LIABILITY STRUCTURE AND RISK-TAKING:
EVIDENCE FROM THE MONEY MARKET FUND INDUSTRY

Ramin P. Baghai
Stockholm School of Economics and CEPR
Mariassunta Giannetti
Stockholm School of Economics, CEPR and ECGI
Ivika Jäger
Stockholm School of Economics

Background

- Can intermediaries still create liquidity in the absence of regulations that provide commitment? (Holmstrom and Tirole 2011)
- Elusive question from an empirical point of view
- This paper exploits a recent reform of US money market funds to try to address this question

Money market funds (MMFs)

- Important financial intermediaries providing short-term funding to
  - Corporates and financial institutions (prime MMF)
  - National governments (government MMF)
  - Municipal governments and agencies (tax-exempt MMF)

- MMFs' liabilities: typically regarded by investors as money-like securities
  - Profitable substitutes for deposits
  - Effectively guaranteed net asset value (NAV) of $1 for a $1 investment

2008: turmoil in the money fund industry

- Reserve Primary Fund “broke the buck” in September 2008 quoting a NAV of 97 cents per $1

- Reason
  - Large holdings of Lehman’s commercial paper

- Consequences
  - Wide-scale run on US prime MMFs
  - US Treasury guaranteed MMFs’ liabilities for a year
  - **Sweeping regulatory efforts** to avoid future runs on MMFs in the US followed

Changes in US MMFs’ regulation

- Changes to Rule 2a-7 (Investment Company Act of 1940)
- 2010: Minimum levels of liquid assets
- 2014: (Some) MMF liabilities trade at actual NAV; all funds can impose redemption gates and liquidity fees

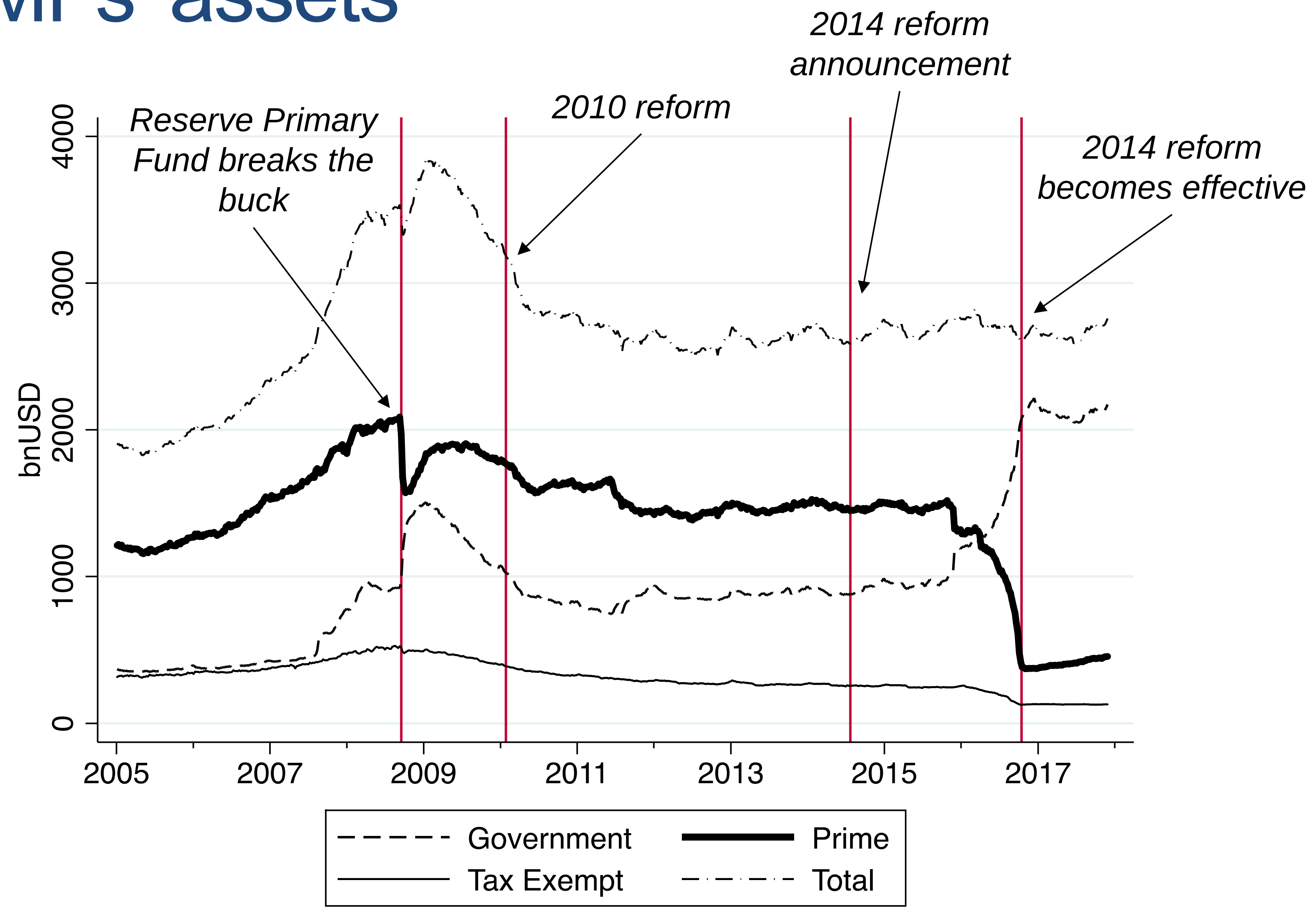
This paper

- Study regulatory changes announced in July 2014 (effective October 2016)

Change	Institutional			Retail		
	Government	Tax-Exempt	Prime	Government	Tax-Exempt	Prime
cNAV to vNAV		X	X			
Fees & Gates		X	X		X	X

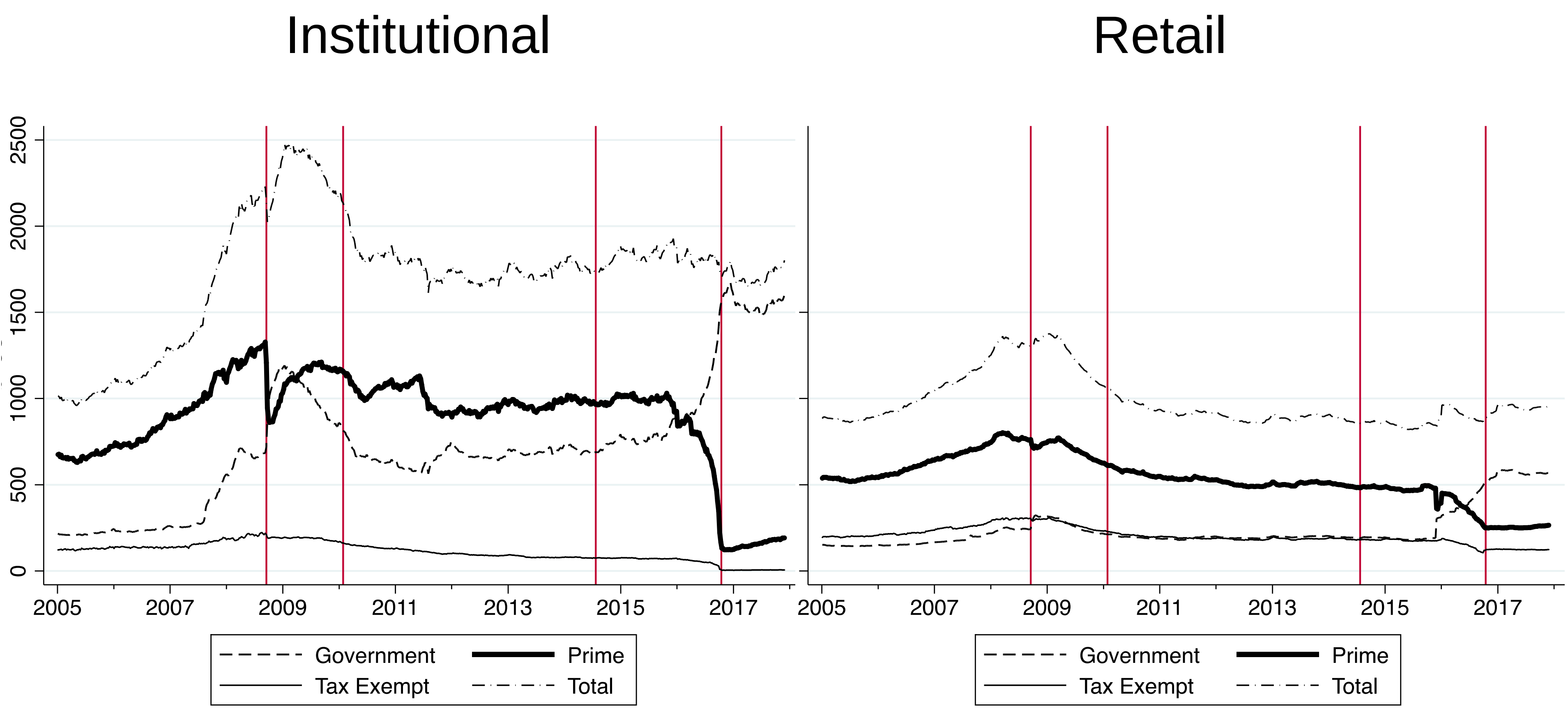
- These changes decreased the liquidity of MMFs' liabilities
- **What are the economic consequences of these changes?**

MMFs’ assets



Reserve Primary Fund breaks the buck
2010 reform
2014 reform announcement
2014 reform becomes effective
bnUSD
0
1000
2000
3000
4000
2005
2007
2009
2011
2013
2015
2017
Government
Prime
Tax Exempt
Total

MMFs' assets



Institutional
Retail
0
500
1000
1500
2000
2500
2005
2007
2009
2011
2013
2015
2017
Government
Prime
Tax Exempt
Total

Research Question

- **Have the changes in the regulation of MMFs' liabilities affected the nature of the services provided by MMFs?**

  - Existing theories highlight synergies between the assets and liabilities of financial intermediaries (Hanson, Shleifer, Stein, and Vishny, 2015)

  - Information-sensitive claims are less liquid (Gorton and Pennacchi, 1990; Dang, Gorton and Holmström 2015)

What we do & what we find

- Have changes in regulation affected the "money-likeness" of MMFs' liabilities?
  - MMFs seem to have become poorer substitute for money-like claims such as Treasury bills
- Did investors start to monitor more?
  - Flow-performance sensitivity has increased (especially for MMFs targeted at institutional investors)
- How has the structure of the money market industry changed?
  - Low-risk prime MMFs exited industry
- How has MMFs' risk taking changed?
  - Prime MMFs take more risk after reform, decreasing funding supply to safe borrowers
  - Positive spillover effect on the safety of Euro MMFs

Related literature

- Kacperczyk and Schnabl (2013):
  - Funds' risk taking increases in 2008, but less for funds affiliated with financial conglomerates

- Di Maggio and Kacperczyk (2017), La Spada (2017):
  - Zero lower bound policies led money market funds to exit the industry and increased the risk taking of the remaining funds

- Schmidt, Timmermann, and Wermers (2016) & Gallagher, Schmidt, Timmerman, and Wermers (2016):
  - Institutional investors in MMFs are more responsive to information events (during 2008 and the Eurozone Crisis)

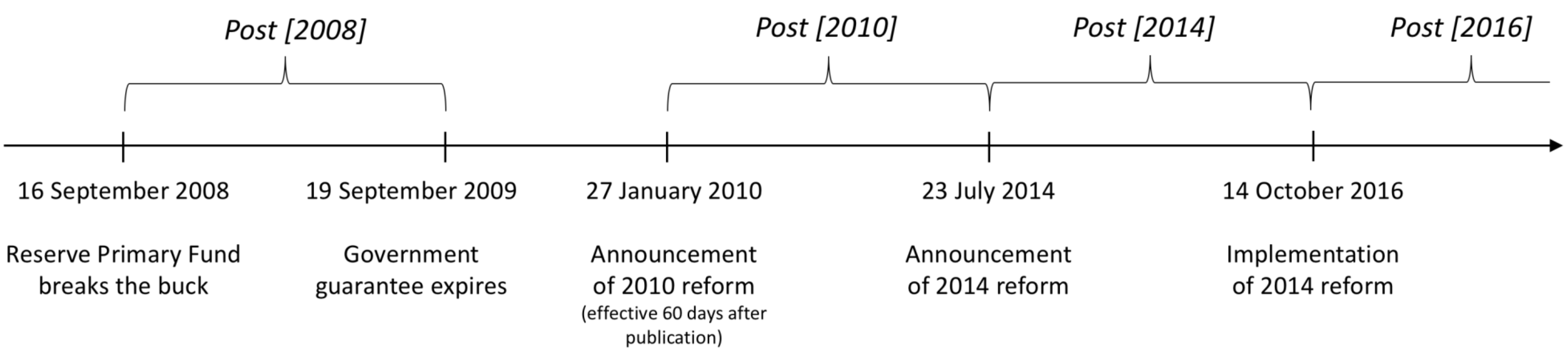
Main data

- iMoneyNet
  - 2005 to 2017
  - Weekly/monthly share class level data of US MMFs
    - 1108 unique share classes, 383 unique fund portfolios
  - Monthly issuer level data of MMF holdings
- Issuer default probabilities: NUS-RMI Credit Research Initiative
  - Matched manually to iMoneyNet holdings data
- Additional data from FRED, ECB, Bloomberg, CRSP

Money-likeness of MMFs liabilities

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

- Idea: Supply of money-like assets should increase when demand for money-like securities is high
- (Inverse) proxy for demand of money-like securities: Treasury-bill spread over overnight indexed swap (OIS) rate
  - Test inspired by Sunderam (2015)



Prime MMFs become less money-like

	(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

Prime MMFs' closures

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

- Control variables:
  - *Institutional*, *Affiliated fund*, *Spread*, *Ln(Family size)*, *Ln(Fund size)*, *Expenses*, *Age*, *Fund flow*, *Fund flow volatility*

Prime MMFs' closures

	(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)
Controls			…	…	…	…	…
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

Less risky MMFs are more likely to close

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)
Maturing in 7 days				0.022***	0.018***	0.015***
				(0.004)	(0.003)	(0.004)
Post [2014] · Maturing in 7 days				0.049***	0.007	0.011
				(0.014)	(0.013)	(0.013)
Post [2016] · Maturing in 7 days				0.001	-0.008	-0.005
				(0.013)	(0.011)	(0.011)
Controls	...	...	...	...	...	...
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

Flow-performance sensitivity (FPS)

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

- Control variables
  - *Ln(Fund size)*, *Ln(Family size)*, *Expenses*, *Age*, *Fund flow*, *Fund flow volatility*, *Institutional, sponsor and week fixed effects*

- 2 measures of performance (*Return*)
  - *Spread (net) and FRANK (fractional ranking)*

2014 reform and FPS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Return measure:	Spread	Spread	Spread	Spread	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***
	(0.001)	(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***			
	(0.004)		(0.004)		(0.002)		(0.002)			
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)
Controls			…	…	…	…	…	…	…	…
Sponsor and week F.E.	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
Adjusted R-squared	0.029	0.029	0.041	0.041	0.029	0.029	0.041	0.041	0.029	0.041

FPS by fund type

Share classes included in sample:	all	retail	institutional	all	all
Dependent variable:			Fund flow		
FRANK		0.003***	0.010***	0.003***	0.005***
		(0.001)	(0.001)	(0.001)	(0.001)
Post · FRANK		0.001	$\boxed{0.007^{***}}$	0.004**	0.006***
		(0.001)	$\boxed{(0.002)}$	(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***	0.001**
	(0.000)	(0.021)	(0.029)	(0.001)	(0.000)
Post · Institutional $_{t-1}$				-0.005***	
				(0.002)	
FRANK ·Institutional $_{t-1}$				0.006***	
				(0.001)	
Post · FRANK · Institutional $_{t-1}$				$\boxed{0.005^{**}}$	
				$\boxed{(0.002)}$	
Controls	...	...	...	...	...
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	0.041

MMF risk taking

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

- Control variables:
  - *Institutional*, *Affiliated fund*, *Spread*, *Ln(Family size)*, *Ln(Fund size)*, *Expenses*, *Age*, *Fund flow*, *Fund flow volatility, sponsor and year fixed effects*

- Measures of fund risk:
  - *Spread*, *Safe holdings*, *Holding risk*, *Maturing in 7 days*

MMFs' risk taking

	(1) Spread	(2) Spread	(3) Spread	(4) Safe holdings	(5) Holding risk	(6) Maturing days
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	126,19
Adjusted R-squared	0.544	0.618	0.645	0.534	0.52	0.527

Heterogeneity in MMFs' risk taking after the reform

	(1) Spread	(2) Safe holdings	(3) Holding risk	(4) Maturing in 7 days	(5) Spread	(6) Safe holdings	(7) Holding risk	(8) Maturing in 7 days
Post [2014] · Institutional $_{t-1}$	-0.017***	-0.035***	0.030***	0.003	-0.008***	-0.034***	0.029***	0.003
	(0.003)	(0.003)	(0.005)	(0.003)	(0.002)	(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***
	(0.006)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)
Post [2014]	0.015***	0.010***	-0.003	-0.001				
	(0.005)	(0.003)	(0.005)	(0.003)				
Post [2016]	0.068***	-0.071***	0.048***	0.046***				
	(0.018)	(0.008)	(0.013)	(0.015)				
Controls	...	...	...	...	...	...	...	...
Sponsor and year F.E.	yes	yes	yes	yes				
Sponsor and week F.E.					yes	yes	yes	yes
Observations	128,152	128,152	128,152	126,197	128,152	128,152	128,152	126,197
Adjusted R-squared	0.618	0.535	0.521	0.527	0.932	0.541	0.527	0.543

(Unintended) effects on corporate issuers

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

- Dependent variables:
  - *Ln(Value), Issuer exit,* and *Issuer entry*

- *PD:* issuer’s 1-month default probability (NUS-RMI)

Riskier firms receive relatively more funding

Riskier corporate issuers: relatively more funding (intensive & extensive margin) from US MMFs after reform

Within-issuer variation points to a supply effect

	(1)	(2)
	Ln(Value)	
PD · Post [2014]	1.326	
	(0.820)	
PD · Post [2016]	7.583**	
	(3.114)	
PD	-1.638*	
	(0.919)	
Inst. funding · Post [2014] · PD		-0.282
		(0.259)
Inst. funding · Post [2016] · PD		15.588***
		(3.139)
Inst. funding · Post [2014]		-0.078
		(0.063)
Inst. funding · Post [2016]		-1.320***
		(0.114)
Inst. funding · PD		0.241
		(0.320)
Inst. funding		0.554***
		(0.081)
Issuer and month F.E.	yes	
Issuer - month F.E.		yes
Observations	23,285	46,610
Adjusted R-squared	0.791	0.826

Spillovers Effects on Offshore Funds- Evidence from Euro Funds

	(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)
Controls	yes	yes	yes	yes	yes	yes
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

Conclusions

- 2014 regulatory change made MMFs' liabilities more information-sensitive
- As a consequence, less risky MMFs exited the industry
- Remaining MMFs
  - experienced increase in sensitivity of their flows to performance and
  - increased riskiness of their portfolios
- Supply of funding to safe borrowers by MMFs decreased
- Intermediaries appear unable to create liquid assets in the absence of regulation (Holmström and Tirole 2011)