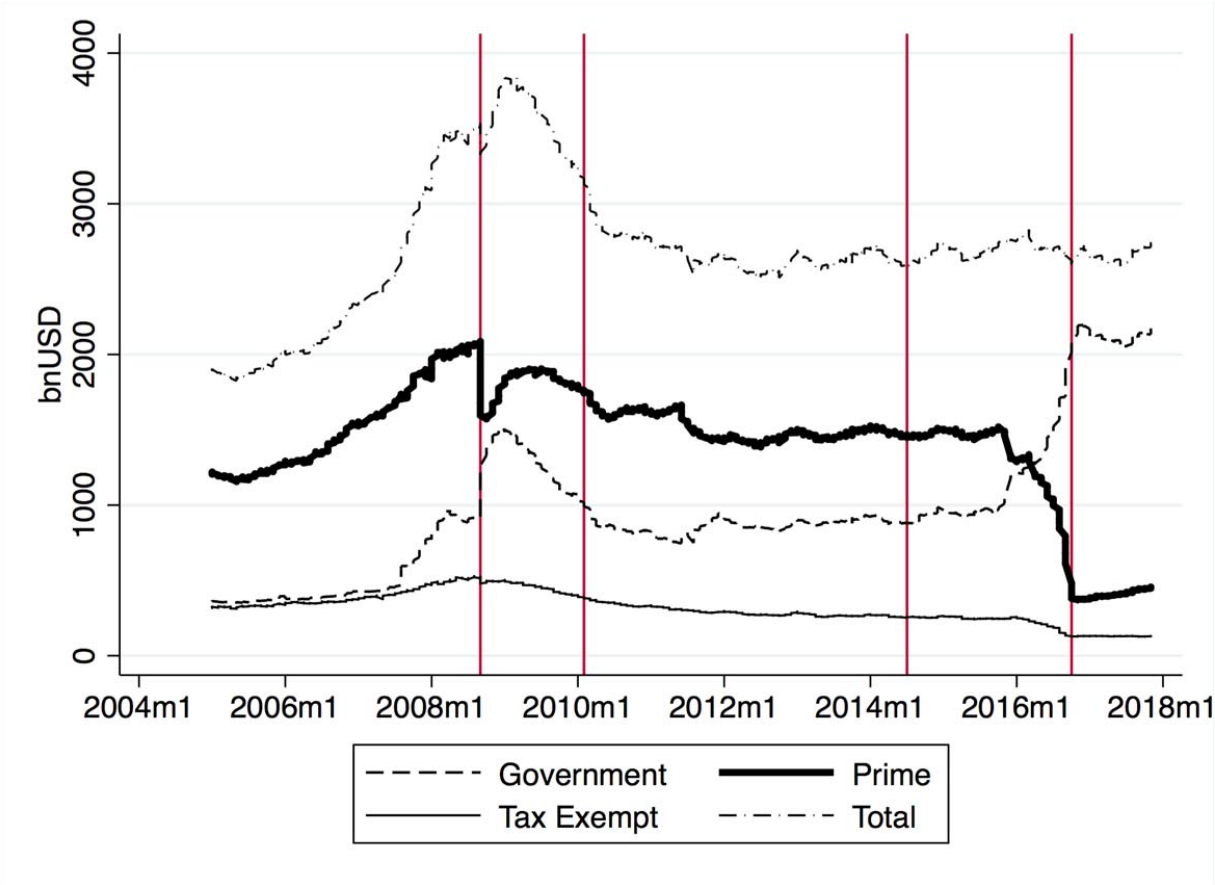

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Figure 2: Institutional and retail money market fund assets

The graph depicts the weekly aggregate outstanding value of institutional and retail money market fund assets (in billion USD). Institutional (retail) assets represent the aggregate assets of all institutional (retail) share classes of MMFs. The vertical lines represent significant dates: September 2008 when the Reserve Primary Fund "broke the buck," January 2010 when the first regulatory changes related to money funds were announced, July 2014 when the amendments to Rule 2a-7 were adopted, and October 2016 when the new rules came into effect.

Figure A: Institutional assets

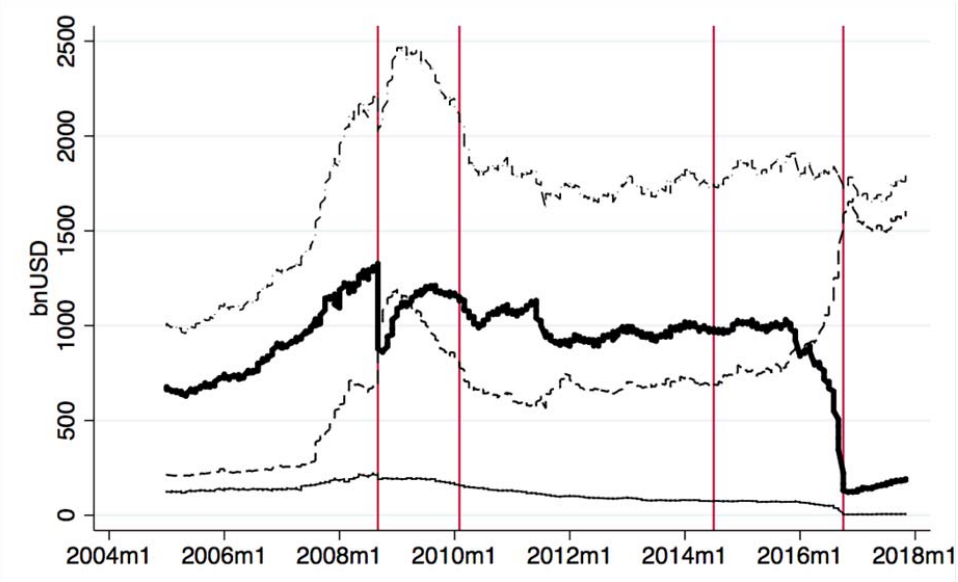

Figure B: Retail assets

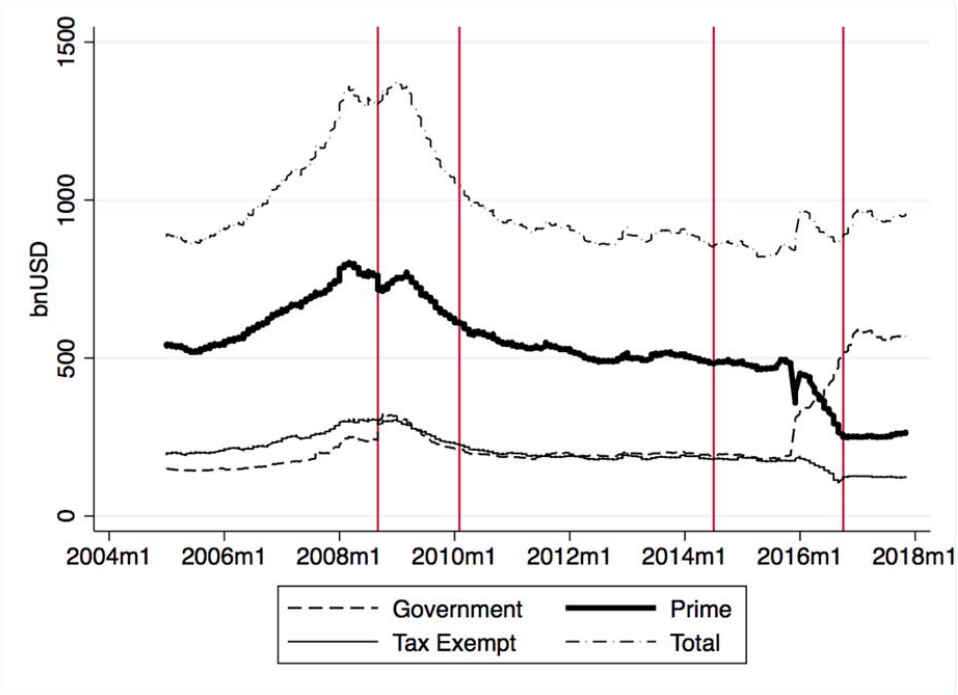

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Figure 3: Spreads by Money Market Instrument

This figure reports the spreads of different money market instruments during the sample period. The monthly data is obtained from FRED and covers the 3-month rate for US Certificates of Deposit (*Deposits*), 3-month AA Financial Commercial Paper Rate (*CP (F)*), 3-month AA Non-Financial Commercial Paper Rate (*CP (NF)*) and 90-day AA Asset-backed Commercial Paper Interest Rate (*ABCP*). The spread is computed relative to the 3-month Treasury Bill Rate.

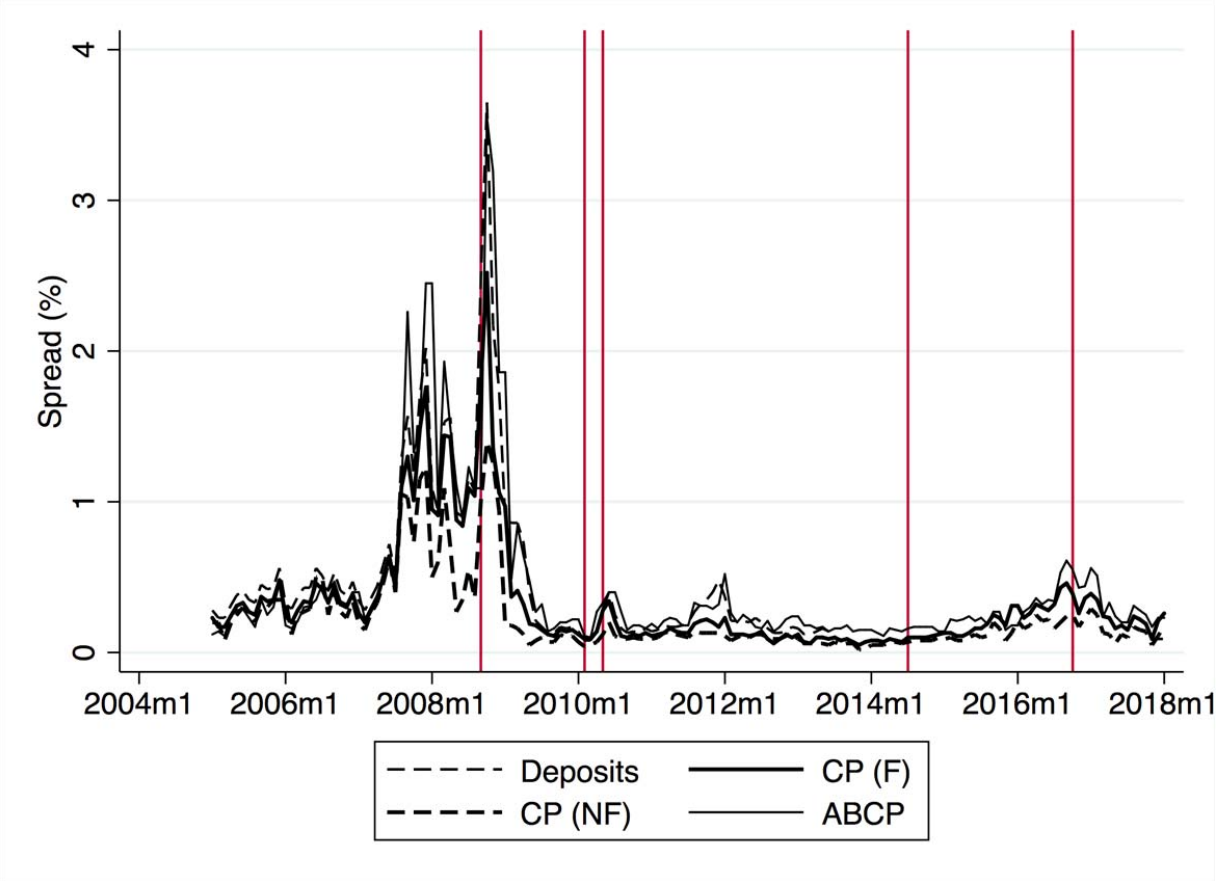

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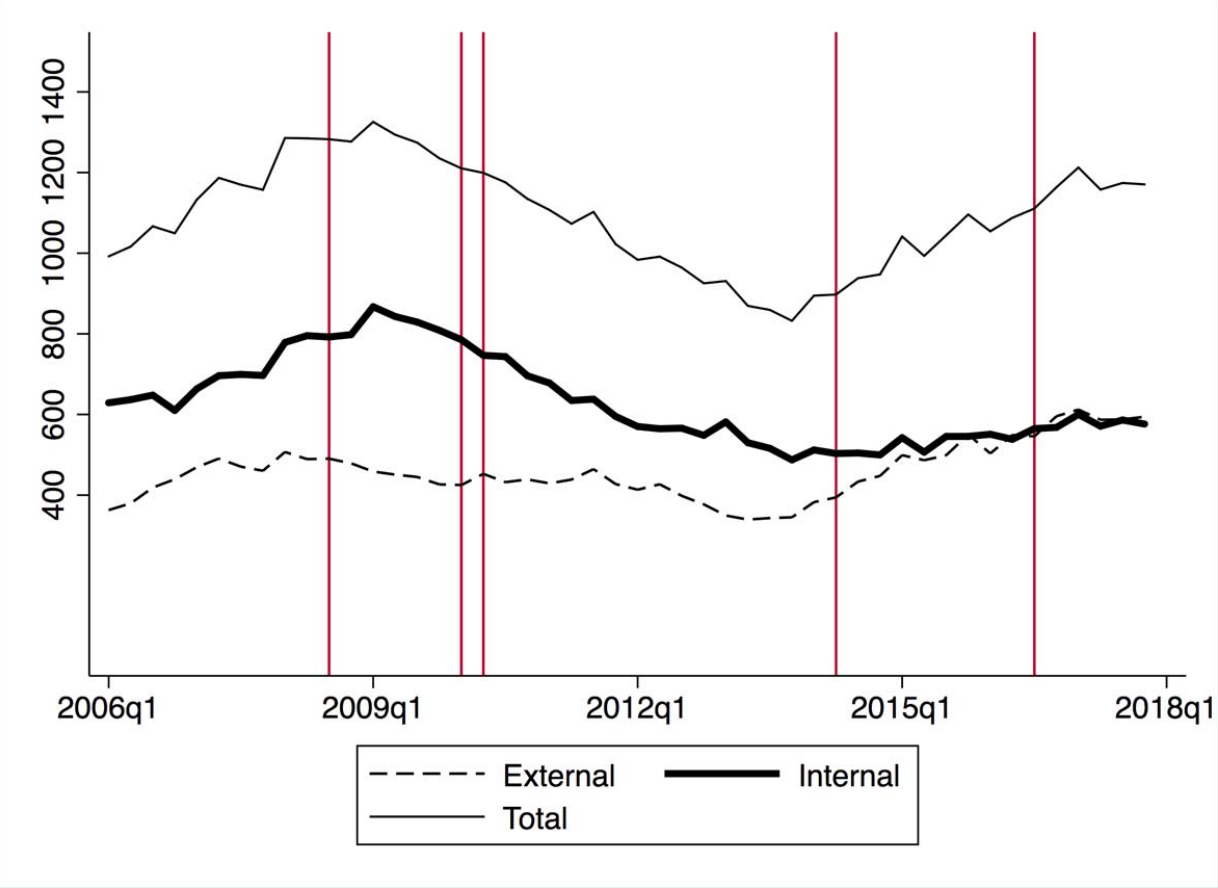
Figure 4: International Spillovers of the Reform

This figure illustrates the asset composition (in billion USD) for Euro area MMFs. Internal assets represent the value of money market assets issued by institutions registered in the Euro area, external assets represent money market instruments issued by institutions outside the Euro area. Data are from the ECB statistical warehouse.



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