

# **U.S. unconventional monetary policy and fragility in emerging market debt funds**

*Bachelor's Thesis*

*Finance*

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## **Abstract**

This thesis analyzes the sensitivity of emerging market debt mutual fund flows to U.S. unconventional monetary policies after the global financial crisis. First, I find that fund flows were affected by large-scale asset purchase announcements made by the Federal Reserve during 2008-2014. Additionally, outflows of emerging market debt funds are more sensitive to bad performance than their inflows are sensitive to good performance, i.e., they exhibit a concave flow-to-performance relation. However, the relation changes during Quantitative Easing, which may increase asset managers' incentives to reach for yield. In contrast, the sensitivity of bad performance strengthens when the policy is lifted. These results point to the possibility of fragility in emerging market debt funds.

*Keywords:* fragility; flow-to-performance relation; bond mutual funds; unconventional monetary policy; emerging markets

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## 1. Introduction

Central banks around the globe – including the Federal Reserve (Fed) in U.S. – used non-standard monetary policy interventions after the 2007-09 global financial crisis (Fratzscher et al., 2012). As a result, yields on government and corporate bonds have decreased in major developed economies, making it harder for investors in bond markets to generate returns. It is often reported that declining rates can incentivize investors to increase the holdings of higher-yielding but riskier securities, which is commonly referred to as “reaching for yield”. (see, e.g., Choi and Kronlund, 2015; Di Maggio and Kacperczyk, 2017) Rajan (2015) suggests that emerging markets might be the most exposed to the increased risk-taking.

Foreign policymakers – particularly in emerging markets – have criticized the Fed’s policies, arguing that they have caused large capital flows to emerging market economies (EMEs) since 2009 (Fratzscher et al., 2012; Ahmed and Zlate, 2014). Importantly, stimulus is not a free lunch, and macroeconomic disruptions may arise when monetary policy is lifted (Feroli et al., 2014).

Shin (2013) distinguishes between two recent phases of “global liquidity”, the first one lasting from 2003-08 and the second phase – which is especially present in the market for emerging market debt securities – starting in 2010. During the first phase, the focus was on global banks transmitting loose financial conditions across borders via banking capital flows. In the second phase, banks have been constrained by regulation, and have thereby given way to asset managers. Also Goldstein et al. (2017) discuss how regulation of other players in the financial industry is likely to increase activity in mutual funds, raising an important question over their fragility.

While inflows to fixed income mutual funds have grown rapidly in recent years (Feroli et al., 2014), the literature on flows in bond mutual funds is still limited (Christoffersen et al., 2014). This paper aims to complement the existing literature on U.S. monetary policy spillovers as well as mutual fund fragility by doing an empirical study on emerging market debt (EMD) mutual funds based in the U.S.

First, I will study how sensitive the fund flows in my sample were of the LSAP announcements made during 2008-2014. Importantly, I do not include only the announcements related to the extensions of the programs, but also the tapering of LSAPs. This allows me to investigate how sensitive EMD mutual funds are to expansive monetary policies as well as a reversal in risk appetite. Second, I will study the flow-to-performance relation in my sample funds to see whether it shows signs of fragility. Third, I will further examine how the flow-to-performance relation changes during the three phases of QE to understand whether it increases the incentives for asset managers to reach for yield. Lastly, I will

investigate whether the funds that experienced larger inflows during QE show greater fragility when the monetary policy is tightened.

My key findings can be summarized as follows. First, inflows to EMD mutual funds are largely affected by the Fed's announcements related to both the expansion and tapering of LSAPs. Second, EMD mutual funds are more sensitive of outflows to bad past performance than of inflows to good past performance – i.e., their flow-to-performance relation is more concave. However, the sensitivity of bad performance weakens during Quantitative Easing (QE), which might increase the incentives for asset managers to reach for yield. In contrary, when monetary policy is lifted, the sensitivity of poor performance strengthens. Furthermore, the sensitivity is greater for the funds that experienced excessive flows during QE. These findings point to a potential fragility in EMD mutual funds.

This paper is organized as follows. Section 2 presents previous literature. Section 3 describes the institutional background and states the main hypotheses. Section 4 describes the data and methodology. Section 5 presents and discusses the main results. Section 6 concludes.

## **2. Literature review**

Previous literature shows that flows between mutual funds and investors are both a cause and outcome in a complex web of decisions (Christoffersen et al., 2014). In mutual funds, the manager compensation and investor flows are both sensitive to fund returns and therefore, managers have an incentive to boost returns. Whereas the existence of flow-to-performance relation is generally a good thing (Chevalier and Ellison, 1997), it may also result in risk-taking behavior, i.e. reaching for yield (Rajan, 2005).

While equity mutual funds are widely documented to be very sensitive to good past performance, i.e., exhibit a convex flow-to-performance relation (see, e.g., Chevalier and Ellison, 1997; Brown et al., 1996), Goldstein et al. (2017) find that the relation for corporate bond funds is concave. In other words, corporate bond investors are more sensitive to bad performance than to good performance. Furthermore, they are more sensitive to underperformance as portfolio and market liquidity gets worse, which points to a potential fragility in corporate bond funds.

The flow-to-performance relation of a mutual fund is connected to managerial incentives. When the relation is more convex, i.e., investor flows are very sensitive of good past performance, managers are more incentivized to take on excess risk in order to generate better returns and attract investor flows. (Chevalier and Ellison, 1997) Rajan (2005) suggests that these incentives should be a concern under

certain situations. Indeed, previous literature widely argues that reaching for yield may be more present in a low-interest-rate environment, as market participants are willing to take on more risk (see, e.g., Acharaya and Naqvi, 2016; Choi and Kronlund, 2016).

Feroli et al. (2014) focus on market tantrums and study whether potential non-bank channels of financial instability exist by investigating fixed income mutual fund flows. They find that flows into and out of bond funds seem to aggravate and be aggravated by changes in bond prices, potentially creating instability in the industry. They point out that whereas banks have been regulated, the instability caused by non-banks does not yet have a simple cure. Indeed, their results suggest that unconventional monetary policies can encourage certain types of risk-taking, which can result in future hazards.

There are also several studies confirming that EME inflows have been affected by the LSAPs implemented by the Federal Reserve. One of the papers providing evidence on this is by Fratzscher et al. (2012), who find that U.S. unconventional monetary policy measures have had an effect on capital flows to EMEs in a pro-cyclical manner. Specifically, the first phase of LSAPs, introduced in late 2008 as a part of unconventional monetary policy tools, caused flows out of EMEs into U.S. equity and bond funds. In contrary, the direction was the opposite under the second phase. The findings of Ahmed and Zlate (2014) and Tillmann (2016) also confirm that U.S. unconventional monetary policy is one among a number of important factors affecting EME inflows.

One relevant study that discusses the effects of market tantrums on EMEs is by Ahmed et al. (2017). They find that financial conditions deteriorated in EMEs during summer 2013, during an event commonly referred to as “taper tantrum”. The Fed chairman Ben Bernanke suggested that the Fed might slow down the pace of large-scale asset purchase programs (LSAPs), and it led to a sharp rise in both the U.S. and EME bond yields. This triggered portfolio adjustments, causing significant outflows from EMEs to the U.S. (Ahmed et al., 2017; World Bank, 2014). Specifically, the findings of Ahmed et al. (2017) suggest that the effects were greater in those countries that had earlier experienced greater private capital inflows and exchange rate appreciation.

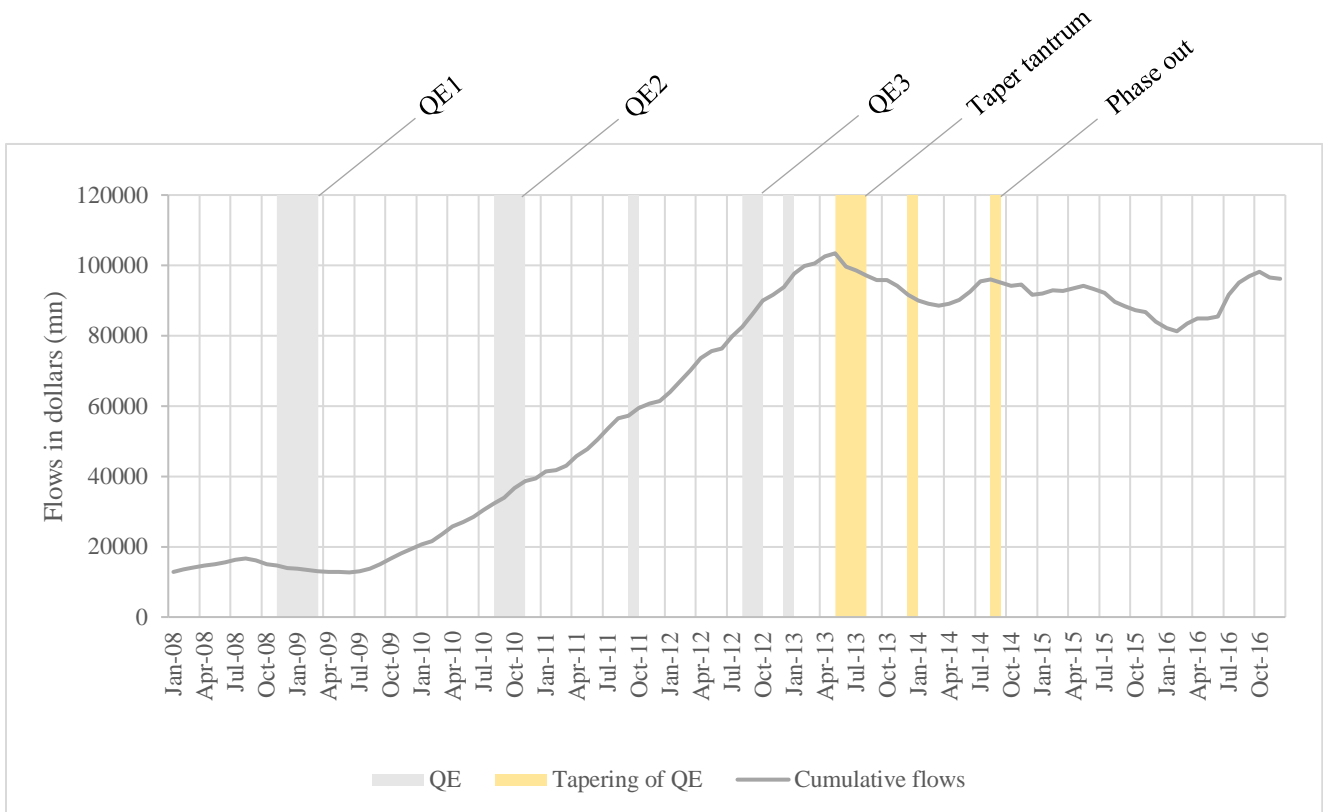
Several studies have also investigated the effects of EME inflows to issues such as currency appreciation, excessive credit issuance and changes in yields (see, e.g., Ahmed and Zlate, 2014; Fratzscher et al., 2012). However, my paper does not attempt to measure in detail the impact EMD mutual fund flows have on U.S. and EM economies or market prices – importantly, it is worth noting that EMD funds form just a small share of the total capital flows to EMEs.

### 3. Institutional background and hypotheses development

In this section, I first present the institutional background and then continue to hypothesis development.

#### 3.1. Institutional background

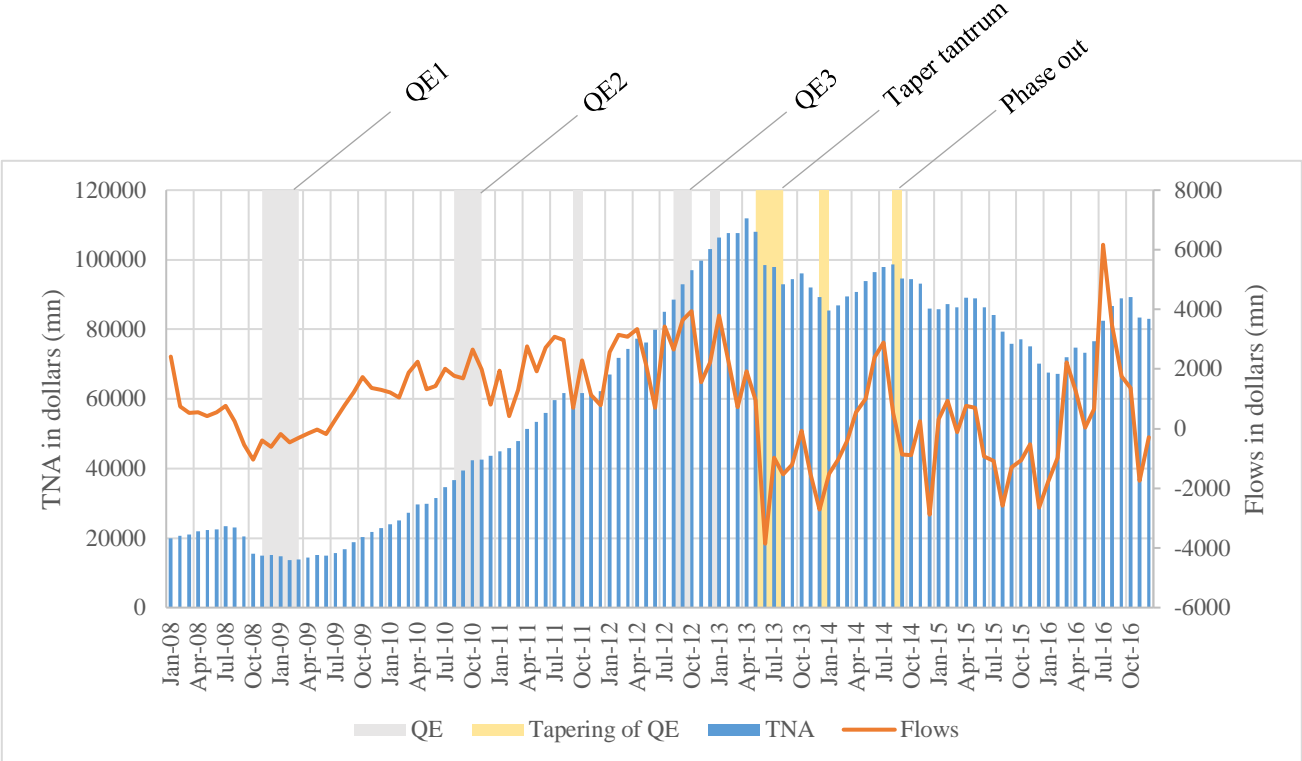
IMF's Global Financial Stability report (2015) documents that recently, mutual funds have been increasing their portfolio weights in less liquid assets, including emerging market assets. Fig.1 confirms the rapid growth of the EMD mutual funds.



**Fig. 1 Cumulative net dollar flows to emerging market debt mutual funds.** This figure plots the net cumulative dollar flows to emerging market debt mutual funds over the period 2008 to 2016. I exclude index funds and exchange traded funds from the CRSP mutual fund database. The grey and yellow areas represent announcements related to the expansion and tapering of LSAPs. QE1, QE2, and QE3 represent the dates the three programs were first announced. Taper tantrum refers to the events of Summer 2013, and Phase out marks the date the programs were halted (see Table 1 in Appendix for details).

The cumulative fund flows have grown quite steadily since the financial crisis, until the events of summer 2013. This raises an interesting question over EMD mutual fund sensitivity of the unconventional monetary policies implemented by the Fed.

Even though the growth has been considerably large, the flows to EMD mutual funds have also been rather volatile. Fig. 2 visualizes this. It shows the total net assets and net dollar flows of the EMD mutual funds in my sample. As of January 2008, the total net assets invested in EMD funds were \$20 billion, and in April 2013 – just before the taper tantrum – the figure had grown over fivefold up to \$112 billion, reaching its peak. In the end of my sample period, December 2016, total net assets were equal to \$83 billion.



**Fig. 2 Total net assets and net dollar flows of active emerging market debt funds.** This figure shows total net assets (TNA) and net dollar flows of actively managed emerging market debt funds from 2008 to 2016. I exclude index funds, exchange traded funds and exchange traded notes from the CRSP mutual fund database. The grey and yellow areas represent announcements related to the expansion and tapering of LSAPs. QE1, QE2, and QE3 represent the dates the three programs were first announced. Taper tantrum refers to the events of Summer 2013, and Phase out marks the date the programs were halted (see Table 1 in Appendix for details).

In order to better understand the factors affecting the flow-to-performance relation in bond mutual funds, it is worth noting the liquidity mismatch in investor flows. When a bond mutual fund experiences net outflows, it is forced to liquidate holdings, which can be costly. Whereas exiting investors get their money as of the day of redemption, the portfolio adjustments may occur later due to the illiquidity of bonds. As all investors trade at the same price, i.e., the net asset value per share, withdrawing money out

of a mutual fund will largely be reflected in future net asset values, creating negative externalities to other investors. This liquidity mismatch causes a first-mover advantage in the withdrawing decision and possibly leads to a ‘run risk’: If investors expect others to withdraw their money, they might have a greater incentive to redeem their shares. (Christoffersen, 2014; Goldstein et al., 2017) The liquidity mismatch is particularly central for EMD mutual funds, as they tend to hold more illiquid assets.

### ***3.2.Hypotheses development***

Since the U.S. unconventional monetary policy has played a role in the inflows to EMEs (Ahmed and Zlate, 2014; Fratzscher et al., 2012; Tillmann, 2016) and also mutual funds have experienced increasing flows during the recent years (Feroli et al., 2014), I expect the funds in my sample to experience flows sensitive to both the expansion and tapering of LSAPs. This leads to my first hypothesis.

**Hypothesis 1:** LSAP announcements prompt shifts in bond market sentiment that move EMD mutual fund flows.

EMD mutual funds tend to hold more illiquid assets compared to e.g. equity mutual funds. It makes the negative externalities of outflows stronger in my sample funds – similarly as for the corporate bond mutual funds studied by Goldstein et al (2017). This leads to my second hypothesis.

**Hypothesis 2:** EMD mutual funds are more sensitive of outflows to bad performance than of inflows to good performance, i.e. they exhibit a concave flow-to-performance relationship.

When QE is expanded, it should increase liquidity in the bond market. When liquidity is higher, the negative externalities should weaken, resulting in a lower sensitivity of outflows to bad performance. In contrast, the sensitivity should be stronger when the LSAPs are tapered, and the market overall is more illiquid. This leads to my third hypothesis.

**Hypothesis 3:** The flow-to-performance relation of EMD mutual funds varies across different phases of QE.

My empirical tests will focus on these hypotheses and provide robustness tests to check whether the results hold. Next, I describe the data and empirical measurements used.

#### 4. Data description and empirical measurement

##### 4.1. Data and summary statistics

I retrieve data on EMD mutual funds from the Center for Research in Security Prices (CRSP), using the lipper objective code EMD to identify the funds in my sample. I exclude all index funds, exchange-traded funds and exchange-traded notes from my sample. I do empirical tests on fund share class level, and my data cover the period from January 2008 to December 2016. I exclude the funds that are under 1 years old or have TNA of less than \$1 million.

Table 1 presents the summary statistics for the funds in my sample from January 2008 to December 2016. In total, my sample includes 321 different fund share classes and 102 unique funds. The average share class size is \$362.1 million, and the average age equals 6.6 years. Over this sample period, active EMD funds record monthly returns of 0.3% and a monthly inflow of 1.5% on average. The average annual expense ratio is 1.2%.

**Table 1. Summary statistics.**

This table shows the summary statistics for characteristics of active emerging market debt mutual funds in my sample from January 2008 to December 2016. Flow % is the percentage fund flow in a given month. Return % is the monthly net fund return. TNA is the total net assets of a fund. Age is the fund age in years. Expense % is the fund expense ratio in per cent. The unit of observations is share class-month. The sample includes 321 unique fund share classes and 102 unique funds. I exclude index funds, exchange traded funds, and exchange traded notes from the CRSP mutual fund database.

Statistic	N	Mean	St. Dev.	Pctl(25)	Median	Pctl(75)
Flow %	18,369	1.5	10.0	-2.0	-0.03	2.6
Return %	18,369	0.3	3.0	-1.1	0.6	1.9
TNA	18,369	362.1	977.9	9.9	41.1	202.0
Age	18,369	6.6	5.8	2.2	4.4	9.3
Expense %	18,369	1.2	0.5	0.9	1.1	1.3

##### 4.2. Empirical model and measurement

My empirical approach for evaluating the impact of QE is to analyze the investor flow response after several LSAP announcements. My focus is on the effects of the three phases of LSAPs – commonly referred to as QE1, QE2 and QE3 – as well as the tapering of QE. All my empirical work relies on monthly data. When looking at the effects of LSAP announcements on EMD mutual funds, I assume that the

change in expectations about future asset prices trigger changes in portfolio allocations, causing shifts in investor flows to EMD mutual funds. It is worth noting that the announcements do not indicate any change in the supply of e.g. U.S. Treasury securities at the time of the announcements. Instead, it will happen at some point in the future. (Fratzcher et al., 2012)

#### ***4.2.1. Measurement of U.S. unconventional monetary policy***

I study the effect of U.S. unconventional monetary policy on capital flows by focusing on LSAP announcements made by the Fed during 2008-2014. In my tests, I estimate the effect of 17 different events, which I divide into five different indicator variables to investigate whether the fund flows are unusual during the events. I list the events and variables in Table 1 in Appendix. The variables equal 1 for the months when the programs were announced, extended, or tapered. One exception is taper tantrum, which equals 1 also in July and August 2013, even though the announcements were made in May and June. The reason for this is that it is widely reported that the stress in the market persisted for much of the summer, until the Fed decided to leave the asset purchase pace unchanged in September (Ahmed et al. 2017). Thus, to make my study consistent with previous literature, it is reasonable to date the taper tantrum from May to August.

#### ***4.2.2. Measurement of flow***

Following Goldstein et al. (2017), I calculate net fund flows from the total net assets of each fund share class between consecutive points in time and the interim net portfolio return. Specifically, flow for fund  $k$  in month  $t$  is defined as:

$$Flow_{k,t} = \frac{TNA_{k,t} - TNA_{k,t-1}(1 + R_{k,t})}{TNA_{k,t-1}} \quad (1)$$

where  $R_{k,t}$  is the return of fund  $k$  during month  $t$ , and  $TNA_{k,t}$  is the total net asset value at the end of month  $t$ . I winsorize the flows at 1 and 99% to eliminate the funds with exceptionally large changes in  $TNA$ .

### 4.2.3. Measurement of performance

As a measure of performance, I use an EMD mutual fund's average alpha in the past year by performing rolling-window time-series regressions for each fund using 12 past months of data. Finding the benchmark relative to which performance is measured has no one solution. For the best estimate, I calculate *Alpha* as the intercept from a regression of excess fund returns on excess aggregate bond market, aggregate stock market, and aggregate EM returns. I use the Vanguard total bond market index fund return, CRSP value-weighted market return and MSCI EM index return to proxy for aggregate bond, stock, and emerging market returns. My measure of performance is thus closely similar to the one used by Goldstein et al. (2017), but I further include a benchmark for overall emerging market returns to also adjust for the exposures to emerging market risks.

## 5. Results

### 5.1. Flow sensitivity of LSAPs in EMD mutual funds

I begin my flow analysis by identifying whether the EMD mutual fund flows in my sample are sensitive of LSAP announcements made during 2008-2014. To this end, I estimate the regression model of monthly fund net flows (*Fund flow*) on the announcements related to the QE programs (*Event*) over my sample period of 2008-2016.

$$Fund\ flow_{k,t} = \alpha + \alpha_1 Event_t + bX_{k,t-1} + \gamma_1 VIX_{t-1} + \gamma_2 TS_{t-1} + \gamma_3 MSCI_{t-1} + \varepsilon_{k,t} \quad (2)$$

with  $Event_t = [QE1_t, QE2_t, QE3_t, Taper\ tantrum_t, Phase\ out\ of\ QE_t]$

In the regression, I include the following control variables (subsumed by vector  $X$ ): the natural log of fund size ( $Log(TNA)$ ), the expense ratio ( $Expense$ ), the natural log of fund age ( $Log(Age)$ ), lagged flows ( $Lagged\ fund\ flow$ ) and lagged returns ( $Lagged\ fund\ return$ ). I also include measures for global risk aversion ( $VIX$ ), as well as term spread ( $TS$ ), calculated as a difference between the 10-year and 3-month U.S. Treasury yield, to capture the effect of other time-varying variables except LSAPs. Additionally, I include the MSCI EM Index return ( $MSCI$ ) to control flows driven by overall emerging market performance. The dependent variable is defined as in Eq. (1). All control variables are measured at the end of month  $t-1$ .

There are some concerns I want to point out. The Fed announcements and operations may have been anticipated by financial markets. In this case, investor flows may have to some extent adjusted already ahead of the events. By contrast, the flows may not fully reflect in the flows on the month the event occurred, and there might be a lagged reaction in the markets. Therefore, I do robustness tests where the indicator variable for different events equals 1 also one month prior and after the event. For robustness, I also introduce fund fixed effects. I report all the results in Table 2.

**Table 2. Fund flows and LSAP announcements.**

This table shows EMD mutual fund flows and their sensitivity of different QE phases. The time period is 2008-2016. Flow is the proportional fund flow in a given month. QE1, QE2, QE3, Taper-tantrum, and Phase out of QE represent the indicator variables for different announcements related to QE. Log(TNA) is the natural log of total net assets, and Log(Age) is the natural log of fund age. Expense is fund expense ratio. Fund return is the monthly return for a fund. I also include three time-dependent variables: VIX, Term spread (calculated as a difference between 10-year and 3-month U.S. Treasury yield) and MSCI EM Index return. All control variables are measured as of t-1. The symbols \*\*\*, \*\* and \* represent the significance at 1%, 5% and 10% level, respectively. The t-statistics are in the parentheses.

	<i>Dependent variable:</i>					
	Fund flow					
	t	t-1 → t	t → t+1	t	t-1 → t	t → t+1
QE1	-0.031*** (-5.110)	-0.041*** (-7.520)	-0.036*** (-6.344)	-0.029*** (-4.827)	-0.043*** (-7.830)	-0.034*** (-6.023)
QE2	0.014*** (3.311)	0.012*** (3.489)	0.015*** (4.454)	0.017*** (3.967)	0.016*** (4.717)	0.020*** (5.881)
QE3	0.014*** (3.531)	0.013*** (4.193)	0.022*** (6.973)	0.014*** (3.503)	0.014*** (4.432)	0.025*** (7.689)
Taper tantrum	-0.010*** (-3.106)	-0.005 (-1.558)	-0.009*** (-2.943)	-0.009*** (-2.670)	-0.003 (-0.884)	-0.006** (-2.142)
Phase out of QE	-0.008* (-1.856)	-0.014*** (-4.380)	-0.010*** (-3.097)	-0.007 (-1.623)	-0.012*** (-3.794)	-0.009*** (-2.822)
Lagged fund flow	0.326*** (48.820)	0.323*** (48.507)	0.320*** (47.925)	0.269*** (39.415)	0.266*** (39.089)	0.264*** (38.659)
Lagged fund return	0.268*** (7.228)	0.251*** (6.730)	0.278*** (7.511)	0.201*** (5.473)	0.181*** (4.875)	0.219*** (5.961)
Expense	-0.341** (-2.119)	-0.377*** (-2.338)	-0.429*** (-2.664)	1.580 (1.345)	1.404 (1.197)	1.092 (0.931)
Log(TNA)	-0.001* (-1.856)	-0.001** (-2.171)	-0.001** (-2.509)	-0.015*** (-16.858)	-0.015*** (-17.484)	-0.016*** (-17.894)
Log(Age)	-0.013*** (-16.069)	-0.012*** (-15.858)	-0.012*** (-15.682)	-0.023*** (-16.497)	-0.022*** (-15.637)	-0.021*** (-14.846)
MSCI	0.047** (2.519)	0.046** (2.446)	0.047** (2.477)	0.052*** (2.802)	0.053*** (2.823)	0.050*** (2.681)
VIX	0.001*** (7.451)	0.001*** (8.000)	0.001*** (6.954)	0.00003 (0.198)	0.0002 (1.624)	0.0001 (0.894)
Term spread	0.738*** (6.172)	0.792*** (6.494)	0.916*** (7.491)	0.392*** (3.089)	0.465*** (3.569)	0.664*** (5.101)
Constant	0.001 (0.294)	-0.002 (-0.501)	-0.003 (-0.865)	0.152*** (9.112)	0.150*** (9.010)	0.148*** (8.896)
Fund fixed effects	No	No	No	Yes	Yes	Yes
Observations	18,369	18,369	18,369	18,369	18,369	18,369
R <sup>2</sup>	0.186	0.189	0.190	0.234	0.237	0.238
Adjusted R <sup>2</sup>	0.186	0.189	0.190	0.219	0.223	0.224

The findings overall give support to my first hypothesis, suggesting that EMD mutual funds' investor flows are sensitive of the LSAP announcements made by the Fed. The announcement of QE1 caused net outflows from the funds included in my sample. The result is consistent with Fratzscher et al. (2012), who study the first and second rounds of QE, and find that QE1 caused a portfolio rebalancing out of EMEs into U.S. funds. In contrast, QE2 and QE3 resulted in statistically significant inflows to the funds

in my sample. The reaction to QE2 is also in line with the findings of Fraztscher et al. (2012). During taper tantrum, the funds in my sample experienced statistically significant outflows, and the reaction was similar when the Fed purchases were tapered.

The findings on my robustness tests suggest that the market already anticipated most of the events. Additionally, most of the events were not fully reflected on investor flows at time  $t$ , when the announcements were made, but also had a lagged reaction. The results are also robust after introducing fund fixed effects. In general, the findings suggest that EMD funds are sensitive to both the expansion and tapering of QE, providing evidence on the spillovers of U.S. unconventional monetary policies to EMEs. They also suggest that asset managers do play a role in the second phase of global liquidity described by Shin (2013).

Interestingly, the CBOE Volatility Index, known by VIX, has a positive effect on the fund flows prior to introducing fund fixed effects, even though it is widely used as a proxy for global risk aversion in the market. As VIX is constructed using the implied volatilities of S&P 500 index options, one explanation for this is that when the volatility in the U.S. market is higher, the contrast between the U.S. and EMEs is not that big, causing investors to increase their holdings in emerging markets.

## ***5.2. Flow-to-performance relation for EMD mutual funds***

Next, I test whether EMD funds exhibit stronger sensitivity of outflows to bad performance than of inflows to good performance. First, I present a semi-parametric model of fund flows on past fund performance. Then, I find further support for my results by estimating a parametric model. Throughout my analysis, I also use several subsamples to identify the changes in the flow-to-performance relation across different phases of QE. Lastly, I examine whether the funds that experience excessive flows during periods of QE exhibit greater fragility when the programs are tapered.

### 5.2.1. The semi-parametric model

To begin, I estimate a semi-parametric regression of fund flows on past fund performance, making my method similar to previous studies (Goldstein et al, 2017; Chevalier and Ellison, 1997). My semi-parametric regression is specified as follows:

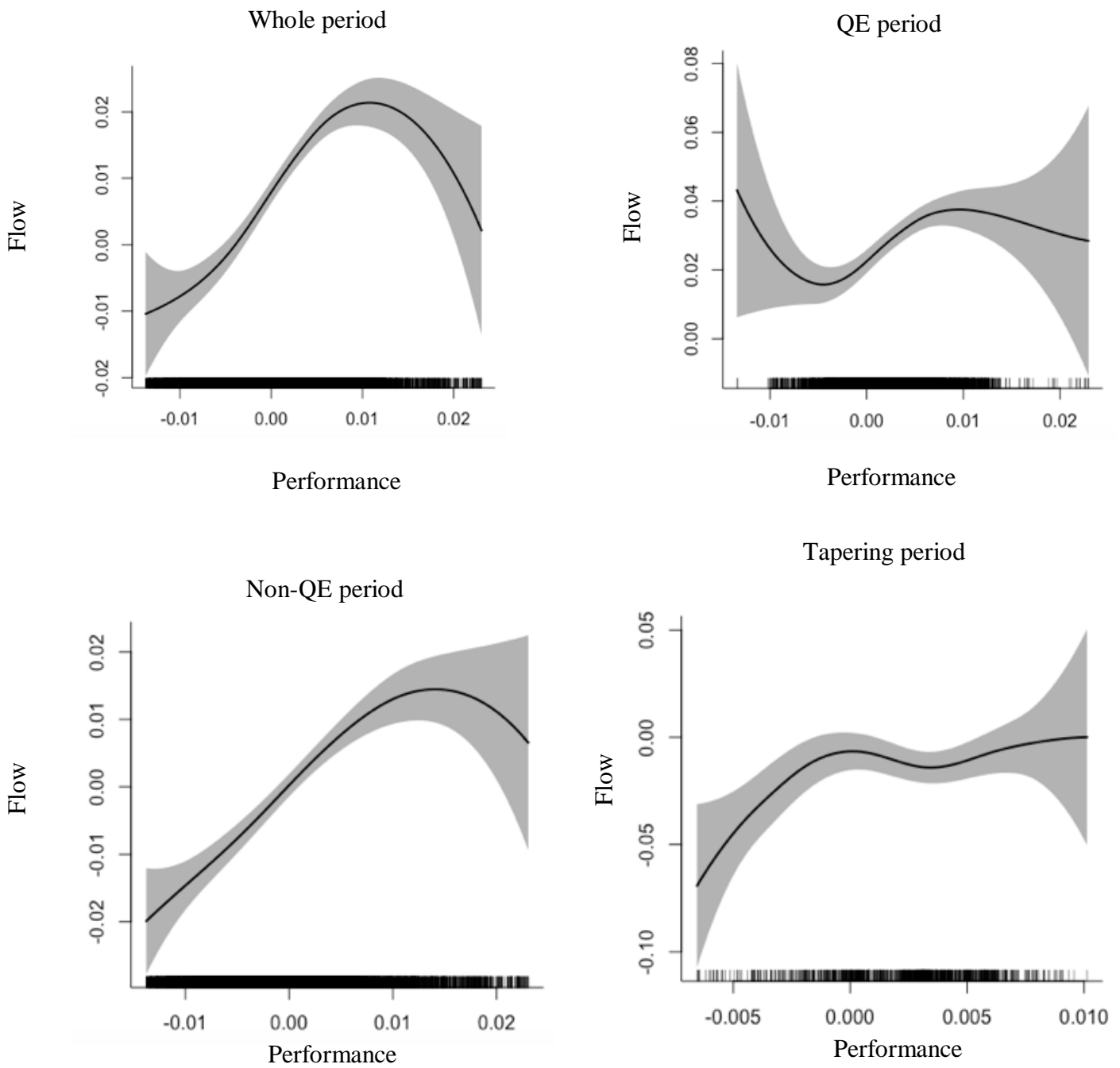
$$Flow_{k,t} = \alpha + f(Alpha_{k,t-12 \rightarrow t-1}) + bX_{k,t-1} + \gamma_1 VIX_{t-1} + \gamma_2 TS_{t-1} + \gamma_3 MSCI_{t-1} + \varepsilon_{k,t} \quad (3)$$

where  $Alpha_{k,t-12 \rightarrow t-1}$  is fund  $k$ 's alpha estimated as the intercept from a regression of excess fund returns on excess aggregate EM, aggregate bond, and aggregate stock market return in the past one year. Dependent and other independent variables are defined as in Eq. (1) and (2), but lagged fund returns are excluded. I winsorize the alphas at 1 and 99 % to exclude the outliers.

To see whether the flow-to-performance relation varies across different periods of unconventional monetary policy, I further divide my data in three subsamples. I use the QE and tapering periods to capture liquid and illiquid periods in the emerging bond markets, respectively. QE includes events 1-13, whereas tapering period includes events 14-17 (see Table 1 in Appendix). The periods include the observations during announcement months  $t$  as well as  $t+1$ , to control for the lagged reaction in the market. Non-QE period includes the months outside of the QE period.

Fig. 3. shows the results. It implies that overall, EMD mutual funds exhibit a stronger sensitivity of outflows to bad performance than of inflows to good performance, providing initial support for my second hypothesis. This is in line with the concave flow-to-performance shape of corporate bond funds investigated by Goldstein et al. (2017). However, whereas the concavity in my sample funds starts at the positive domain, for corporate bond funds, it starts already at the negative domain.

Additionally, the results suggest that the flow-to-performance varies across different phases of QE. When the LSAPs are announced or extended, the shape of the flow-to-performance relation changes, suggesting that investor flows to EMD funds are less sensitive to bad performance. In contrary, when the policy is lifted, the sensitivity of poor performance further strengthens, and the concavity already starts at the negative domain. Thus, the results also give support to my third hypothesis.



**Fig. 3 Flow-to-performance relation for individual emerging market debt funds.** This figure shows the flow-to-performance relation for emerging market debt funds using a semi-parametric regression of monthly fund flows on past fund alpha and fund characteristics including fund size, fund age, expense ratio, lagged flows, and lagged returns as well as time-dependent variables including VIX, term spread and lagged MSCI EM Index returns. The shaded areas represent standard errors.

### 5.2.2. The parametric model

As Goldstein et al. (2017) note, the semi-parametric approach has rather low statistical power due to the flexible functional specification. To formally test hypothesis 2, I estimate the following parametric regression that captures a potential non-linearity in the flow-to-performance relation:

$$\begin{aligned}
 \text{Fund flow}_{k,t} = & \alpha + \beta_1 \text{Alpha}_{k,t-12 \rightarrow t-1} + \beta_2 \text{Alpha}_{k,t-12 \rightarrow t-1} \\
 & \times I(\text{Alpha}_{k,t-12 \rightarrow t-1} < 0) + \beta_3 I(\text{Alpha}_{k,t-12 \rightarrow t-1} < 0) + bX_{k,t-1} \\
 & + \gamma_1 \text{VIX}_{t-1} + \gamma_2 \text{TS}_{t-1} + \gamma_3 \text{MSCI}_{t-1} + \varepsilon_{k,t}
 \end{aligned} \tag{4}$$

where  $I(\text{Alpha}_{i,t-12 \rightarrow t-1} < 0)$  is an indicator variable equal to one if the fund achieves a negative alpha in the past year and zero otherwise, and the dependent and other control variables are defined as in previous equations. Again, I further divide my data in three subsamples: QE, non-QE, and tapering periods, which are defined similarly as before.

The results are reported in Table 3. They give further support for my second hypothesis, indicating that EMD mutual funds exhibit a concave flow-to-performance relation. For robustness, I conduct several tests with different measures of alpha, and find that the flow-to-performance relation in EMD mutual funds overall is always concave or linear. The concavity is also robust after introducing fund fixed effects. The results are left unreported in order to conserve space.

For the whole period, the slope coefficient for *Alpha* is 0.593, and the slope coefficient for *Alpha* interacted with  $\text{Alpha} < 0$  is 0.892. Thus, the sensitivity of outflows to negative alpha is 1.485 (0.593 + 0.892), which is 2.50 times that of sensitivity of inflows to positive alpha (0.593). The results are statistically significant. When the periods of QE are excluded, the sensitivity of outflows to negative alpha is 1.418, 2.05 times greater than the sensitivity of inflows to positive alpha (0.695).

The results also further support my third hypothesis. The flow-to-performance relation changes during the QE period: the sensitivity of outflows to negative alpha is -0.952, and the sensitivity of inflows to positive alpha 0.659. The negative coefficient of alpha interacted with  $\text{Alpha} < 0$  is not significant, but the greater sensitivity of outflows to negative alpha disappears. In contrast, the sensitivity further strengthens during tapering of QE. The sensitivity of inflows to positive alpha is 0.173, whereas the sensitivity of outflows to negative alpha is 10.433. The noticeably high sensitivity might be due to the size of the subsample, which is rather small.

**Table 3. Flow-to-performance relations for EMD mutual funds.**

This table shows the flow-to-performance relations for active EMD mutual funds from January 2008 to December 2016. For all funds, alpha is the intercept from a regression of excess fund returns on excess aggregate bond market, aggregate stock market, and aggregate EM returns. I use the Vanguard total bond market index fund return, CRSP value-weighted market return and MSCI EM Index return to proxy for aggregate bond market, stock market, and EM returns. Other variables are defined as in Table 2. The unit of observations is share class-month. I exclude index funds, exchange traded funds, and exchange traded notes from the CRSP database. The symbols \*\*\*, \*\* and \* represent the significance at 1%, 5% and 10% level, respectively. The t-statistics are in the parentheses.

	<i>Dependent variable:</i>			
	Fund flow			
	All periods	QE periods	Non-QE periods	Tapering periods
Alpha	0.593*** (2.872)	0.659* (1.654)	0.695*** (2.812)	0.173 (0.128)
Alpha x (Alpha <0)	0.892*** (2.604)	-1.611 (-1.605)	0.723* (1.915)	10.260*** (3.138)
Alpha <0	-0.006*** (-2.954)	-0.016*** (-3.971)	-0.004* (-1.697)	0.014 (1.414)
Lagged fund flow	0.324*** (44.350)	0.313*** (24.824)	0.293*** (32.981)	0.290*** (8.523)
Expense	-0.250* (-1.735)	-0.172 (-0.573)	-0.659*** (-4.057)	-1.366** (-1.970)
Log(TNA)	-0.0001 (-0.324)	0.0004 (0.540)	-0.001*** (-2.743)	-0.001 (-0.696)
Log(Age)	-0.011*** (-13.363)	-0.015*** (-10.252)	-0.008*** (-8.013)	-0.007** (-2.031)
MSCI	0.153*** (14.468)	0.155*** (7.542)	0.140*** (11.641)	-0.084 (-0.471)
VIX	0.0004*** (4.120)	0.0002 (1.042)	0.0003** (2.329)	-0.004 (-1.105)
Term spread	0.678*** (6.399)	0.537*** (3.012)	0.781*** (5.920)	-1.098 (-1.456)
Constant	0.008** (2.391)	0.029*** (3.944)	0.005 (1.439)	0.099** (2.222)
Observations	16,206	4,715	11,491	1,365
R <sup>2</sup>	0.177	0.196	0.144	0.131
Adjusted R <sup>2</sup>	0.176	0.194	0.144	0.122

To further support my results, I estimate the following regression with a subsample of underperforming funds, i.e. funds with a negative alpha:

$$\begin{aligned}
Fund\ flow_{k,t} = & \alpha + \beta_1 Alpha_{k,t-12 \rightarrow t-1} + \beta_2 Alpha_{k,t-12 \rightarrow t-1} \times Period_t + \beta_3 Period_t \\
& + bX_{k,t-1} + \gamma_1 VIX_{t-1} + \gamma_2 TS_{t-1} + \gamma_3 MSCI_{t-1} + \varepsilon_{k,t}, \forall Alpha_{k,t-12 \rightarrow t-1} < 0
\end{aligned} \tag{5}$$

where  $Period_t$  is an indicator variable that represents different periods of QE. It equals to one during the periods of QE and tapering, which are defined similarly as before, and zero otherwise. In addition, the dependent variable and control variables remain the same as before. The results are presented in Panel A

in Table 4. Consistently with my previous findings, they confirm that the sensitivity of poor performance is greater during tapering periods, but the fund flows are not fragile when announcements regarding the expansion of QE are made.

Additionally, I estimate the same regression by using individual indicator variables as defined in Eq. (2) interacted with  $Alpha < 0$ . The results are presented in Panel B in Table 4. They further suggest that EMD mutual funds were particularly fragile during tapering periods, especially taper tantrum, where the greater sensitivity of bad performance is statistically significant.

### 5.2.3. Excessive flows

To investigate whether the magnitude of fund flows received during periods of expansive monetary policy has an effect on the fragility of the funds, I estimate the following regression involving a triple interaction variable:

$$\begin{aligned}
 Fund\ flow_{k,t} = & \alpha + \beta_1 Alpha_{k,t-12 \rightarrow t-1} + \beta_2 Alpha_{k,t-12 \rightarrow t-1} \times Excessive\ Flows_{k,t} \\
 & \times Tapering\ Period_t + \beta_3 Alpha_{k,t-12 \rightarrow t-1} \times Tapering\ Period_t \\
 & + \beta_4 Alpha_{k,t-12 \rightarrow t-1} \times Excessive\ flows_{k,t} + bX_{k,t-1} + \gamma_1 VIX_{t-1} + \gamma_2 TS_{t-1} \\
 & + \gamma_3 MSCI_{t-1} + \varepsilon_{k,t}, \forall Alpha_{k,t-12 \rightarrow t-1} < 0
 \end{aligned} \tag{6}$$

where  $Excessive\ Flows_{k,t}$  is an indicator variable equal to one if the fund has attracted above-median flows during QE periods, and zero otherwise. The dependent and other independent variables are defined as in previous equations. In this regression, I also use the subsample of funds with a negative alpha. The results are presented in Table 5.

The results suggest that the funds that attract above-median flows during QE, i.e., when the overall market is more liquid, are also more sensitive of bad performance when the policy is lifted. As such, the findings imply that the funds with excessive flows during expansive monetary policies are more fragile. However, there is a potential limitation to the current setting. The independent variable (*Excessive flows*) is mechanically correlated with the dependent variable during QE. Whether it has an effect on my triple interaction term (*Alpha x Excessive Flows x Tapering period*) is unclear, but deserves consideration.

**Table 4. Flow-to-performance relations for underperforming funds.**

This table shows the flow-performance relations for EMD mutual funds with negative alpha from January 2008 to December 2016. The fund characteristics are defined as in Table 2. In Panel A, I use two indicator variables to capture the liquid period (QE) and illiquid period (Tapering) in my sample. In Panel B, I use five separate indicator variables for the 17 LSAP events included in my sample (see Table 1 in Appendix). The unit of observations is share class-month. I exclude index funds, exchange traded funds, and exchange traded notes from the CRSP mutual fund database. The symbols \*\*\*, \*\* and \* represent the significance at 1%, 5% and 10% level, respectively. The t-statistics are in the parentheses.

Panel A: Underperforming funds during different periods

	<i>Dependent variable: Fund flow</i>	
	QE period	Tapering period
Alpha	1.424** (5.054)	0.435 (0.717)
Alpha x Period	-1.943** (-2.240)	1.009 (1.507)
Period	0.007** (2.068)	-0.005 (-1.509)
Control variables	Yes	Yes
Observations	7,214	7,214
R <sup>2</sup>	0.177	0.174
Adjusted R <sup>2</sup>	0.175	0.173

Panel B: Underperforming funds with individual indicator variables

	<i>Dependent variable: Fund flow</i>
Alpha	1.291*** (4.602)
Alpha x QE1	2.796 (0.710)
Alpha x QE2	2.383 (1.278)
Alpha x QE3	-3.167 (-1.136)
Alpha x Taper tantrum	6.440** (2.398)
Alpha x Phase out of QE	1.713 (1.494)
QE1	-0.049*** (-2.592)
QE2	0.021** (2.469)
QE3	0.027*** (2.866)
Taper tantrum	-0.004 (0.584)
Phase out of QE	-0.005 (-0.778)
Control variables	Yes
Observations	7,214
R <sup>2</sup>	0.186
Adjusted R <sup>2</sup>	0.183

**Table 5. Flow-to-performance relations of underperforming EMD mutual funds and excessive flows.**

This table shows the flow-to-performance relations for EMD mutual funds with a negative alpha in my sample from January 2008 to December 2016. Excessive flows is an indicator variable equal to one if the fund experiences inflows that are above-median during periods of QE, and zero otherwise. Other variables are defined as in previous tables. I exclude index funds, exchange traded funds, and exchange traded notes from the CRSP mutual fund database. The symbols \*\*\*, \*\* and \* represent the significance at 1%, 5% and 10% level, respectively. The t-statistics are in the parentheses.

	<i>Dependent variable:</i>
	Fund flow
Alpha	1.098* (1.855)
Alpha x Excessive flows x Tapering period	10.837* (1.724)
Alpha x Tapering period	1.066 (0.204)
Alpha x Excessive flows	0.650 (0.970)
Excessive flows x Tapering period	0.025 (1.080)
Tapering period	-0.017 (-0.935)
Excessive flows	0.009** (2.497)
Controls	Yes
Observations	5,775
R <sup>2</sup>	0.212
Adjusted R <sup>2</sup>	0.210

### 5.3. Discussion of results

Overall, the results show that the LSAP announcements do not only affect the investor flows of EMD mutual funds, but also change their flow-to-performance relation and thereby affect the managerial incentives, too. The findings in this paper thereby give insight on the fragility in EMD mutual funds, especially when market liquidity changes.

A concave flow-to-performance relation in general suggests that managers are not that incentivized to take on excessive risk in order to achieve better returns, as the reward of doing that is not high enough. However, it raises a concern over the fragility of the funds. If investors rush to exit the funds following negative developments, it is possible that the effects of flows go beyond the fund itself, and e.g. start to push prices down (Goldstein et al., 2017). Thus, the flows can also have effects on the real economy. As my sample includes EMD mutual funds, the findings raise an important question especially on the implications for EMEs. However, my paper leaves that for future research.

Interestingly, the findings suggest that investors are more sensitive of good past performance during QE. This suggests that EMD mutual fund managers' incentives to reach for yield become greater during times of non-standard monetary policies. In contrast, during tapering periods – when overall market

is more illiquid – poor performance generates considerable outflows while good performance generates much milder inflows. Specifically, the fragility is greater for funds that experienced excessive flows during QE.

The assessment of whether asset managers do engage in reaching for yield during expansive monetary policies, and whether it affects the fund flows, would make the analysis of EMD mutual funds' fragility more thorough. However, due to data constraints, it is left out of the scope of this paper.

It is also worth noting that Fed policies may not be the only factor influencing the investor flows. One example is the financial market turbulence in early 2014, when EM mutual funds were reported to have experienced a remarkably large flight by investors. Even though the market volatility followed several weeks after the FOMC meeting in December 2013, and there has been some debate over the causes of the sell-off, the meeting was still tied to the run out of EM funds. (Feroli et al., 2014) It should also be noted that even though the LSAPs were halted in October 2014, the Fed did not start the balance-sheet reduction during the sample period in this paper. Thus, the effects of phasing out of the QE programs might not have been fully reflected in the events the paper covers.

While the U.S. unconventional monetary policy is one of the many factors affecting EME flows, the results in this paper imply that the Fed announcements do cause significant changes in EMD mutual fund flows. Especially the fragility of EMD mutual funds deserve increased attention due to the funds' rapid growth in recent years.

## **6. Conclusion**

The growth in bond mutual funds has been substantial in recent years. Additionally, capital flows to EMEs have increased. While the literature on EME flows is quite broad, the research on bond mutual funds is still very limited. This paper aims to give more insight on these topics by showing that flows to EMD mutual funds have been largely effected by U.S. unconventional monetary policies. The results also confirm that asset managers in mutual funds do play a significant role in transmitting the capital flows to EMEs.

Additionally, the results show that EMD mutual funds exhibit a more concave flow-to-performance relation, indicating a greater sensitivity of outflows to bad performance. The findings are consistent with recent literature, which suggests that corporate bond mutual fund outflows are more sensitive to poor performance than inflows to good performance.

I further show that the greater sensitivity of outflows to poor past performance disappears during periods of QE, increasing the incentives of asset managers to reach for yield. In contrast, the sensitivity of bad performance strengthens when the Fed either plans or decides to start the tapering of QE, i.e., when the market is more illiquid. Especially the funds that experience excessive flows during the periods of expansive monetary policy are more sensitive of bad performance during the tapering periods.

The results point to a fragility in EMD mutual funds and adds to the discussion on the outcomes of unconventional monetary policies. Fragility of bond mutual funds and its implications to the real economy still requires future research. A better understanding on of how large a threat they pose to financial stability is needed – and not only in the U.S. It might provide answers for regulators on the tradeoff between expansive monetary policies and financial stability.

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## Appendix

**Table 1. List of QE events during 2008-2014.**

<b>Date and QE phase</b>	<b>Description of the event</b>	<b>Indicator variable</b>
(1) QE1 25/11/2008	FOMC statement The first LSAP announcement. The Fed will purchase of \$100 billion in government-sponsored enterprise (GSE) debt and up to \$500 billion in mortgage-backed securities (MBS).	QE1
(2) QE1 01/12/2008	Bernanke Speech The Fed might purchase long-term Treasuries.	QE1
(3) QE1 16/12/2008	FOMC statement The FOMC assesses the potential benefits of purchasing longer-term Treasury securities.	QE1
(4) QE1 28/01/2009	FOMC statement The Fed is ready to expand agency debt and MBS purchases, and purchase long-term treasuries.	QE1
(5) QE1 18/03/2009	FOMC statement The Fed announces additional purchases of \$750 billion in agency MBS and an additional \$100 billion in Agency Debt. The FOMC decides to purchase up to \$300 billion of longer-term Treasury securities.	QE1
(6) QE2 10/08/2010	FOMC statement The Fed will reinvest principal payments from agency debt and agency MBS in longer-term Treasury securities.	QE2
(7) QE2 27/08/2010	Bernanke speech Bernanke mentions a possibility for further easing, including further purchases of long-term securities.	QE2
(8) QE2 15/10/2010	Bernanke speech The Fed is prepared to provide more accommodation to support the economic recovery.	QE2
(9) QE2 03/11/2010	FOMC statement The Fed will purchase a further \$600 billion of longer-term Treasury securities by the end of 2011:Q2, a pace of about \$75 billion per month.	QE2
(10) QE2 21/9/2011	FOMC statement – “Operation Twist” The FOMC will sell \$400 billion of short-term Treasuries and use the proceeds to buy \$400 billion of long-term Treasuries.	QE2
(11) QE3 31/8/2012	Bernanke speech The Fed will provide additional accommodation.	QE3
(12) QE3 13/09/2012	FOMC statement The Fed will purchase \$40 billion of MBS per month.	QE3
(13) QE3 12/12/2012	FOMC statement The Fed will increase the open-ended purchases from \$40 billion to \$85 billion per month.	QE3
(14) QE3 22/05/2013	Bernanke speech – Taper tantrum. Ben Bernanke addresses Congress’ Joint Economic Committee and mentions that the Fed may take a step down in the asset purchases during the next two meetings.	Taper tantrum
(15) QE3 19/06/2013	Bernanke speech – Taper tantrum. Bernanke says that Fed could scale back its bond purchases from \$85 billion to \$65 billion a month during the upcoming September 2013 policy meeting, also suggesting that the bond-buying program could be finished by mid-2014.	Taper tantrum
(16) QE 18/12/2013	FOMC statement – Tapering of QE. The Fed will start to taper its bond-buying program to \$75 billion a month in January. FOMC also announces it will cut its monthly long-term Treasury bond purchases to \$40 billion and mortgage-backed securities to \$35 billion a month.	Phase out of QE
(17) QE3 29/10/2014	FOMC statement – Tapering of QE. Purchases are concluded after the Fed has accumulated over £3.5 trillion in assets on its balance sheet.	Phase out of QE

*Source: The Federal Reserve*