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The portfolio of euro area fund investors and ECB monetary policy announcements

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Abstract

This paper studies the impact of major ECB monetary policy announcements on the portfolio allocation of euro area fund investors, using daily data between 2012 and mid-2016, a period that includes a variety of unconventional measures. We distinguish between *active* portfolio reallocation, driven by redemptions or injections of investors, and *passive* portfolio rebalancing, triggered by valuation effects related to changes in asset prices and exchange rates. We find that, for this class of fund investors, policy announcements work mainly through valuation effects (the *signalling* channel), rather than via active reallocation (the *portfolio rebalancing* channel). Notably, since the autumn of 2014, monetary policy shocks triggered large asset price and exchange rate effects and prompted a *passive* shift of euro area investors into riskier assets, in particular European and Emerging Market equity funds and out of bond funds.

Keywords: monetary policy, euro area, European Central Bank, asset allocation, investment funds

JEL: E2, F3, G11, G15

NON-TECHNICAL SUMMARY

This paper focuses on the euro area and studies the empirical relevance of different channels of transmission of unconventional monetary policies implemented by the ECB. Most studies have focused on the transmission of monetary policy via its impact on the banking system and financial markets. In this study, we check whether monetary policy had an impact on the asset allocation behaviour of institutional and retail investors. In particular, we study the impact of major ECB monetary policy announcements on a portfolio consisting of Luxembourg-based investment funds, broadly representative of euro-area investors, daily, between 2012 and mid-2016, a period that includes a variety of different unconventional measures. We study how investors, on aggregate, choose investment funds at the fund category level, e.g. bond funds versus equity funds, not the portfolio allocation of fund managers. As common in the literature on the impact of central banks' monetary policy decisions, we identify the announcement effects of traditional and unconventional policies looking at the intraday change in key euro area interest rates around major events, such as ECB Governing Council meetings. To identify the relevance of the different channels of transmission of monetary policy, we construct measures of *active* portfolio reallocation, driven by the redemptions or injections of underlying investors, and of *passive* portfolio reallocation, triggered by valuation effects related to changes in asset prices and exchange rates.

Central banks can affect investors' behaviour via several channels. One main channel can be referred to as the *Signalling Channel*. Changes in monetary policy stance usually affect expectations about future rates, that is the risk neutral components of interest rates. In frictionless finance models, central banks' actions provide new information to investors and affect the forward rates and bond prices, without affecting the positions that arbitrageurs hold in equilibrium and therefore they do not affect risk premia. As a consequence, the signalling channel should not have an impact on active reallocation (due to actual changes in portfolio shares), but should have an impact on passive reallocation (due to the effects on prices).

A second important channel, which typically goes under the name of *Portfolio Balance Channel*, works through the effect that monetary policy operations have on risk premia. For instance, according to preferred habitat models, following surprises in purchases of long term Treasury bonds by the central bank, investors will be forced to hold smaller positions in long term bonds and bear less duration risk, which in turn will lead to a decrease in risk premia and an increase in bond prices. Therefore, monetary policy shocks associated with the portfolio balance channel should have an impact both on the active and on the passive reallocation of investors.

Our main findings show that the ECB monetary policy did not lead to significant active reallocation in the portfolio of euro area fund investors. Instead, our empirical findings provide robust evidence that the class of fund investors are affected by monetary policy mainly through the impact it has on asset prices and exchange rates by changing expectations of future interest rates (the signalling channel). The significant valuation effects associated with these price movements *passively* shifted the asset allocation of euro area fund investors towards riskier securities, like funds investing in European and Emerging Market equity, and away from European bond funds. These effects are more pronounced for unconventional measures, such as the Asset Purchase Programme (APP).

Overall, our empirical evidence is consistent with monetary policy affecting unsophisticated investors' behaviour via the signalling channel, rather than the portfolio balance channel. Our results are also consistent with the empirical evidence on the behaviour of investors in mutual funds, who are generally reluctant to sell past winners, and the growing literature on rational inattention, predicting that unsophisticated investors adjust their portfolios only rarely.

1. Introduction

Since the start of the global financial crisis in 2008, central banks around the world have stimulated the economies by aggressively cutting interest rates and implementing unconventional monetary policies. This paper studies the impact that ECB monetary policy surprises between 2012 and mid-2016 have on the portfolio allocation of euro area fund investors. Our main finding is that these investors are only indirectly affected by monetary policy actions via their impact on asset prices and exchange rates. We find only little evidence of investors actively reallocating their portfolios, following significant monetary policy announcements.

Most studies have analysed the transmission of monetary policy via the banking system and financial markets. We want to study whether there is a channel of transmission which goes through the asset allocation behaviour of institutional and retail investors. We look in particular into the class of investment fund investors. From an asset pricing perspective, monetary policy shocks affect investors' behaviour only insofar they affect the stochastic discount factor and therefore risk premia. A formal analysis of the links between monetary policy and asset allocation would first try to assess how monetary policy shocks affect the statistical joint distribution of the returns of the portfolio asset classes and then derive its implication for the allocation. We bypass altogether the intermediate step of studying the statistical properties of the asset returns and look instead directly at the impact that monetary policy shocks have on allocations.

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associated with the portfolio balance channel should have an impact both on the active and on the passive reallocation of investors.[1]

In order to study the impact of ECB policies on the portfolio of euro area investors, we track the evolution of an aggregate portfolio of investment funds that are based in Luxembourg, the largest financial centre for the euro area investment fund industry which mainly attracts euro area investors. We study how investors, on aggregate, choose investment funds at the fund category level, e.g. bond funds versus equity funds, not the portfolio allocation of fund managers. To identify the relevance of the different channels of transmission, we construct measures of *active* portfolio reallocation, driven by the redemptions or injections of underlying investors, and of *passive* portfolio reallocation, triggered by valuation effects related to changes in asset prices and exchange rates, as proposed by Ahmed et al. (2016) and previous work. As common in the literature on the impact of central banks' monetary policy decisions, we identify the announcement effects of traditional and unconventional policies looking at the intraday change in key euro area interest rates around major events, such as ECB Governing Council meetings.

Our main findings show that the ECB monetary policy affected investment fund investors mainly via its impact on asset prices and exchange rates. The significant valuation effects associated with these price movements *passively* shifted the asset allocation of euro area investors towards riskier securities, like funds investing in European and Emerging Market equity, and away from European bond funds. These effects are more pronounced for unconventional measures, such as the Asset Purchase Programme (APP). Some *active* reallocation into emerging equity markets following ECB actions is observed for institutional investors. The lack of active reaction of retail investors is consistent with Calvet et al. (2009) and Ivkovi and Weisbenner (2009) who find little evidence of a *disposition effect* of past winners for mutual funds. Our findings are also consistent with the growing literature on rational inattention of informationally constrained investors (see for instance Gabaix and Laibson (2001) and Alvarez et al. (2012)). If information is costly to acquire and process, it is optimal to alternate long periods of inaction with brief periods in which information is processed and portfolios are rebalanced.

The paper is structured as follows. In the next section we provide a review of the related literature. Section 3 presents the investment funds data and explains the construction of our measures of active and passive portfolio rebalancing. Furthermore, we introduce the identification strategy for the impact of ECB monetary policy announcements, with a particular focus on major unconven-

[1] Haldane et al. (2016) provide a broader list of the various channels through which unconventional monetary policies are expected to work, including those channels that are more relevant to our study: policy signalling, portfolio balance, as well as confidence, exchange rate, bank lending and market liquidity premia.

tional measures. Section 4 describes the empirical methodology and summarizes our joint estimation approach. Section 5 discusses the main results and Section 6 presents further robustness checks and extensions of the main model. Finally, Section 7 concludes.

2. Related literature

Our paper is related to many studies about the impact of standard and non standard monetary policy measures. Borio and Zabai (2016) provide a review of the flourishing literature on this topic and introduce a useful taxonomy to distinguish *balance sheet policies* aimed at influencing financial conditions beyond the short-term rate, from *forward guidance* that manages expectations regarding the future path of policy rates and *negative interest rate policy*. Overall, they find ample evidence of a significant impact of these policies on financial conditions, but only tentative evidence regarding their impact on output and inflation.

The focus of our paper is more specifically on ECB policies and their immediate impact on financial markets and investors, rather than on their broader impact on the economy. It is therefore closer to studies such as Rogers et al. (2014) who show that ECB monetary policy surprises had a positive impact on stock markets, led to a compression in spreads between core and periphery euro area countries and an appreciation of the euro exchange rate, at least until 2014, the period covered by their study. During this first phase, the *confidence* channel was the predominant channel of transmission, as the ECB promoted financial stability and confidence in the integrity of the eurozone. In addition, Fratzscher et al. (2016a) show that the ECB unconventional monetary polices between 2007 and 2012 had positive financial spill-overs to advanced economies and emerging markets and lowered credit risk among banks and sovereigns in the euro area and other G20 countries. The launch of a quantitative easing programme targeting public sector securities in January 2015, following the introduction of a negative deposit facility rate since mid-2014, characterises a second phase of ECB unconventional monetary policies, where the *signalling* and *portfolio balance* channel take the centre stage and the intended policy objective is the flattening of the yield curve. The early assessment of the APP is generally positive. The launch of the programme persistently reduced long-term sovereign bond yields (Andrade et al., 2016) and the related APP announcements had a price impact that generally increased with maturity and riskiness of assets, with significant spill-overs to non-targeted assets, such as corporate bonds (Altavilla et al., 2015). The APP announcement had international spillovers, boosting equity prices around the world and causing a broad-based depreciation of the euro, but it did not lead to an increase in portfolios flows to emerging market economies (Georgiadis and Gräb, 2016).

Our paper is closely related to a relatively new strand of literature which uses investment funds data to study the impact of monetary policy on portfolio investment decisions, since these data are particularly useful to test the portfolio balance channel of unconventional monetary policies. It is important to note that, over time, the overall portfolio allocation of investment funds is influenced by the behaviour of two types of agents: (i) underlying investors – through injections in and redemptions from funds – and (ii) asset managers. Similarly to several other papers, we identify the changes in asset allocation driven *only* by underlying investors, not by asset managers, because flow data allow a cleaner identification of short-term shifts in asset allocation – since flows are available at a daily frequency, whereas detailed asset allocation data are only available at a monthly frequency. Moreover, as noted by Raddatz and Schmukler (2012), over the short-run managers usually allow shocks to returns to pass-through to country weights. Table 1 summarises the main findings of this empirical literature, clarifying how conventional or unconventional monetary policies have been identified. Overall, the existing evidence suggests that monetary policy easing by major central banks is associated with a shift towards riskier assets, even though these are not necessarily domestic equity securities, but may include foreign securities. Specifically, positive monetary policy surprises, i.e. those associated with an unexpected easing of monetary policy, lead to a rotation of the portfolio towards developed market equity by asset managers (Cenedese et al., 2015) or by underlying investors (Curcuru et al., 2015). Similarly, Hau and Lai (2016) show that loose monetary policies in the euro area are associated with a shift out of money market funds towards equity. However, Banegas et al. (2016) and Kroencke et al. (2015) find the opposite result in the case of US Fed monetary policy shocks. Indeed, Fratzscher et al. (2016b) show that US Fed QE1 and QE2 had opposite effects on flows to US equity, suggesting that it is important to distinguish carefully the type of monetary shock. The evidence of spill-over of an expansionary domestic monetary policy to foreign securities is more coherent and convincing. Notably, with the exception of US Fed QE1 (Fratzscher et al., 2016b), monetary policy easing by the Fed prompts a rebalancing of portfolio towards non-US equity (Cenedese et al. (2015), Fratzscher et al. (2016b) and Kroencke et al. (2015)). Similarly, unconventional ECB monetary policies – until 2012 – led to larger flows to emerging market bond and equity funds and developed market bond funds (Fratzscher et al., 2016a).

Papers that include more detailed information regarding the asset allocation of specific investors - such as Joyce et al. (2014) for UK-based institutional investors or Bua and Dunne (2017) for Irish investment funds – find evidence of rebalancing from government bonds – those targeted by the Bank of England or ECB operations - towards corporate bonds or closer substitutes, such as foreign government bonds. In particular, Bua and Dunne (2017) stress that the portfolio balance channel of the ECBs public sector asset purchase programme operated through purchases of foreign assets, in

particular by funds not holding euro area government bonds and not directly exposed to the ECB APP. At the same time, Koijen et al. (2016) and the report by the Bundesbank (2017) confirm the important role of foreign investors as the main counterpart of ECB APP operations.

Finally, since we distinguish active rebalancing by fund investors from passive return effects, the results in our paper can be related to the ample literature on the behaviour of individual investors chasing returns or selling past winners, surveyed by Barber and Odean (2013) and, in particular as regards fund investors, by Levy and Lieberman (2015).

Our paper contributes to this literature in several different ways. First, it is the only study zooming in on ECB policies and portfolio decisions of euro area investors, together with Fratzscher et al. (2016a). Compared to the latter study, which covers ECB policies until 2012, we extend the sample to mid-2016, including in particular the Asset Purchase Programme. In addition, we construct our measures of ECB monetary policy surprises, based on the impact of announcements on euro area short-term and long-term interest rates. Similarly to the most recent studies using investment funds data, we analyse proper portfolio shifts, not just flows, through the measure of active reallocation. Compared to the other studies, to our knowledge, this is the first paper using daily data to identify the contribution of each component – active versus passive – to the total reallocation of a broad portfolio, in particular highlighting the contribution of a proxy of the passive exchange rate component against the passive return effect.

The next two sections explain our identification of monetary policy surprises and the construction of active and passive reallocation measures, respectively.

3. Data

This section presents the investment fund data and explains the construction of our portfolio of euro area investors. In particular, it introduces the concepts of *active* and *passive* reallocation that shall be used throughout the rest of the paper as main dependent variables. We also explain how monetary policy shocks are identified.

3.1. Investment funds data

Our sample is daily and runs from 1 January 2012 to 30 June 2016. We downloaded data for investment funds based in Luxembourg from the EPFR database. This dataset has been extensively used in the recent literature on the impact of monetary policy (cf. previous section), but it has also been used to study the impact of funding shocks on emerging markets asset prices (Jotikasthira et al., 2012) and to analyse capital flows to emerging markets (Fratzscher, 2012).

Table 1: Survey of empirical evidence

Study	Data	Identification	Main findings
Banegas et al. (2016)	ICI fund flows, US-based funds, monthly (2000-14)	Deviation of Fed fund rate from Taylor rule based on survey data	Unexpected Fed tightening (shock to the path of monetary policy) associated with outflows from bond and inflows to equity mutual funds
Bua and Dunne (2017)	Portfolio holdings, Ireland-based funds, quarterly (2014-2016)	QE dummy variables for different time periods	QE leads to rebalancing by fund managers from EU government bonds (targeted by CB operations) towards corporate bonds or closer substitutes, such as foreign government bonds
Cenedese et al. (2015)	EPFR country flows, global funds, monthly (2008-14)	Intraday change in US long-term yields and actual US Fed operations	US unconventional monetary policies prompt rebalancing of fund managers to non-US securities, in particular DM equity, and away from US securities
Curcuru et al. (2015)	EPFR fund flows, global funds, daily (2007-14)	Intraday change in long-term yields (US/UK/JP) or spreads (EA)	Active reallocation of underlying investors to DM equity and out of DM bonds following Fed and ECB easing
Fratzscher et al. (2016b)	EPFR fund and country flows, global and US-based funds, daily (2007-10)	Event dummy and actual US Fed operations	US Fed QE1 in 2008 triggered a portfolio rebalancing by underlying investors into US equity and bond funds and out of EM funds. US Fed QE2 since 2010 had the opposite effect
Fratzscher et al. (2016a)	EPFR fund and country flows, global and EA-based funds, daily (2007-12)	Event dummy and actual ECB operations	Some evidence of stronger inflows by underlying investors into EA periphery equity and, in some cases, bond markets, partly rebalancing from highly-rated EA countries. Positive impact on flows to EM equity and bond funds and DM bond funds
Hau and Lai (2016)	LIPPER fund flows, EA-based funds, quarterly (2003-10)	Change in real interest rates across EA countries	Loose monetary policy associated with an increase in inflows by underlying investors into equity and outflows from money market funds
Kroencke et al. (2015)	EPFR fund flows, US-based funds, weekly (2006-2014)	Weekly changes in US 2-year and 10-year Treasury yields	Fed easing associated with reallocation by underlying investors to non-US assets. Yield curve flattening associated with a shift out of equities and into US bonds
Joyce et al. (2014)	Micro dataset of UK-based institutional investors, quarterly (1985-2012)	Actual BoE operations	Reallocation of fund managers from UK gilts to corporate bonds following BoE quantitative easing

Funds are classified in the EPFR database according to their main mandate by asset class – equities or bonds – in a specific geographic area – Western Europe (WE), US and Asia Pacific including Japan (USAPJ), Global (GLOB) or Emerging Markets (EM).[2] We use this classification to create eight different fund categories that are the main components of our aggregate portfolio.

We fix our fund universe as of the 1st of January 2012 in order to eliminate any *entry* bias in our sample and we control for the possible exit of funds through internal consistency checks.[3] Table 2 shows the Total Net Assets (TNA) under management in each of the eight categories of funds. The coverage of the whole universe of Luxembourg-based funds is significant. On average between 2012 and mid-2016, total net assets of Luxembourg-based funds amounted to EUR 554 billion in our dataset; this corresponds to 27% of the total universe of equity and bond funds, as reported by the ECB (almost EUR 2.1 trillion). The EPFR coverage is higher for equity funds (36%) than for bond funds (19%). The lower coverage for bond funds is a disadvantage in our case, as we could miss the activity of the funds that were most affected by ECB APP purchases. Moreover, the EPFR dataset does not provide a breakdown for funds investing only in the euro area. However, the available aggregation allows to study fund flows at a daily frequency, a distinct advantage compared to several other studies using fund data, since it allows a clean identification of the monetary policy shock and its impact.

Table 2: EPFR portfolio, Jan 2012 - Jun 2016 averages

	Equity				Bonds				*Total*
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM	
EPFR Portfolio									
TNA (EUR bn)	87.3	67.5	64.2	113.9	58.7	17.7	93.1	51.2	*553.6*
% of TNA in total portfolio	16%	12%	12%	21%	11%	3%	17%	9%	*100%*
Currency denomination of funds (% of TNA within each fund category)									
EUR	92%	17%	38%	14%	92%	12%	43%	23%	*43%*
USD	3%	67%	60%	83%	0%	83%	46%	73%	*50%*
Other	5%	17%	2%	2%	8%	5%	11%	4%	*7%*
Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Country allocation of funds (% of TNA within each fund category)									
EA	62%	2%	13%	1%	83%	5%	29%	0%	*26%*
US	0%	67%	46%	0%	1%	73%	34%	0%	*22%*
Other	38%	32%	42%	99%	16%	22%	37%	100%	*53%*
Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

Note: See also footnote [4]

[2]We generate the category USAPJ ourselves, by aggregating data on North America and Asia Pacific Japan from EPFR.

[3]Funds might drop out of the sample and create a structural break in our series on a daily basis. Following Kroencke et al. (2015), it is possible to reconstruct an internally consistent series of TNA and identify these potential structural breaks. We find major inconsistencies – larger than 1% of fund category TNA - for 52 fund category-day combinations out of 9,328 and include a dummy variable in our regressions to control for these breaks. Moreover, we double check the results with a different sample, fixing the universe as of the 1st of January 2014.

[4]For USAPJ bonds, the currency allocation reflects only US bond funds since EPFR does not provide currency information on APJ Bonds. The country allocation is based on the monthly country allocation dataset of EPFR. The coverage of this dataset is more limited, the average TNA of Emerging market funds in the country allocation dataset

The coverage by EPFR of investment funds domiciled in other euro area countries is increasing over time, but still relatively low, and this led to the decision to focus on Luxembourg-based funds. This decision, however, is not only driven by data availability but also justified by the fact that Luxembourg is the most important financial centre for the euro area investment fund industry. This is a large industry with EUR 10.6 trillion assets under management (AuM) for equity and bond funds (including funds of funds and excluding money market funds) as of the second quarter of 2016, of which around one third, EUR 3.7 trillion are located in Luxembourg.[5] Crucially, euro area investors account for the bulk of cross-border equity investment in Luxembourg, 75% of the total stock of derived Luxembourg equity liabilities according to the IMF CPIS dataset.[6] Therefore, we may claim that Luxembourg-based funds are broadly representative of an average euro area investor.[7]

EPFR provides daily data on returns ($R_{i,t}$), the Total Net Assets ($A_{i,t}$), and flows ($f_{i,t}$) into a certain category of funds (i), e.g. Luxembourg-based funds investing in Western European equities (see upper panel of Table 4 for summary statistics). The original data are collected in the currency denomination of the fund and transformed by EPFR into US dollars. Therefore, the dataset includes an additional term ($fx_{i,t}$) to account for changes in the valuation of non-US dollar denominated fund shares. Flows are derived from the changes in a fund's Total Net Assets and the daily returns at the level of fund shares. Flows, assets and returns are then aggregated into the eight broad categories, which form our portfolio. Flows and assets are summed up across all funds in a given category, whereas the aggregate return for the asset class i ($R_{i,t}$) is the weighted average of the returns of each single fund in that category, where the weights are the assets of each fund divided by Total Net Assets in category i.

Applying the same methodology as EPFR, we convert our portfolio into euros, using the end-of-day exchange rates from Datastream[8] (Ticker: USEURSP) for Total Net Assets $A_{i,t}$ and the

is 49% of the total TNA of the flow dataset, which we use for the remainder of our analysis. However, coverage is generally lower for bonds than for equities and, e.g. coverage of the TNA of Global funds from the flow dataset is in the single digits in the allocation dataset. The category USAPJ is entirely missing from the allocation dataset. We aggregate funds with suitable mandates from Thomson Reuters Lipper for IM (e.g. United States, ASEAN, Korea, Japan) in order to extrapolate the country holdings for this category. For the totals we multiply the percentages from the country/currency allocation table with the TNA of the EPFR flow dataset.

[5]The industry is highly concentrated in a few countries of the euro area. The four largest domiciles by assets under management (Luxembourg, Germany, Ireland and France) account for more than 80% of total AuM between 2010 and mid-2016.

[6]In balance of payments statistics, the purchase of a share of an investment fund based in Luxembourg by a non-resident is recorded under portfolio equity investment liability.

[7]However, it should be noted that Floreani and Habib (2015) show that the investors from peripheral euro area countries are generally overexposed to euro area financial centres, such as Luxembourg and Ireland, compared to investors from core euro area economies and according to an international gravity model.

[8]The provider of the mutual fund database (EPFR) uses foreign exchange quotes from XE.com Inc., a commercial provider of FX information. Since all TNAs and flows are reported by Luxembourg-based funds with respect to the same market close, we apply the same conversion factor to all asset classes, and then focus our analysis on the differential effects between asset classes, small mismatches between the two data providers should not be consequential for our estimation. Quoting all results in Euro, however, makes the interpretation of the effects a lot easier. Our daily closing spot rates are quotes that are fixed at 4 p.m. UK time which ensures that there is no overlap with our

average exchange rate between the two days for flows ($f_{i,t}$), obtaining a valuation adjustment term in euro, $fx_{i,t}$[9], which accounts for the currency impact of fund shares denominated in a currency different from the euro. It is important to note that this term does not reflect the actual exchange rate exposure of the funds, whose impact is included in the return ($R_{i,t}$) if the fund has a foreign (non-euro) currency exposure, but it is denominated in euro. A simple example may clarify this point. In general, funds domiciled in Luxembourg with a mandate to invest only in US stocks may be denominated in US dollar – usually to target global investors, or in euro – to appeal to euro area investors. Assume that the daily return of the US stock market is equal to zero, but the dollar appreciates by 1% against the euro. In our dataset, the USD-denominated fund will correctly report a flat daily return and an increase in valuation by 1% in the exchange rate term. Nevertheless, the EUR-denominated fund will report a daily return by 1%, driven by the valuation effect, and a zero contribution by our *fx* term. Therefore, the closer the denomination of funds to the actual currency exposure, the better our *fx* term will capture the true valuation effect related to exchange rate movements. Fortunately, comparing the middle and lower panel of Table 4, it is possible to note a relatively broad correspondence between the currency denomination of funds and their country allocation in particular for WE and USAPJ equity and bond funds, and partly also for GLOB bond funds. Moreover, in the case of EM bond funds, the country asset allocation does not reflect the currency exposure, as this market segment is dominated by US dollar issuance and, only recently, domestic currency issuance started to take place. Therefore, also for this asset class the currency denomination of funds may offer a good indication of the direction of exchange-related valuation effects in our broad portfolio.

3.2. Measures of active and passive reallocation

For our empirical exercise we take as a starting point the euro-based portfolio weight of fund category i (we look at $N = 8$ fund categories) at time t:

$$w_{i,t} = \frac{A_{i,t}}{\sum_{i=1}^{N} A_{i,t}}.$$

where $A_{i,t}$ denotes the amount of assets under management in euro for all funds of category i at time t. This measure enables us to answer the following question: how do unexpected changes in the monetary policy of the ECB affect the global investment portfolio of fund investors in Luxembourg?

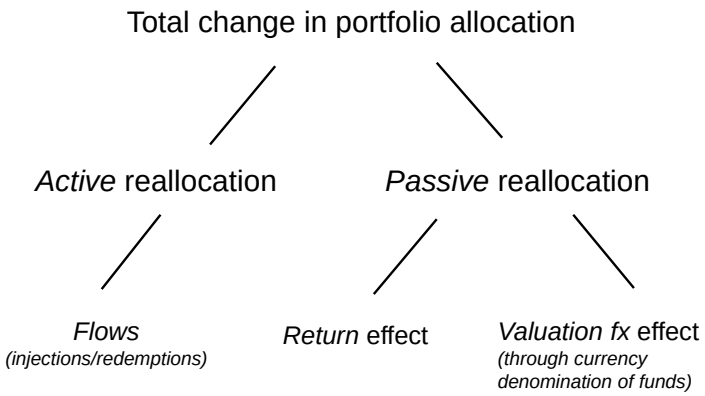
event windows. See also https://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/financial/wm-reuters-methodology.pdf

[9] If there are inconsistencies in the data reported by EPFR, e.g. a drop in overall AuM due to a fund dropping out of the sample, this will also be asorbed by $fx_{i,t}$.

The sum of the end-of-day portfolio weights is 1 at any point in time. However, a change in the portfolio weight $\Delta w_{i,t} = w_{i,t} - w_{i,t-1}$ can be due to valuation effects (*passive* rebalancing) or inflows/outflows (*active* reallocation). Figure 1 illustrates these terms, which we use throughout the paper.

What matters for portfolio weights are the changes in category i relative to the other fund categories. This is why focusing exclusively on fund flows will only reveal a partial answer to our question regarding active reallocation: for example there might be simultaneous outflows from all fund categories without an effect on the individual portfolio weights.[10] At the same time, there might be positive returns in all asset classes; however, the weight of the asset class with the highest return will increase at the expense of the weight of the asset class with the lowest return.

Figure 1: Decomposition of portfolio changes



We extend the measures proposed by Grinblatt et al. (1995) and Curcuru et al. (2011), incorporating the FX term from the EPFR dataset. These measures are based on the following identity:

$$A_{i,t} = A_{i,t-1}R_{i,t} + f_{i,t} + fx_{i,t}$$

Total Net Assets $A_{i,t}$ of fund category i at the end of period t, can be expressed as the combination of the assets at the end of the previous period $A_{i,t-1}$ multiplied by the gross returns over this period $R_{i,t} = 1 + r_{i,t}$, inflows/redemptions by investors $f_{i,t}$, and currency valuation effects $fx_{i,t}$ due to changes in the value of the denomination currency of fund shares vis-à-vis the reporting currency.

[10] This would happen if some investors convert fund shares in cash proportional to their ex-ante portfolio weights.

In our final dataset all these measures are in euro terms, including the FX effect of the currency denomination of the funds, as explained in Section 3.1.

Our goal is a decomposition of the changes in the portfolio weights due to passive reallocation (driven by changes in returns and exchange rates) and active reallocation (due to new inflows and outflows of funds). We take as a starting point the decomposition of Ahmed et al. (2016), which we extend accounting for an additional FX term that captures passive changes in the portfolio due to exchange rate movements.

$$\begin{aligned} \Delta\text{Portfolio Share} &= \Delta\text{Passive reallocation (returns)} \\ &+ \Delta\text{Passive reallocation (FX)} \\ &+ \Delta\text{Active reallocation (flows)}. \end{aligned}$$

According to this decomposition, it is possible to isolate the change in the portfolio that is simply driven by differential changes in asset prices across the different categories in our portfolio. In particular, to obtain the passive realloaction due to differential returns, one should compare the new portfolio weight of category i abstracting from flows and FX effects with the portfolio weight from the previous period:

$$\begin{aligned} \Delta\text{Passive realloction (returns)} &= \frac{A_{i,t-1}R_{i,t}}{\sum_{j=1}^{N} A_{j,t-1} \cdot R_{j,t}} - \frac{A_{i,t-1}}{\sum_{j=1}^{N} A_{j,t-1}} \\ &= w_{i,t-1} \cdot \left(\frac{R_{i,t}}{R_{P,t}} - 1 \right) \end{aligned}$$

where $R_{i,t}$ denotes the returns of the portofolio between period $t-1$ and period t and the portfolio return is computed as $R_{P,t} = \sum_{j=1}^{N} w_{j,t-1} \cdot R_{j,t}$. In a similar fashion, one can compute the passive change in the weight of fund shares denominated in a currency different from the euro that is triggered by exchange rate changes:[11]

$$\begin{aligned} \Delta\text{Passive realloction (FX)} &= \frac{A_{i,t-1} + fx_{i,t}}{\sum_{j=1}^{N} (A_{j,t-1} + fx_{j,t})} - \frac{A_{i,t-1}}{\sum_{j=1}^{N} A_{j,t-1}} \\ &= w_{i,t-1} \cdot \left(\frac{R^f_{i,t}}{R^f_{P,t}} - 1 \right) \end{aligned}$$

Here we use the FX return $R^f_{i,t} = 1 + \frac{fx_{i,t}}{A_{i,t}}$ and the average FX return across all fund categories $R^f_{P,t} = \sum_{j=1}^{N} w_{j,t-1} \cdot R^f_{j,t}$. As in Ahmed et al. (2016) the active reallocation, the part of the decom-

[11] As discussed in Section 3.1, EPFR data do not allow us to look at the true currency exposure of the fund portfolio, but only a proxy through their currency denomination.

position that is driven by inflows and outflows of investors, can be computed as the part of the shift in portfolio weights not due to returns or FX effects.

$$\Delta\text{Active reallocation} \quad = \quad w_{i,t} - w_{i,t-1} \cdot \left(\frac{R^f_{i,t}}{R^f_{P,t}} - 1 \right) - w_{i,t-1} \cdot \left(\frac{R_{i,t}}{R_{P,t}} - 1 \right) - w_{i,t-1}$$

But one can also show the equivalence to:

$$\Delta\text{Active reallocation} \quad = \quad \frac{A_{i,t}}{\sum_{j=1}^{N} A_{j,t}} - \left(\frac{A_{i,t} - f_{i,t}}{\sum_{j=1}^{N} A_{j,t} - f_{j,t}} \right)$$

This captures the *active* reallocation component of the underlying fund flows $f_{i,t}$ that induces an actual change in the asset allocation. Active changes in the portfolio weight of a certain fund category should be able to capture quite well the intentions of investors to increase the exposure towards this specific asset class and geographic focus.

The value of this measure will be 0 both in the absence of flows, and in the case of inflows/redemptions that affect every fund category in the same manner. It is measured on the same scale as the portfolio weight $w_{i,t}$ which is strictly between 0 and 1. However, for the purpose of our empirical analysis we multiply it by 100 to capture the active reallocation in percentage points based on portfolio weights between 0% and 100% of the total portfolio.

Finally, we want to stress again two important properties of our reallocation measures that are both implied by the fact that we provide a decomposition of portfolio shifts. First, across the $N = 8$ fund categories all reallocation measures mechanically sum up to 0. We exploit this in our estimation approach, by imposing an additional restriction on the fitted values. Second, the sum of the active reallocation measure and the two passive reallocation measures will indicate the total reallocation, i.e. the total shift in portfolio weights between period $t-1$ and period t.

Table 4 includes summary statistics for all our reallocation measures for the aggregate portfolio, while Table B.9 in the Appendix provides detailed statistics for each fund category. It is important to note that on a daily basis the volatility of these measures is very low, ranging from 0.02 percentage points for the *active* reallocation measure to around 0.1 percentage points for the *total* reallocation measure. This is not surprising and consistent with the findings of Bacchetta and van Wincoop (2017) who suggest that portfolio decisions are "infrequent" (at most once in 15 months). Therefore, aggregating all investors, the adjustment of the total portfolio can only be at the margin. The interesting question we tackle in this paper is whether ECB monetary policy announcements drive this marginal adjustments for euro area investors, similarly to one of the main findings of Ahmed

et al. (2016) showing that active reallocations into emerging market equities by US investors, at a low frequency, appear to be mainly driven by the level of US long-term interest rates.

3.3. ECB Unconventional Monetary Policies and Identification Strategy

Our sample period starts at the beginning of 2012 and ends in June 2016. Our focus is on the second phase of unconventional measures that were implemented by the ECB, targeting in particular the European sovereign debt market, including the OMT programme and the APP programme. Monetary policy surprises are calculated using an approach similar to Rogers et al. (2014). The surprises (Δi_t^{EA}) are based on changes in short-term interest rates and long-term government bond yields for the euro area on the days of announcements of ECB monetary policy decisions. We use quoted bid prices from the Thomson Reuters Tick History Database within a 2-hour window around important ECB announcements – all Governing Council meetings and other events, as identified by Rogers et al. (2014) and Curcuru et al. (2015) and Altavilla et al. (2015) – and select the first and last available observation within each time window.[12]

We extract changes in the weekly, the monthly and the 3-month EONIA OIS and average them to obtain our monetary policy surprise to euro area short-term rates. However, as regards long-term rates, the choice of the benchmark for the euro area is not straightforward. One candidate could be the Bund-yield, but, as noted by Rogers et al. (2014), price changes in Bund prices may be driven by safe-haven motives, in particular at the peak of the euro area crisis in 2012, rather than by changes in the expected future path of long-term interest rates. A positive surprise that removes uncertainty in the market and reduces risk premia would lead to an increase in equity market valuations, but it might lead to a decrease in Bund prices, since holdings of safe haven asset become less attractive. At the same time, if the markets were expecting more expansionary measures than those that were announced during during a particular ECB announcement – a negative surprise – Bund yields could decrease on the back of higher demand for safe haven assets. Therefore, in order to identify a positive surprise, i.e. a loosening of the monetary policy, we use the *inverse* of the average change in the 10-year sovereign bond yields of Germany, Italy and Spain, so that a decline in the average yield would correspond to a monetary policy easing. This approach bears some similarities to Rogers et al. (2014) who use the spread between German and Italian bonds for the identification of monetary policy surprises in the euro area. Our approach has the advantage that we would identify both a decrease in sovereign risk through a tightening of the spreads and a simultaneous decrease in all three rates as a positive monetary policy surprise, for instance an easing announcement such as the

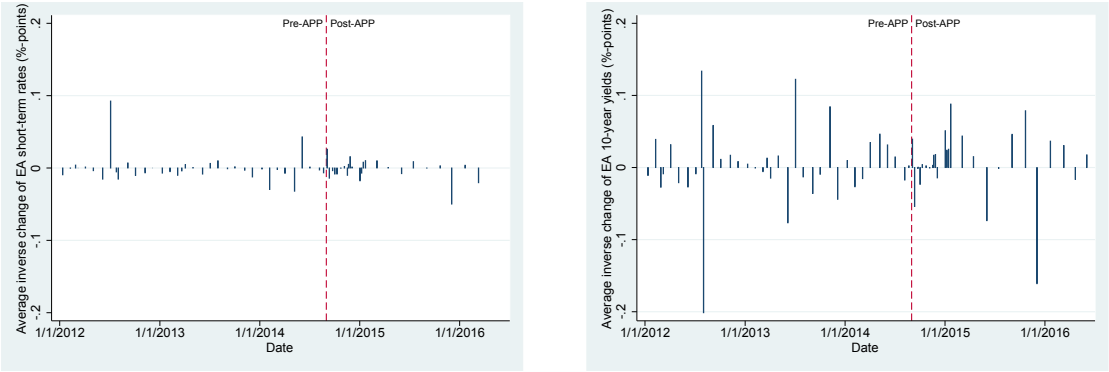
[12] We use intraday 1-minute data provided by Thomson Reuters Tick History. The last bid price before the event window might come from a quote from some earlier one-minute window. Yields are re-matched from tick data and identified by the (median yield of) RIC-day-bid price-combinations.

launch of the APP that shifted the yield curve downward. At the same time by relying on three instruments we can decrease the amount of noise in the small surprises, since we will only identify a clear positive surprise related to the portfolio balance channel if all three rates move in the same direction. The interpretation is straightforward. All coefficients can be interpreted as if we would look at the yield change in percentage points of just one instrument.

The choice of the 10-year maturity in order to capture changes in the long end of the yield curve is standard in the literature.[13] For the German Bund yields the 10-year and 5-year maturities have historically been the most liquid segments.[14] A high level of liquidity ensures a timely response of prices to new market developments.

Figure 2 plots our surprises to euro area short-term rates (left panel) and long-term rates (right panel). It is evident that the size and volatility of shocks to short-term rates is much lower than that of long-term rates. Interestingly, even though the ECB policy rate rates approach the lower bound in September 2014, when the main refinancing rate is cut from 0.15% to 0.05%, it is still possible to identify significant shocks to the euro short-term rates after that date. Similarly, the volatility of surprise shocks to average euro area long-term rates does not seem to be affected by announcement of the APP.

Figure 2: Surprises over time



(a) EA short-term rates

(b) EA 10-year rates

Table 3 reports summary statistics for the largest shocks to euro area short-term rates and long-term rates around ECB announcements. For short-term rates, we find the large surprises concentrated around important rate cuts and announcements of measures targeted towards the euro area banking sector. As regards long-term rates, our surprises capture quite well the effects of the most important unconventional policy measures by the European Central Bank between 2012 and mid-2016. We

[13] See for example Rogers et al. (2014), Curcuru et al. (2015) and Fratzscher et al. (2016a).

[14] See Figure 1 of Ejsing and Sihvonen (2009) for a graph of the daily trading volumes (EUR billion) as a function of time-to-maturity (years) We expect the level of the trading to have changed over time but not the overall pattern of liquidity with respect to the term structure.

find large positive surprises around the announcement of the Asset Purchases Program, around the announcement in July 2013 that interest rates would "remain at present or lower levels for an extended period of time" (forward guidance) and around the famous "Whatever it takes"-speech by the President of the ECB, Mario Draghi in July 2012 (cf. Table 3).

Table 3: Summary table of the largest and smallest monetary policy surprises (inverted sign)

			60 min inverse yield change		Daily Returns (%)		
Date	Event		ST rates	10-year rates	S&P 350	WE Bond	EUR/USD
Positive Surprises to short-term rates ($\cdot > 0.025$)							
05/07/2012	GC meeting, MRO rate decreased to 0.75%, deposit facility rate to 0	Standard MP	**0.09**	**-0.01**	-0.11	0.05	-1.03
05/06/2014	Targeted Longer-Term Refinancing Operations (TLTRO) Announcement	Balance Sheet	**0.04**	**0.03**	0.42	0.20	-0.05
04/09/2014	GC meeting, MRO rate decreased to 0.05%	Standard MP	**0.03**	**0.04**	1.17	0.08	-1.30
Negative Surprises to short-term rates ($\cdot < -0.025$)							
06/02/2014	GC meeting, rates unchanged	No action	**-0.03**	**-0.03**	1.45	-0.26	0.50
08/05/2014	GC meeting, rates unchanged	No action	**-0.03**	**0.05**	1.04	0.23	-0.43
03/12/2015	GC meeting, deposit facility cut by 10 bps to -0.30%	Standard MP	**-0.05**	**-0.16**	-3.29	-1.07	2.63
Positive Surprises to 10-year rates ($\cdot > 0.075$)							
26/07/2012	Whatever it takes London speech	Confidence Channel	**-0.01**	**0.13**	2.46	0.36	1.46
04/07/2013	GC meeting, Open-ended guidance	Forward guidance	**0.01**	**0.12**	2.47	0.17	-0.45
22/01/2015	GC meeting, APP announced	Balance sheet	**0.01**	**0.09**	1.60	0.27	-1.47
07/11/2013	GC meeting, MRO rate decreased to 0.25%	Standard MP	**0.00**	**0.08**	0.03	0.32	-1.07
22/10/2015	GC meeting, willingness to cut rates and expand QE	Balance Sheet/Forward guidance	**0.00**	**0.08**	2.11	0.37	-1.71
Negative Surprises to 10-year rates ($\cdot < -0.075$)							
06/06/2013	GC meeting, rates unchanged	Downward revision of economic outlook	**-0.01**	**-0.08**	-1.16	-0.40	0.83
03/12/2015	GC meeting, deposit facility cut by 10 bps to -0.30%	Balance sheet (APP not expanded) and rates not decreased as expected	**-0.05**	**-0.16**	-3.29	-1.07	2.63
02/08/2012	GC meeting, OMT considerations announced but no details	Balance sheet (disappointment of no immediate action)	**-0.02**	**-0.20**	-1.26	0.18	-1.12

Interestingly, the "Whatever it takes"-speech by the President of the ECB is associated with the largest positive surprise to average euro area long-term rates, but with a marginal negative surprise (i.e. a rise) in short-term rates. This stresses the importance to keep a distinction between the identification of the impact of ECB announcements through short-term and long-term rates. Indeed, Table B.8 reports the correlation among short-term rates, long-term-rates and our two surprise indicators. In the more recent past (after September 2014) there is a strong correlation between long-term and short-term surprises. Furthermore all single instruments from which we compose our aggregates are strongly correlated. However, in the first part of the sample (from January 2012 to

September 2014), the correlation between the Bund and the other sovereign yields is negative and between the Bund and euro area short-term rates remarkably low. This means there were different channels at work during the early part of our sample and many of the efforts of monetary policy were concentrated on restoring the confidence of Euro area investors.

While a classification of surprises is relatively straightforward for the larger surprises (cf. Table 3) it is hard to uniquely assign our whole universe of 63 surprises to a certain set of policies. We do split the sample around the period when markets started to expect a major balance sheet expansion by the ECB through purchases of public sector bonds – September 2014 – in order to distinguish the impact of the ECB APP from the set of conventional and unconventional measures that had been adopted between 2012 and mid-2014.

4. Empirical Methodology

Our goal is to assess the effect of euro area monetary policy surprises on the reallocation measures defined in section 3.2: total reallocation ($\Delta w_{i,t}$) across asset classes (i=1,2, ..., 8), active reallocation, passive reallocation through returns, passive reallocation through FX effects on the fund share level. Moreover, we look also at a simple measure of fund flows in percent of TNA ($100 \cdot f_{i,t}/A_{i,t}$). Our baseline regression approach is captured by the following equation:

$$\begin{aligned}(\text{Reallocation\_measure})_{i,t} = \beta_{i0} &+ \sum_{j=0}^{4} \theta_{ij} (\text{MP\_surprise})_{t-j} \\ &+ \sum_{k=1}^{4} \beta_{ik} (\text{Reallocation\_measure})_{i,t-k} \\ &+ \sum_{l=0}^{4} \boldsymbol{\gamma}_{il} (\text{Controls})_{i,t-l} + \varepsilon_{i,t}\end{aligned}$$

where the impact of our monetary policy surprises is captured by the vector θ estimated for each combination of: (i) reallocation measure and (ii) asset class. However, by definition, our reallocation measures are constructed in a way that they sum up to 0 across categories. We exploit this feature in our approach by imposing an additional constraint on the fitted values and estimate a joint regression across asset classes for each dependent variable, i.e. active or passive reallocation measures. The econometric approach of our joint regression specification is outlined in Appendix A.1.

In our main specification, we look at the effect of monetary policy surprises over a one-week horizon, to allow for a lagged reaction of fund investors to news. For the one-week horizon we report $\sum_{j=0}^{4} \theta_{ij}$ and test whether it significantly differs from 0 using a two sided test (Wald-Test). This would capture the cumulative effect of a monetary policy shock over the course of one week. Flows,

active reallocation and total reallocation are ultimately driven by (unsophisticated) investors, which are slower at incorporating new information.

A second specification looks at the contemporaneous effects of monetary policy, testing whether the contemporaneous coefficient θ_{i0} is statistically significant, excluding the lags $1-4$ from our estimation equation. In this case, we are mainly concerned about the passive return and FX effects that are driven by the reaction of asset prices, which are forward-looking and embed immediately the new information. Therefore, the contemporaneous effect of our surprises is the relevant one for these measures.

The main specification includes lagged dependent variables, and a number of control variables, whose impact is captured by the coefficient matrix $\boldsymbol{\gamma}$. In order to control for additional pull and push factors that may influence investors' decisions, we include the change in the CITI Economic surprise index for the euro area (lagged) and the relevant one(s) for the respective geographic focus of the funds (contemporaneous and lagged): G10 economies and emerging markets. This index tracks on a daily basis to what extent actual economic releases[15] have been beating consensus forecasts. Finally, we include a dummy that differs from 0 for days with inconsistent data in the reports from EPFR. We present our main results in Tables 5–6. Each line reports the relevant coefficients associated with the impact of a monetary policy surprise based on a joint regression for each the dependent variable.

4.1. Control variables and summary statistics

4.2. Benchmark regressions

We compare our results on passive reallocation measures with the daily change in several benchmark indices and the euro-dollar exchange rate as dependent variables. This ensures that our results for passive rebalancing through returns and exchange rate effects properly reflect price or exchange rate adjustments (keeping in mind that a simultaneous increase in market values across categories does not necessarily lead to passive reallocation – it is the differential effect across categories that matters). For the benchmark indices we obtain daily returns from Thomson Reuters Datastream. We use broad stock indices and bond benchmarks that include both government and corporate debt. All indices are computed in USD except the Pan-European Aggregate Bond Index and the S&P 350 Europe Index, which we use as a benchmark for bond funds focused on Western Europe. We convert the returns of the US-dollar based indices to euro. Table 4 also shows summary statistics for these variables.

[15] These releases include monetary policy decisions by the respective central banks.

Table 4: Summary statistics

		Summary Statistics				
Description	Unit	N	mean	sd	min	max
EPFR Raw Measures (All Funds)						
Total Net Assets – $A_{i,t}$	Euro (billion)	9336	69.194	30.081	14.886	145.381
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	9328	0.024	0.554	-5.803	3.364
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	9328	-0.007	0.172	-3.524	2.730
EPFR Portfolio Measures						
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	9328	0.000	0.016	-0.198	0.198
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	9328	-0.000	0.056	-0.618	0.506
Passive reallocation (due to FX changes)	%-points	9328	-0.000	0.043	-1.366	1.277
Total Reallocation –$\Delta w_{i,t}$	%-points	9328	0.000	0.071	-1.359	1.281
Benchmarks	*Daily Returns (euro-based)*					
WE Equity - S&P EUROPE 350	%	1167	0.031	1.054	-6.836	4.188
USAPJ Equity - S&P 500 COMPOSITE	%	1167	0.062	0.973	-6.110	4.156
GLOB Equity - S&P GLOBAL 1200	%	1167	0.045	0.855	-6.005	4.098
EM Equity - MSCI EM USD	%	1167	0.010	0.996	-7.145	5.015
WE Bonds - Barclays Pan-European Aggregate EUR	%	1167	0.011	0.194	-1.143	0.770
USAPJ Bonds - Barclays U.S. Aggregate USD	%	1167	0.014	0.586	-3.287	2.692
GLOB Bonds - Barclays Global Aggregate USD	%	1167	0.019	0.574	-3.192	2.640
EM Bonds - Barclays EM USD Aggregate USD	%	1167	0.013	0.590	-3.047	2.220
EUR/USD – Exchange rate	%	1167	-0.012	0.561	-2.081	2.634
Surprises (TR Tick History)	*60-min yield change*					
EA_10Y_rates	%-points	63	0.005	0.052	-0.201	0.134
German 10-year yield	%-points	62	0.003	0.035	-0.122	0.103
Spanish 10-year yield	%-points	62	-0.010	0.073	-0.218	0.310
Italian 10-year yield	%-points	63	-0.007	0.077	-0.274	0.340
EA_ST_rates	%-points	63	-0.001	0.017	-0.050	0.093
Weekly EONIA OIS	%-points	63	-0.000	0.017	-0.076	0.037
1-month EONIA OIS	%-points	63	0.002	0.022	-0.106	0.055
3-month EONIA OIS	%-points	63	0.002	0.021	-0.095	0.063

5. Main Results

We provide results for two different types of monetary policy shocks, one to euro area short-term rates and one to euro area long-term rates, in two separate tables, Table 5 and Table 6, respectively. We also split our sample period. In each table, we first report the results for our entire sample period from 2012 to mid-2016 (panel a). Then, we look at the effects during the pre-APP period from January 2012 to August 2014 (panel b). Finally, we look at the period in which the European Central Bank was conducting the Asset Purchase Programme (panel c). Following Altavilla et al. (2015), we split the sample in September 2014, since a series of announcements related to the APP preceded the official launch of this programme in January 2015. The analysis of time variation in parameters provides statistical support for the choice of this particular break point. We sequentially estimate Chow Test-statistics with respect to a break in all regression parameters at time t (Hansen, 2001) and find a sharp increase in the test statistic in mid-2014. [16].

As discussed, we present the results for the main specification with 4 lags of our dependent variable to allow for a delayed response of investors to monetary policy news. However, we check the

[16]The results of this analysis are not shown for reasons of space and available from the authors upon request

results also with only the contemporaneous impact of the monetary policy surprise (see Table B.10 and B.11 in the Appendix) and with 2 lags.[17].

The interpretation of the effects of our surprises are straightforward as all variables have the same unit of measurement. For instance, a typical large positive monetary policy surprises, say a two standard deviation shock – is characterised by a decline in euro area short-term rates by 3-4 basis points and in average euro area long-term yields by 10 basis points (see Table 3). In turn, the impact of a large shock to average euro area long-term yields – a decline by 10 basis points – would lead to an increase in the portfolio weight of Emerging Market equity by 0.13 percentage points over one week, on the back of an *active* reallocation by 0.01 percentage points and, in particular, a *passive* reallocation due to the FX effect, almost 0.11 percentage points, as the euro depreciates by around 1.2%, boosting the weight of funds that are not denominated in euro (see fifth column of Table 6a).

5.1. Results with surprises to euro area short-term rates

We start by analysing the impact of shocks to the euro area short-term rates following important ECB monetary policy announcements. As shown in Section 3, our sample period is characterised by relatively stable policy rates – the main refinancing rate of the ECB gradually declined from 1% to 0% – and relatively subdued policy surprises identified through changes in euro area short-term rates. Tables 5 shows the results of the impact of these monetary policy surprises on our portfolio of euro area investors. Generally, it is difficult to identify a statistically significant effect of these surprises on flows and the active reallocation to specific asset classes. Investors seem to reduce the weight of equity funds dedicated to non-euro area developed economies following positive surprises identified through short-term rates, as the active reallocation coefficient is negative and statistically significant (see first row of Table 5a). However, the result does not appear to be particularly robust across different time periods (see Table 5b and 5c), using a different lag structure of the main specification (see appendix) or mirrored by the reaction of flows (as % of TNA, i.e. not aggregated in a single portfolio) to ECB announcements. If any, splitting the sample between the pre-AAP period (panel b) and the APP-related period (panel c), we may note that easing surprises lead to purchases of bonds of non-euro area developed economies – see statistically positive coefficient for flows into USAPJ and Global bond funds and the active reallocation into Global bond funds – possibly reflecting a search for yield.

However, Tables 5a-5c show that ECB monetary policy announcements lead to sharp exchange rate and price fluctuations that in turn generate significant passive shifts in the portfolio of euro area

[17]The latter set of results is available from the authors upon request

Table 5: **Main results Euro area short-term rates (impact over 4 lags)**

The table shows the (cumulative) effect associated with the surprise change in Euro area short-term rates. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 3.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area short-term rates on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA ST rates – full sample

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	0.036	-0.321^{*}	-0.188^{**}	0.113	-0.040	0.114	0.167	0.065
Passive reallocation *return*	1.682	-0.886^{*}	-0.480	-1.691^{*}	0.307	0.174	0.593	0.280
Passive reallocation *FX*	-2.308^{**}	1.221^{**}	0.083	2.126^{***}	-1.290^{*}	-0.283	0.436	0.805^{***}
Total reallocation	-0.464	-0.331	-0.592	-0.085	-0.950	0.169	1.354	1.251^{*}
Separate estimation (equation by equation)								
Flows (% of TNA)	0.746	-1.643	-0.382	1.260	1.223	4.046	1.264	1.135
Surprises	60	60	60	60	60	60	60	60
Observations	1162	1162	1162	1162	1162	1162	1162	1162
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
-31.0^{***}	15.0	14.9	13.6	12.5	9.6^{***}	33.3^{***}	34.6^{***}	33.0^{***}

(b) Impact of a surprise change in EA ST rates – before September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	-0.210	-0.294	-0.166	-0.018	0.049	0.180	0.324^{*}	0.065
Passive reallocation *return*	-0.717	-1.230^{***}	-1.042^{***}	-1.856^{*}	1.313^{***}	0.497^{***}	1.932^{**}	0.862^{**}
Passive reallocation *FX*	-1.820^{**}	1.070^{**}	0.174	2.147^{***}	-1.140^{*}	-0.268	-0.113	0.831^{***}
Total reallocation	-2.512^{**}	-1.147^{*}	-0.968^{**}	-0.936	0.359	0.623	2.636^{***}	2.051^{***}
Separate estimation (equation by equation)								
Flows (% of TNA)	-1.346	-1.750	-0.200	0.531	1.378	5.554^{*}	1.801^{*}	0.430
Surprises	36	36	36	36	36	36	36	36
Observations	686	686	686	686	686	686	686	686
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
-19.1^{**}	-13.7	-4.9	-6.8	-6.5	8.8^{***}	24.8^{**}	24.4^{**}	22.1^{**}

(c) Impact of a surprise change in EA ST rates – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	0.371	-0.302	-0.255	0.088	-0.080	-0.103	-0.212	0.127
Passive reallocation *return*	8.729^{***}	-0.151	1.342	-1.181	-2.430	-0.938^{**}	-3.913^{**}	-1.793^{**}
Passive reallocation *FX*	-4.123^{**}	2.598^{**}	-1.598	3.044^{**}	-2.913	0.393^{**}	2.054	0.646
Total reallocation	5.795^{**}	2.095	-0.751	1.844	-4.968^{**}	-0.442	-2.841	-1.304
Separate estimation (equation by equation)								
Flows (% of TNA)	3.865	-0.915	-0.807	1.470	1.375	-2.975	0.212	3.691
Surprises	24	24	24	24	24	24	24	24
Observations	471	471	471	471	471	471	471	471
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
-67.3^{***}	100.8^{***}	65.6^{**}	74.1^{***}	73.6^{*}	15.2^{**}	62.2^{**}	68.2^{***}	68.0^{***}

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

investors. The impact on exchange rates is significant. An unexpected large easing – say a decline in euro area short-term rates by 3 to 4 basis points - leads to a depreciation of the euro against the US dollar by around 1% in one week (by 0.6% on the day of the announcement, as shown in Table B.10 in the appendix).[18] Interestingly, the impact is much larger in the second phase of ECB unconventional monetary policies, those that were associated with the announcement of purchases of euro area government securities. The absolute value of the impact of a large positive surprise on the exchange rate over one week (on the same day) increases from 0.6% (0.3%) in the sample until mid-2014 to 2.3% (1.4%) in the period starting from September 2014.[19] As a result, a positive monetary policy surprise triggers on average a passive reallocation out of European equity funds (−0.08 percentage points) and bond funds (−0.04 percentage points), which are largely denominated in euro, and positive shift in the weight of USAPJ and EM asset classes that include relatively small share of euro-denominated funds (see Table 2). During the APP-period, the passive FX reallocation out of European equity funds peaks at 0.16 percentage points, a significant shift corresponding to 3 standard deviations of the daily distribution of this series.

Asset prices also react dramatically to ECB announcements. In particular, bond prices of extra-European bonds rise by around 1.1% (0.7%) over one week (day) following a positive surprise. Even though not statistically significant, the impact on other asset prices is also positive and, as a result, there is not a clear trend in the passive reallocation driven by returns. Moreover, splitting the sample, it is evident that, again, the announcement of the launch of the APP-programme was associated with much sharper asset price fluctuations compared to the previous period. Notably, European equity markets rise by 3.4% (1.9%) over one week (day) and extra European equity markets by around 2.2-2.5% following positive surprises since the autumn of 2014 (last row of Table 5c). Bond prices also rise by around 2% outside Europe and by 0.5% in Europe. Eventually, in this second phase of ECB unconventional policies, these relative changes in asset prices lead to a passive shift in the portfolio allocation towards European equity funds, increasing their weight by 0.30 (0.14) percentage points over one week (day). This shift is large and offsets the negative passive FX effect driven by the euro depreciation and, all together, results in a total reallocation of the portfolio of euro area investors into European equity funds at the expenses of European bond funds, whose weight is affected by the combination of a negative FX effect and a negative return effect (relative to other asset classes) since the autumn of 2014.

[18] Precisely, a two-standard deviation shock to euro area short-term rates around ECB announcements corresponds to 0.034 percentage points, therefore to quantify the impact is sufficient to divide the coefficients by around 3 and then by 10.

[19] Ferrari et al. (2017) show that the FX impact of monetary policy of major central banks, not only of the ECB, has been growing significantly and is stronger the lower the level of interest rates.

5.2. Results with surprises to euro area 10-year yields

Tables 6a-6c show the results for the monetary policy surprise identified through the change in average euro area long-term interest rates. As in the previous identification, we find only scant evidence of active reallocation towards specific asset categories. A surprise loosening of monetary policy leads to an *active* reallocation to Emerging Market equity funds across the whole sample (Table 6a, first row), in turn driven by a positive impact in the first part of our sample until mid-2014. In particular, in this first period, the active reallocation towards Emerging Market equity funds comes at the expenses of a rebalancing out of European bond funds. The last row of panel (b) shows that emerging stock markets had the strongest positive price reaction to a monetary policy surprises, even though not statistically significant, whereas European bonds display the weakest performance. This provides some support to the body of evidence suggesting that inflows into investment funds are positively correlated to their return performance (see (Levy and Lieberman, 2015)). However, even for statistically significant coefficients, the size of impact on the active reallocation measure of a large shock – say, by 10 basis points – to average euro area long-term rates is relatively small - generally, close to one standard deviation of the distribution - and these results are not robust to the use of a different lag structure. Flows into EM equity funds are also statistically significant following an unexpected ECB monetary easing, amounting 0.08% of their TNA, corresponding to around EUR 90 million over one week. However, these numbers are not particularly large when compared to the historical volatility of the series (see Table B.9 in the Appendix), confirming one of the main findings of Fratzscher et al. (2016a) regarding the impact of ECB policies between 2007 and 2012. Finally, we may note that the negative flows into European bond funds in the first phase of ECB policies until mid-2104 turn positive after September 2014. In this latter period, the impact of a large positive surprise to long-term yields is associated with an inflow into European bond funds corresponding to 0.2% of TNA, which however does not translate into a significant *active* shift in the portfolio. Overall, matching these results with the impact of shocks identified through short-term rates, we may conclude that the portfolio balance channel of ECB unconventional policies is substantially muted according to our evidence.

Again, ECB monetary policy surprises identified through changes in long-term yields are associated with fluctuations in asset prices and exchange rates, which trigger a passive reallocation of the portfolio of euro area investors (Table 6a). Differently from the previous identification through short-term rates, though, the reaction in asset prices is mainly visible in the second part of our sample (Table 6c), not in the period up to August 2014 (Table 6b). This suggests that long-term yields may be a good proxy of the impact of balance sheet unconventional monetary policies targeting public debt, but not necessarily of those polices working through forward guidance on short-term

Table 6: **Main results Euro area 10-year yields (impact over 4 lags)**

The table shows the (cumulative) effect associated with the surprise change in Euro area 10-year yields. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 4.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area 10-year yields on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA 10Y yields – full sample

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.099	−0.061	0.004	0.124*	−0.019	0.010	0.043	0.015
Passive reallocation *return*	1.390**	−0.082	0.299	0.319	−0.447*	−0.189*	−0.806*	−0.420**
Passive reallocation *FX*	−1.068***	0.598**	0.163*	1.051***	−0.464	−0.365	0.018	0.359***
Total reallocation	0.364	0.336	0.445**	1.278**	−0.905**	−0.512	−0.774*	−0.140
Separate estimation (equation by equation)								
Flows (% of TNA)	−0.207	−0.040	0.533	0.769**	−0.052	0.736	0.533	0.440
Surprises	63	63	63	63	63	63	63	63
Observations	1162	1162	1162	1162	1162	1162	1162	1162
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−12.0**	17.7**	15.7**	15.2**	18.4***	3.9***	13.5**	13.9**	13.4**

(b) Impact of a surprise change in EA 10Y yields – before September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.178	−0.003	0.049	0.194**	−0.149**	0.025	0.034	0.058
Passive reallocation *return*	0.267	−0.018	0.129	0.391	−0.063	−0.091	−0.288	−0.275
Passive reallocation *FX*	−0.504*	0.296	0.107	0.842**	−0.218	−0.389	0.068	0.298*
Total reallocation	−0.315	0.206	0.268	1.153	−0.394	−0.371	−0.182	−0.000
Separate estimation (equation by equation)								
Flows (% of TNA)	−1.083	0.191	0.757	0.798	−1.698***	1.146	0.259	0.638
Surprises	36	36	36	36	36	36	36	36
Observations	686	686	686	686	686	686	686	686
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−3.8	4.5	5.4	4.1	6.6	1.4	4.2	4.8	3.6

(c) Impact of a surprise change in EA 10Y yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.002	−0.120	−0.040	0.003	0.178	−0.037	0.054	−0.047
Passive reallocation *return*	3.377***	−0.265	0.512**	0.156	−1.132***	−0.413***	−1.679***	−0.687***
Passive reallocation *FX*	−1.798***	1.006***	0.051	1.270***	−0.987*	0.170***	−0.007	0.355***
Total reallocation	1.500**	0.604	0.520	1.294**	−1.883***	−0.174*	−1.771***	−0.472**
Separate estimation (equation by equation)								
Flows (% of TNA)	0.895	−0.125	0.304	0.764*	2.238**	−0.248	1.082	0.252
Surprises	27	27	27	27	27	27	27	27
Observations	471	471	471	471	471	471	471	471
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−25.9***	40.6***	29.5***	33.6***	38.4***	7.8***	28.3***	29.8***	28.9***

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

rates through the expectations hypothesis. Focusing on the impact of a large positive surprise – say a decline in long-term yields by 10 basis points – in the APP-period, we find that the response of exchange rates and asset markets in Table 6c are of a similar magnitude compared to the previous identification (Table 5c). In particular, the euro depreciates by 2.6% (1.6%) against the US dollar in one week (day). European equity markets display the strongest performance +4.1% (1.9%) over one week (day), followed by extra-European equity markets, in particular Emerging Markets (+3.8% in one week). Bond markets outside Europe also react positively to ECB announcements, rising by almost 3% (1.8%) over one week (day). European bond markets, again, are those showing the weakest positive performance (+0.6% in one week). As a result the passive reallocation effects are largely similar to the previous results. The FX effect leads to a reduction in the weight of European equity and bond funds as the euro depreciates. Nevertheless, the weight of European equity funds benefit from a strong offsetting *passive* return effect (+0.34 percentage points in one week), which is instead negative for European bond funds, as well as other bond categories. Eventually, summing up all components, ECB announcements lead to a passive reallocation into European and Emerging Market equity and out of bond funds, in particular European bonds.

6. Robustness

We provide a series of robustness checks to our results, distinguishing between the effects of large and small surprises, positive versus negative shocks and controlling that our results are not driven by the particular choice of the universe of funds, drawing a new (and more comprehensive) sample of funds starting from the beginning of 2014. Finally, we study the long-term impact on portfolio weights. In our robustness checks, we focus on the second phase of ECB policies since the autumn of 2014, where our study finds evidence of significant shifts in asset allocation due to price and exchange rate effects.

6.1. Categorizing monetary policy surprises

To assess whether our results are mostly driven by large shocks to prices and yields, we classify the monetary surprises using an exponentially weighted moving average (EWMA) volatility model based on daily trading between 13:30 and 14:30 Frankfurt time.[20] Surprises that exceed $4.5|\sigma_{H,t}|$ are

[20] For the EWMA model we use weights that are corrected for a finite observation window (Pesaran, 2015), and initialize our model with data from 2011. Denoting by H the length of the backward-looking observation window, we can compute the volatility at time t as:

$$\sigma_{H,t} = \sqrt{\sum_{\tau=0}^{H} \frac{(1-\lambda)\lambda^{\tau}}{1-\lambda^{H+1}} \cdot r_{t-1-\tau}^{2}}.$$

classified as tail events. In our empirical specification we distinguish between two types of shocks: tail events and small surprises. We estimate two separate vectors, θ^{normal} and θ^{tail}, for each type of shock by multiplying our monetary policy surprises with a dummy that equals one for tail surprises. We use the regression specification outlined in section 4.

Table 7 reports the results of this robustness test. In general, the direction of the impact of normal shocks is usually similar to that of tail shocks. However, the main qualitative and quantitative results of the previous section are clearly driven by tail shocks. In particular, the passive FX effect out of European equity and bond funds and the positive return effect into European equity funds and out of bond funds are statistically significant when isolating tail shocks. The size of the impact of tail shocks, moreover, is very similar to those estimated across the whole sample of shocks. Therefore, unsurprisingly, we may conclude that only major ECB announcements lead to significant shifts in the portfolio of euro area investors.

Moreover, we split our announcements into positive and negative monetary policy surprises. Overall, we find that the effects of positive and negative surprises do not seem to differ (see Table B.12 in the Appendix).

Our sample starts in 2012 and covers almost 30% of the universe of Luxembourg-based funds. The coverage of funds by EPFR increases through time and we wonder whether our results are affected by the particular universe of funds. For this reason, we drew a new sample of Luxembourg-based funds starting from 2014 and checked whether the main results for the APP-period continue to hold. Table B.13 in the Appendix show that the results across the two universes of funds are substantially similar with only minor differences regarding the statistical significance of a few coefficients.

6.2. Retail vs. institutional investors

In Tables B.14 and B.15 we look a flows and active reallocation by investor type, distinguishing between fund shares marketed to retail investors and those targeting institutional investors or that have a minimum investment of USD 100,000. Generally, it appears that flows in and out of fund shares targeting institutional investors react more strongly to our monetary policy surprises compared to fund shares targeting retail investors. Interestingly, the active reallocation into emerging market equity funds – in the sample before September 2014 – in response to a change in 10-year yields that we have underlined in Section 5.2 is clearly driven by institutional investors, not by retail investors (see panel (b) of Table B.15). This suggests that institutional investors follow active portfolio strategies more often than unsophisticated retail investors, who instead prefer a buy-and-hold strategy.

The return r_t is a daily time series of one-hour changes in (median) bid yields and (median) bid prices between 13:30 and 14:30 Frankfurt time, which we assume to be centered around 0. We use a decay factor of $\lambda = 0.97$ (slow decay, more weight on past observations) and select subsets of our data such that $H = 200$ in terms of trading days.

Table 7: **Main results Euro area rates (outliers)**

The table shows the (cumulative) effect associated with the surprise change in Euro area rates. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 3.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area 10-year yields on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA 10Y yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation (normal)	0.060	−0.152	0.065	0.157	0.328	−0.073	−0.303	−0.086
Active reallocation (tails)	−0.009	−0.118	−0.065	−0.023	0.157	−0.035	0.111	−0.032
Passive reallocation *return* (normal)	8.590^{***}	−0.728	0.846	−0.448	−2.038	-0.775^{*}	-3.058^{*}	-1.905^{***}
Passive reallocation *return* (tails)	2.384^{***}	−0.212	0.430	0.235	-0.924^{**}	-0.335^{***}	-1.362^{***}	-0.461^{**}
Passive reallocation *FX* (normal)	−1.789	0.737	0.438	1.405	0.007	0.138	−0.995	0.324
Passive reallocation *FX* (tails)	-1.727^{***}	1.006^{***}	−0.015	1.192^{***}	-1.138^{***}	0.166^{***}	0.179	0.353^{***}
Total reallocation (normal)	6.761^{***}	0.004	1.258	0.924	−1.781	−0.429	-4.600^{*}	-1.889^{***}
Total reallocation (tails)	0.544	0.677	0.373	1.289^{**}	-1.827^{***}	−0.129	-1.190^{*}	−0.214
Separate estimation (equation by equation)								
Flows (% of TNA) (normal)	2.117	0.279	1.780	1.788	3.912	2.136	−0.579	−0.051
Flows (% of TNA) (tails)	0.687	−0.238	−0.016	0.577	1.951^{**}	−0.792	1.319	0.370
Normal Surprises	20	20	20	20	20	20	20	20
Tail Surprises	7	7	7	7	7	7	7	7
Observations	471	471	471	471	471	471	471	471
Benchmarks (normal/tails):	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
-31.303^{*}	75.884^{***}	21.051	47.856^{***}	45.626^{**}	11.414^{***}	26.959^{*}	33.871^{*}	30.818^{**}
-24.906^{***}	31.170^{***}	27.767^{***}	31.314^{***}	36.574^{***}	7.082^{***}	24.239^{***}	25.588^{***}	26.563^{***}

(b) Impact of a surprise change in EA ST yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation (normal)	1.531^{**}	−0.407	−0.256	0.162	−0.613	−0.104	−0.778	−0.285
Active reallocation (tails)	-0.646^{***}	-0.247^{*}	-0.239^{***}	−0.114	0.623^{***}	-0.092^{*}	0.224	0.497^{***}
Passive reallocation *return* (normal)	8.610^{*}	−0.068	0.412	−3.582	−0.570	−0.613	−3.159	−1.893
Passive reallocation *return* (tails)	9.228^{***}	−0.165	2.292^{***}	1.567^{**}	-4.694^{***}	-1.279^{***}	-5.098^{***}	-1.929^{***}
Passive reallocation *FX* (normal)	−2.378	2.150	−4.520	2.196	−2.538	0.147	4.969	0.090
Passive reallocation *FX* (tails)	-5.871^{***}	3.084^{***}	1.012^{***}	3.906^{***}	-3.069^{***}	0.622^{***}	-0.858^{*}	1.173^{***}
Total reallocation (normal)	10.131^{**}	1.470	−4.602	−1.458	−2.731	−0.504	0.003	-2.669^{*}
Total reallocation (tails)	2.135^{*}	2.752^{***}	2.837^{***}	5.357^{***}	-7.049^{***}	-0.447^{***}	-6.220^{***}	−0.358
Separate estimation (equation by equation)								
Flows (% of TNA) (normal)	10.182^{**}	−1.782	−0.346	1.393	−2.275	−4.039	−2.940	−0.930
Flows (% of TNA) (tails)	-1.784^{*}	−0.328	−0.958	0.550	6.311^{***}	−1.932	2.479^{**}	8.192^{***}
Normal Surprises	23	23	23	23	23	23	23	23
Tail Surprises	1	1	1	1	1	1	1	1
Observations	471	471	471	471	471	471	471	471
Benchmarks (normal/tails):	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−60.775	74.734	24.670	48.989	12.173	11.462	39.751	53.916	51.935
-75.648^{***}	113.066^{***}	98.123^{***}	108.591^{***}	140.631^{***}	18.912^{***}	75.779^{***}	77.444^{***}	84.087^{***}

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

6.3. Impulse responses

To shed some light on the dynamics of the adjustment in the the overall portfolio we estimate the effect of a MP surprise during the two weeks following the announcement. We compute the impulse responses to a monetary policy shock using Local Projection Methods (Jordà, 2005). The exercise bears some similarities to the work by Swanson (2017) who looks at the longer run impact of FW guidance and asset purchases by the Fed.

We use the following baseline specification for the estimation of impulse responses:

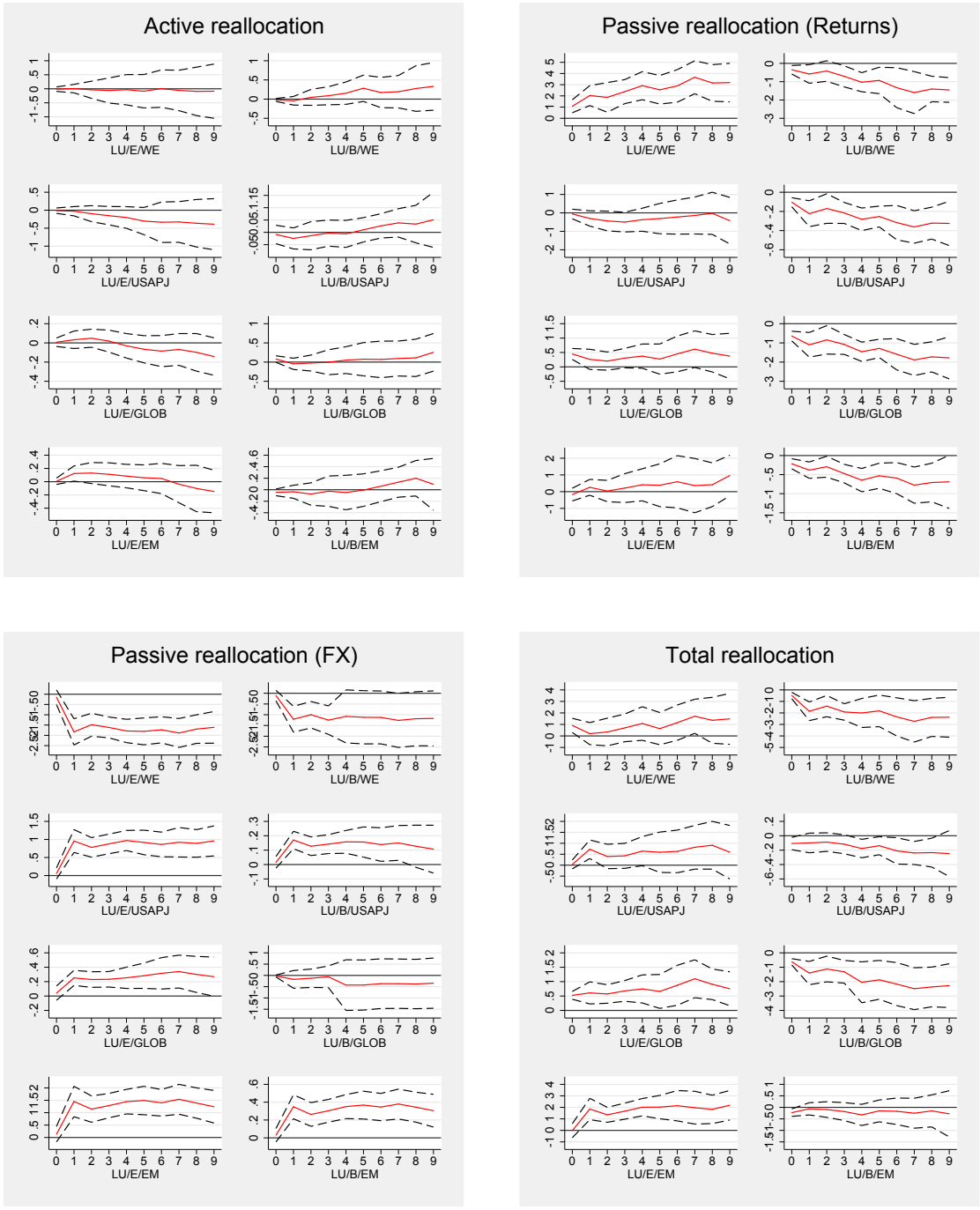
$$(\text{cum\_realloc})_{i,t+h} = \beta_{i,h0} + \theta_{i,h}(\text{MP\_surprise})_t + \beta_{i,hk}(\text{cum\_realloc})_{i,t-1} + \boldsymbol{\gamma}_{i,h}(\text{Controls})_{i,t} + \varepsilon_{i,t+h}.$$

We estimate this equation separately for $i = 1, \ldots, I; \quad h = 0, ..., H$. The dependent variables are cumulative sums of the reallocation measures. We use a parsimonious regression setup and look at the effects over a two-week horizon ($H = 9$). In this specificiation we include no controls $\boldsymbol{c}_{i,t-l}$ apart from a dummy that controls for the effect of inconsistencies in EPFR data on some dates. Portfolio weights are highly persistent. Each h-step ahead forecast is computed in a separate regression. We use Newey-West estimators for the standard errors of our regression coefficents. Figure 3 shows impulse responses with respect to a surprise change in euro area 10-year yields for the period after September 2014. Again we find a reallocation towards equity, in particular of Emerging Markets, and out of European and Global bonds, with differences that persist over a two-week horizon.

7. Conclusion

We study the impact of major ECB monetary policy announcements on a portfolio of Luxembourg-based investment funds, broadly representative of euro-area investors, daily, between 2012 and mid-2016. This period includes a variety of different unconventional measures. In order to provide evidence on the different channels of these unconventional policies, we distinguish between *active* portfolio reallocation, driven by the redemptions or injections by investors, and *passive* portfolio rebalancing, triggered by valuation effects related to changes in asset prices and exchange rates. We find that the portfolio balance channel of ECB policies is generally muted. There is only scant evidence of active reallocation by investors into specific asset classes, which is not robust to different specifications of the model, different sample periods or the identification of the monetary policy shock. However, the asset price impact and exchange rate impact of ECB announcements are large, in particular in the APP-period starting from September 2014, leading to significant shifts in the total portfolio of euro area investors. As the exchange rate of the euro significantly depreciates following positive ECB monetary policy surprises, the portfolio of euro area investors passively shifts

Figure 3: Cumulative reallocation over two weeks in response to changes in EA 10-year yields – after September 2014



towards extra-European funds. This result is robust to different sample periods and identifications of shocks. The asset price impact may change over time, but it is very large following the announcement of the APP by the ECB, benefiting in particular European equity markets, but with important positive spillovers to other – extra-European – equity and bond markets. As a results of these asset price changes, the portfolio of euro area investors passively shifts towards riskier assets, in particular European and Emerging Markets equity funds, and out of bond funds.

Overall our empirical findings provide robust evidence that fund investors are affected by monetary policy mainly through the impact it has on asset prices by changing expectations of future interest rates (the signalling channel). We find little evidence of retail and institutional fund investors being exposed to the portfolio balance channel, whereby monetary policy operates by changing risk premia and inducing active portfolio reallocation. Since our main element of analysis is fund investor behaviour, including unsophisticated retail investors, our findings are not necessarily in contradiction with the theories behind the portfolio rebalancing channel, since these theories operate through arbitrageurs who can be thought of as relatively sophisticated investors. Our empirical evidence is also consistent with the empirical evidence on the behaviour of investors in mutual funds, who are generally reluctant to sell past winners, and the growing literature on rational inattention, predicting that unsophisticated investors adjust their portfolios only rarely.

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Appendix A. Econometric approach

For each outcome the basic model setup is the following regression specification:

$$y_{i,t} = \beta_{i,0} + \sum_{j=0}^{s} \theta_{ij} \Delta i_{t-j}^{EA} + \sum_{k=1}^{p} \beta_{ik} y_{i,t-k} + \sum_{l=0}^{q} \boldsymbol{\gamma}_{il} \boldsymbol{c}_{i,t-l} + \varepsilon_{i,t}$$

The main coefficients of interest are the parameters θ_{ij} associated with the realizations of our monetary policy surprise Δi^{EA}.

Appendix A.1. Joint estimation of reallocation measures

Before we explain the exact choice of specification for each of the reallocation measures, we want to recall a specific property: portfolio shares sum up to 1 by definition, hence reallocation measures sum up to 0. We exploit this property in our estimation approach by imposing an additional constraint on the fitted values.

Joint estimation without a restriction

We take the dependent variable total reallocation $\Delta w_{i,t}$ with respect to fund category i and write the above equation more compactly. Instead of

$$\Delta w_{i,t} = \beta_{i,0} + \sum_{j=0}^{s} \theta_{ij} \Delta i_{t-j}^{EA} + \sum_{k=1}^{p} \beta_{ik} \Delta w_{i,t-k} + \sum_{l=0}^{q} \boldsymbol{\gamma}_{il} \boldsymbol{c}_{i,t-l} + \varepsilon_{i,t},$$

we can rewrite the equation based on the vector $\boldsymbol{\Delta w}_i = (w_{i,1}, \ldots, w_{i,T})$:

$$\boldsymbol{\Delta w}_i = \boldsymbol{\delta}_i' \mathbf{X}_i + \boldsymbol{\varepsilon}_i.$$

where the matrix $\mathbf{X}_i$ contains all values of the (lagged) regressors from the vectors $\boldsymbol{\Delta i^{EA}}$, $\boldsymbol{\Delta w}_i$ and the matrix $\boldsymbol{c}_i$. We have $I = 8$ fund categories and $\boldsymbol{\delta}_i$ consists of coefficients for $K-1$ regressors and a constant. There are $t = 1, \ldots, T$ time periods. In order to jointly estimate all portfolio shares of the $i = 1, \ldots, 8$ fund categories we can rewrite, $\boldsymbol{\Delta w} = (\boldsymbol{\Delta w}_1, \ldots, \boldsymbol{\Delta w}_I) = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$ by stacking the equations using a block diagonal matrix $\mathbf{X}$ of dimension $IT \times IK$:

$$\begin{bmatrix} \boldsymbol{\Delta w}_1 \\ \boldsymbol{\Delta w}_2 \\ \vdots \\ \boldsymbol{\Delta w}_I \end{bmatrix} = \begin{bmatrix} \mathbf{X}_1 & \mathbf{0}_T & \ldots & \mathbf{0}_T \\ \mathbf{0}_T & \mathbf{X}_2 & \ldots & \mathbf{0}_T \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0}_T & \mathbf{0}_T & \ldots & \mathbf{X}_I \end{bmatrix} \begin{bmatrix} \boldsymbol{\beta}_1 \\ \boldsymbol{\beta}_2 \\ \vdots \\ \boldsymbol{\beta}_I \end{bmatrix} + \begin{bmatrix} \boldsymbol{\varepsilon}_1 \\ \boldsymbol{\varepsilon}_2 \\ \vdots \\ \boldsymbol{\varepsilon}_I \end{bmatrix}.$$

The first part of our approach equals a SURE (seemingly unrelated regressions) approach, where one would jointly estimate $\boldsymbol{\Delta w} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$ by OLS – or if certain conditions were to hold with respect to the error terms by (F)GLS. A joint estimation approach also enables us to correct standard errors for correlation in the error terms across fund categories.

Introducing the Summing-up restriction

In order to exploit that, across our $I = 8$ fund categories, total reallocation sums to zero ($s = 0$) – while portfolio weights sum to one ($s = 1$), we can rewrite the total reallocation into a certain fund category as minus the sum of the total reallocation into the other fund categories (we subtract their sum from s):

$$\Delta w_{i,t} = s - \sum_{j \neq i} \Delta w_{i,t} = s - \boldsymbol{i}_{i,t}' \boldsymbol{\Delta w},$$

where $\boldsymbol{i}_{i,t}$ is simply a vector of length IT containing $(T-1)I + T$ zeros and $I-1$ ones, which extracts the appropriate coefficents from the vector $\boldsymbol{\Delta w}$.[21] Hence for the vector $\boldsymbol{\Delta w}_i$, which contains the full time series of total reallocation towards the fund category i, we can now write:

$$\boldsymbol{\Delta w}_i = \mathbf{1} \cdot s - \mathbf{i}_i' \boldsymbol{\Delta w} = \mathbf{1} \cdot s - \mathbf{i}_i' \left(\mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \right),$$

[21] For a stylized example with I=3 and T=2, the appropriate vector in order to extract $\Delta w_{1,1}$ via the equation $\Delta w_{1,1} = s - \boldsymbol{i}_{1,1} \boldsymbol{\Delta w}$ would be $\boldsymbol{i}_{1,1} = (0, 0, 1, 0, 1, 0)$

where the $T \times IT$ matrix $\mathbf{i}_i'$ stacks the appropriate vector $\boldsymbol{i}_{i,t}'$ for all time periods $t = 1, \ldots, T$. Alternatively one can construct the matrix $\mathbf{i}_i'$ by joining $I-1$ identity matrixes of dimension T and a matrix of zeros (from left to right, the matrix of zeros is at the i-th place among the identity matrices in $\mathbf{i}_i'$). In a subsequent step, we can replace the vector $\boldsymbol{\Delta w}$ with the equation $\boldsymbol{\Delta w} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$ (from the SURE approach).

Joint estimation with a restriction

Now we stack the joint estimation equation and the constraint:

$$\begin{bmatrix} \boldsymbol{\Delta w} \\ \boldsymbol{\Delta w}_i \end{bmatrix} = \begin{bmatrix} \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \\ \mathbf{1} \cdot s - \mathbf{i}_i' \left(\mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \right) \end{bmatrix} = \begin{bmatrix} \mathbf{0}_{IT \times 1} \\ \mathbf{1}_{T \times 1} \cdot s \end{bmatrix} + \begin{bmatrix} \mathbf{I}_{IT} \\ -\mathbf{i}_i' \end{bmatrix} \mathbf{X}\boldsymbol{\beta} + \begin{bmatrix} \boldsymbol{\varepsilon} \\ -\mathbf{i}_i'\boldsymbol{\varepsilon} \end{bmatrix},$$

and rearrange,

$$\widetilde{\boldsymbol{\Delta w}} = \begin{bmatrix} \boldsymbol{\Delta w} \\ \boldsymbol{\Delta w}_i - \mathbf{1}_{T \times 1} \cdot s \end{bmatrix} = \underbrace{\begin{bmatrix} \mathbf{I}_{IT} \\ -\mathbf{i}_i' \end{bmatrix}}_{(I+1)T \times IT} \mathbf{X}\boldsymbol{\beta} + \begin{bmatrix} \boldsymbol{\varepsilon} \\ -\mathbf{i}_i'\boldsymbol{\varepsilon} \end{bmatrix} = \widetilde{\mathbf{X}}\boldsymbol{\beta} + \widetilde{\boldsymbol{\varepsilon}}$$

The last step shows that we can estimate a combined $KI \times 1$-vector $\widehat{\boldsymbol{\beta}}$ of regression coefficients for each fund category $i = 1, \ldots, I$ by using the transformed regression matrix $\widetilde{\mathbf{X}}$ with dimension $(IT+T) \times NK$. The following example uses the summing-up restriction with respect to fund category I:

$$\widetilde{\mathbf{X}} = \begin{bmatrix} \mathbf{I}_{IT} \\ -\mathbf{i}_I' \end{bmatrix} \mathbf{X} = \begin{bmatrix} \mathbf{X}_1 & \mathbf{0}_T & \ldots & \mathbf{0}_T \\ \mathbf{0}_T & \mathbf{X}_2 & \ldots & \mathbf{0}_T \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{0}_T & \mathbf{0}_T & \ldots & \mathbf{X}_I \\ -\mathbf{X}_1 & -\mathbf{X}_2 & \ldots & \mathbf{0}_T \end{bmatrix}$$

Upon close inspection of the resulting matrix $\widetilde{\mathbf{X}}$ and the vector $\widetilde{\boldsymbol{w}}$ we can add the following intuition: in essence we exploit the summing-up restriction in order to add a $(I+1)$-th group of observations where the $\widetilde{\boldsymbol{w}}$-values are transformations of the values of the last fund category (the last T values of $\widetilde{\boldsymbol{w}}$ are obtained via $\boldsymbol{\Delta w}_I - \mathbf{1}_{T \times 1} \cdot s$) while the values in $(I+1)$-th row of $\widetilde{\mathbf{X}}$ are coming from the other groups (excluding the last group I).[22]

[22] We can therefore estimate this using a pooled regression setup (with appropriate correction of standard errors for dependency over time and across fund categories) and can replicate the matrix operations needed to get to $\widetilde{\mathbf{X}}$ and $\widetilde{\boldsymbol{w}}$ by using *collapse*, *merge* and *append* in Stata.

Appendix B. Additional Tables

Table B.8: Correlation of the monetary policy surprises

Full sample	EA_10Y_rates	DE10YT	ES10YT	IT10YT	EA_ST_rates	EONIA (1W)	EONIA (1M)	EONIA (3M)
EA_10Y_rates	1.000	0.301	0.969	0.948	0.299	0.189	0.181	0.407
DE10YT	0.301	1.000	0.127	0.025	0.215	0.147	0.134	0.278
ES10YT	0.969	0.127	1.000	0.936	0.312	0.200	0.213	0.398
IT10YT	0.948	0.025	0.936	1.000	0.206	0.123	0.100	0.311
EA_ST_rates	0.299	0.215	0.312	0.206	1.000	0.807	0.903	0.909
EONIA (1W)	0.189	0.147	0.200	0.123	0.807	1.000	0.578	0.608
EONIA (1M)	0.181	0.134	0.213	0.100	0.903	0.578	1.000	0.751
EONIA (3M)	0.407	0.278	0.398	0.311	0.909	0.608	0.751	1.000
Pre Sept 2014	EA_10Y_rates	DE10YT	ES10YT	IT10YT	EA_ST_rates	EONIA (1W)	EONIA (1M)	EONIA (3M)
EA_10Y_rates	1.000	-0.173	0.970	0.973	0.114	0.047	0.001	0.266
DE10YT	-0.173	1.000	-0.346	-0.342	0.000	-0.015	-0.040	0.056
ES10YT	0.970	-0.346	1.000	0.952	0.171	0.093	0.079	0.297
IT10YT	0.973	-0.342	0.952	1.000	0.049	0.004	-0.055	0.189
EA_ST_rates	0.114	0.000	0.171	0.049	1.000	0.924	0.941	0.916
EONIA (1W)	0.047	-0.015	0.093	0.004	0.924	1.000	0.829	0.776
EONIA (1M)	0.001	-0.040	0.079	-0.055	0.941	0.829	1.000	0.766
EONIA (3M)	0.266	0.056	0.297	0.189	0.916	0.776	0.766	1.000
Post Sept 2014	EA_10Y_rates	DE10YT	ES10YT	IT10YT	EA_ST_rates	EONIA (1W)	EONIA (1M)	EONIA (3M)
EA_10Y_rates	1.000	0.896	0.985	0.933	0.730	0.429	0.581	0.663
DE10YT	0.896	1.000	0.875	0.699	0.588	0.350	0.419	0.574
ES10YT	0.985	0.875	1.000	0.892	0.719	0.430	0.585	0.635
IT10YT	0.933	0.699	0.892	1.000	0.730	0.418	0.601	0.652
EA_ST_rates	0.730	0.588	0.719	0.730	1.000	0.587	0.795	0.908
EONIA (1W)	0.429	0.350	0.430	0.418	0.587	1.000	0.076	0.327
EONIA (1M)	0.581	0.419	0.585	0.601	0.795	0.076	1.000	0.725
EONIA (3M)	0.663	0.574	0.635	0.652	0.908	0.327	0.725	1.000

Note: Yield changes are shown with inverted signs, such that a positive value indicates a positive surprise, i.e. a loosening of monetary policy.

Table B.9: Summary table of the EPFR dataset by fund category

Description	Unit	Summary Statistics				
		N	mean	sd	min	max
LU/E/WE						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	87.273	21.894	55.712	129.131
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.043	0.888	-5.249	3.364
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	0.013	0.163	-2.135	0.700
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	0.004	0.020	-0.193	0.082
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	0.002	0.085	-0.618	0.402
Passive reallocation (due to FX changes)	%-points	1166	-0.001	0.049	-0.379	0.390
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	0.005	0.095	-0.851	0.481
LU/E/USAPJ						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	67.502	11.617	49.238	91.913
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.045	0.675	-5.591	3.062
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	-0.017	0.151	-2.113	0.671
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	-0.001	0.015	-0.198	0.061
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	0.002	0.040	-0.293	0.156
Passive reallocation (due to FX changes)	%-points	1166	0.000	0.028	-0.264	0.311
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	0.002	0.049	-0.337	0.297
LU/E/GLOB						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	64.177	6.350	51.746	79.736
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.034	0.660	-5.141	2.710
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	-0.014	0.112	-1.784	0.518
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	-0.000	0.010	-0.061	0.054
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	0.001	0.030	-0.198	0.118
Passive reallocation (due to FX changes)	%-points	1166	0.001	0.036	-0.155	1.166
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	0.002	0.048	-0.208	1.183
LU/E/EM						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	113.909	16.529	74.667	145.381
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.012	0.802	-5.803	3.196
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	-0.042	0.116	-2.269	0.273
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	-0.006	0.017	-0.161	0.066
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	-0.003	0.086	-0.384	0.391
Passive reallocation (due to FX changes)	%-points	1166	0.001	0.045	-0.334	0.429
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	-0.008	0.096	-0.507	0.484
LU/B/WE						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	58.656	13.250	44.375	95.278
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.020	0.128	-0.676	0.766
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	0.019	0.154	-1.195	1.692
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	0.003	0.016	-0.101	0.146
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	0.000	0.053	-0.253	0.442
Passive reallocation (due to FX changes)	%-points	1166	0.002	0.061	-0.427	1.277
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	0.006	0.081	-0.440	1.281
LU/B/USAPJ						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	17.713	2.059	14.886	24.810
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.012	0.122	-0.644	0.652
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	0.015	0.276	-3.524	2.730
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	0.001	0.009	-0.113	0.087
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	-0.000	0.014	-0.064	0.088
Passive reallocation (due to FX changes)	%-points	1166	-0.001	0.043	-1.366	0.540
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	-0.000	0.046	-1.359	0.548
LU/B/GLOB						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	93.107	8.548	63.586	108.634
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.014	0.106	-0.716	0.430
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	-0.018	0.124	-0.630	0.904
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	-0.001	0.018	-0.088	0.198
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	-0.001	0.067	-0.246	0.506
Passive reallocation (due to FX changes)	%-points	1166	-0.003	0.050	-1.277	0.262
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	-0.005	0.086	-1.263	0.518
LU/B/EM						
Total Net Assets – $A_{i,t}$	Euro (billion)	1167	51.217	6.915	39.553	69.078
Portfolio returns of the fund – $100 \cdot r_{i,t}$	%	1166	0.009	0.299	-2.441	1.588
Flows in percent of TNA – $100 \cdot f_{i,t}/A_{i,t}$	%	1166	-0.017	0.210	-2.126	2.047
Active reallocation (due to flows) – $\Delta w^{\mathrm{A}}_{i,t}$	%-points	1166	-0.000	0.016	-0.086	0.152
Passive reallocation (due to returns) – $\Delta w^{\mathrm{R}}_{i,t}$	%-points	1166	-0.001	0.029	-0.100	0.195
Passive reallocation (due to FX changes)	%-points	1166	0.000	0.017	-0.161	0.189
Total Reallocation –$\Delta w_{i,t}$	%-points	1166	-0.002	0.036	-0.151	0.215

Table B.10: **Main results Euro area short-term rates (instant impact)**

The table shows the (cumulative) effect associated with the surprise change in Euro area short-term rates. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 4.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area short-term rates on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA ST rates – full sample

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	0.180**	−0.051	−0.044	0.083	−0.158***	0.000	0.040	−0.060
Passive reallocation *return*	0.662	−0.115	0.162	−0.298	−0.082	0.003	−0.161	−0.121
Passive reallocation *FX*	−0.537**	0.215*	−0.000	0.530**	−0.367*	0.090	−0.101**	0.188**
Total reallocation	0.294	0.072	0.109	0.268	−0.634***	0.100	−0.219	0.035
Separate estimation (equation by equation)								
Flows (% of TNA)	1.748***	0.094	0.312	0.958	−1.029*	0.126	0.668	−0.168
Surprises	60	60	60	60	60	60	60	60
Observations	1165	1165	1165	1165	1165	1165	1165	1165
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−18.57***	14.41	20.45*	16.40	18.85**	5.18	21.69***	22.01***	21.35***

(b) Impact of a surprise change in EA ST rates – before September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	0.130*	−0.062	−0.073	0.142	−0.204***	0.042	0.016	−0.023
Passive reallocation *return*	−0.326	−0.050	−0.266*	−0.029	0.188	0.104	0.376	0.054
Passive reallocation *FX*	−0.678**	0.260**	0.009	0.707***	−0.549***	0.123*	−0.128**	0.256***
Total reallocation	−0.881*	0.193	−0.330	0.723**	−0.558**	0.265*	0.288	0.311
Separate estimation (equation by equation)								
Flows (% of TNA)	1.526**	−0.065	0.053	1.273	−1.663***	1.094	0.441	0.015
Surprises	36	36	36	36	36	36	36	36
Observations	689	689	689	689	689	689	689	689
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−9.79***	−1.56	6.24	2.73	7.48*	1.64	11.43***	11.50***	11.16***

(c) Impact of a surprise change in EA ST rates – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	0.291	−0.039	0.024	−0.139*	−0.018	−0.105***	0.140	−0.150
Passive reallocation *return*	3.399***	−0.285	1.294***	−1.072**	−0.810**	−0.278***	−1.690***	−0.585**
Passive reallocation *FX*	−0.243	0.147	−0.015	0.113	0.115	0.000	−0.042	−0.007
Total reallocation	3.493***	−0.171	1.285***	−1.108*	−0.761	−0.366***	−1.693***	−0.723***
Separate estimation (equation by equation)								
Flows (% of TNA)	2.248	0.302	0.828	−0.186	0.600	−2.336*	1.493	−0.997
Surprises	24	24	24	24	24	24	24	24
Observations	474	474	474	474	474	474	474	474
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−42.74***	56.18***	59.67***	53.97***	50.41***	14.89***	50.40***	50.93***	50.05***

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

Table B.11: **Main results Euro area 10-year yields (instant impact)**

The table shows the (cumulative) effect associated with the surprise change in Euro area 10-year yields. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 4.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area 10-year yields on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA 10Y yields – full sample

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.036	0.019	0.004	0.007	−0.001	0.007	0.019	−0.012
Passive reallocation *return*	0.814***	−0.043	0.246***	−0.068	−0.204***	−0.096***	−0.461***	−0.174***
Passive reallocation *FX*	−0.122	0.055	0.015	0.090	−0.064	−0.009	−0.031	0.066
Total reallocation	0.663***	0.041	0.263***	0.025	−0.277***	−0.098**	−0.478***	−0.123
Separate estimation (equation by equation)								
Flows (% of TNA)	−0.003	0.348	0.243*	0.211	0.214	0.360	0.348	0.069
Surprises	63	63	63	63	63	63	63	63
Observations	1165	1165	1165	1165	1165	1165	1165	1165
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−5.20	13.38***	9.70**	9.29**	8.28**	2.92**	6.12	6.50	6.17

(b) Impact of a surprise change in EA 10Y yields – before September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.054	0.037	0.007	0.008	0.001	0.019	−0.022	0.015
Passive reallocation *return*	0.624***	−0.058	0.100	0.053	−0.113	−0.085*	−0.347*	−0.154**
Passive reallocation *FX*	−0.060	0.027	−0.008	0.039	−0.020	−0.018	−0.040	0.072
Total reallocation	0.503*	0.070	0.097	0.099	−0.164	−0.086	−0.411**	−0.065
Separate estimation (equation by equation)								
Flows (% of TNA)	−0.149	0.480	0.265	0.217	0.225	0.644	0.066	0.397
Surprises	36	36	36	36	36	36	36	36
Observations	689	689	689	689	689	689	689	689
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
0.99	9.93***	0.90	2.61	2.50	1.24	−1.07	−0.54	−0.61

(c) Impact of a surprise change in EA 10Y yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.012	−0.006	0.005	−0.001	−0.011	−0.012	0.103**	−0.052
Passive reallocation *return*	1.167***	−0.008	0.469***	−0.265**	−0.378***	−0.117***	−0.677***	−0.229***
Passive reallocation *FX*	−0.192	0.069	0.046	0.163	−0.120	0.018	−0.014	0.038
Total reallocation	0.973***	0.047	0.528***	−0.121	−0.512***	−0.109***	−0.616***	−0.242***
Separate estimation (equation by equation)								
Flows (% of TNA)	0.217	0.179	0.239	0.215	0.184	−0.078	0.937**	−0.362
Surprises	27	27	27	27	27	27	27	27
Observations	474	474	474	474	474	474	474	474
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−15.76***	18.73***	24.89***	20.66***	18.68***	5.68***	18.53***	18.39***	17.89***

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

Table B.12: **Main results Euro area rates (positive vs. negative surprises)**

The table shows the (cumulative) effect associated with the surprise change in Euro area rates. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 3.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area 10-year yields on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA 10Y yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation (neg)	−0.080	−0.086	−0.103*	−0.050	0.261**	−0.031	0.023	0.099
Active reallocation (pos)	0.109	−0.165	0.055	0.073	0.073	−0.046	0.083	−0.259
Passive reallocation *return* (neg)	2.624***	−0.261	0.629***	0.627**	−1.200***	−0.379***	−1.646***	−0.521**
Passive reallocation *return* (pos)	4.487***	−0.276	0.342	−0.550	−1.023	−0.452**	−1.715**	−0.962***
Passive reallocation *FX* (neg)	−1.547***	0.795***	0.331**	1.062***	−1.108***	0.143**	−0.149	0.295**
Passive reallocation *FX* (pos)	−2.211***	1.365***	−0.361	1.619***	−0.902	0.213***	0.233	0.450***
Total reallocation (neg)	0.818	0.440	0.844***	1.503***	−2.038***	−0.167*	−1.996***	−0.071
Total reallocation (pos)	2.444*	0.865	0.050	0.968	−1.727	−0.178	−1.414	−1.061***
Separate estimation (equation by equation)								
Flows (% of TNA) (neg)	0.171	−0.122	−0.546	0.071	2.462**	−0.364	0.534	2.037*
Flows (% of TNA) (pos)	1.949**	−0.071	1.606*	1.708**	2.020	−0.108	1.774	−2.338
Negative Surprises	9	9	9	9	9	9	9	9
Positive Surprises	18	18	18	18	18	18	18	18
Observations	471	471	471	471	471	471	471	471
Benchmarks (neg/pos):	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−21.569***	33.528***	26.057***	31.982***	40.853***	8.099***	20.838***	23.241***	26.237***
−32.376***	45.536***	27.563*	37.824***	35.336***	7.290***	30.114***	32.931***	29.137***

(b) Impact of a surprise change in EA ST yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation (neg)	0.068	−0.390	−0.287	0.225	−0.193	−0.014	0.059	0.254
Active reallocation (pos)	1.035*	−0.013	0.168	−0.145	1.027	−0.381	−1.913	−0.367
Passive reallocation *return* (neg)	6.977**	−0.084	2.162**	1.526	−3.583**	−0.913*	−4.448**	−1.378
Passive reallocation *return* (pos)	20.340***	−0.924	−1.728	−7.576*	−1.258	−1.623	−5.194	−4.745***
Passive reallocation *FX* (neg)	−3.280	1.667	0.984*	2.097	−0.485	0.303	−1.013*	0.593
Passive reallocation *FX* (pos)	−8.942	6.644	−10.459	8.026*	−12.384**	0.891*	11.478**	0.952
Total reallocation (neg)	4.578	1.043	2.544**	3.695*	−4.031	−0.495	−6.311***	−0.536
Total reallocation (pos)	12.732**	5.899	−12.054*	−0.143	−11.223	−0.585	4.469	−5.179**
Separate estimation (equation by equation)								
Flows (% of TNA) (neg)	0.849	−2.486	−2.334	0.704	−1.255	−1.635	0.605	4.098
Flows (% of TNA) (pos)	12.285***	5.103	8.055*	4.908**	17.343	−6.687	−5.745	2.780
Negative Surprises	12	12	12	12	12	12	12	12
Positive Surprises	12	12	12	12	12	12	12	12
Observations	471	471	471	471	471	471	471	471
Benchmarks (neg/pos):	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−46.165*	83.008**	55.315	69.474**	91.935**	14.710**	39.995	43.928	58.560***
−173.442***	167.271**	115.236	142.056*	81.275	24.547	148.994**	166.779***	135.214**

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

Table B.13: **Results with different fund universe (impact over 4 lags)**

For this table we **fix the fund universe on the 1st of January 2014** (for the remainder of the analysis we use the fund universe as of the 1st of January 2012).

The table shows the (cumulative) effect associated with the surprise change in Euro area rates. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 4.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area 10-year yields on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA ST yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	0.204	−0.116	−0.117	−0.304	−0.164	0.186	0.127	−0.010
Passive reallocation *return*	8.023***	−0.008	1.546	−0.367	−2.522	−1.417**	−3.574**	−1.478**
Passive reallocation *FX*	−2.768**	2.658***	−0.723	2.277**	−3.316*	−0.464	1.784	1.080**
Total reallocation	6.073**	2.395*	0.548	1.500	−5.567**	−1.509	−2.344	−0.835
Separate estimation (equation by equation)								
Flows (% of TNA)	3.258	0.812	0.792	−0.904	0.815	5.682	3.235	1.251
Surprises	24	24	24	24	24	24	24	24
Observations	471	471	471	471	471	471	471	471
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−67.3***	100.8***	65.6**	74.1***	73.6*	15.2**	62.2**	68.2***	68.0***

(b) Impact of a surprise change in EA 10Y yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
Joint estimation with restriction on the sum of the fitted values								
Active reallocation	−0.080	−0.033	0.001	−0.003	0.153	−0.017	0.086	−0.060
Passive reallocation *return*	3.100***	−0.141	0.655***	0.372	−1.280***	−0.600***	−1.524***	−0.561***
Passive reallocation *FX*	−1.276***	0.938***	0.142	0.942***	−1.237**	0.099	0.069	0.296***
Total reallocation	1.688**	0.733*	0.796***	1.205***	−2.289***	−0.428**	−1.533***	−0.447**
Separate estimation (equation by equation)								
Flows (% of TNA)	0.167	0.297	0.507	0.551	1.462**	0.696	1.188**	−0.135
Surprises	27	27	27	27	27	27	27	27
Observations	471	471	471	471	471	471	471	471
Benchmarks:	Equity				Bonds			
EUR/USD	WE	USA	GLOB	EM	WE	USA	GLOB	EM
−25.9***	40.6***	29.5***	33.6***	38.4***	7.8***	28.3***	29.8***	28.9***

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

Table B.14: **Retail vs. Institutional investors: Main results Euro area short-term rates (impact over 4 lags)**

The table shows the (cumulative) effect associated with the surprise change in Euro area short-term rates. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 3.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area short-term rates on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA ST rates – full sample

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
All Funds								
Active reallocation	0.036	−0.321*	−0.188**	0.113	−0.040	0.114	0.167	0.065
Flows (% of TNA)	0.746	−1.643	−0.382	1.260	1.223	4.046	1.264	1.135
Retail fund shares								
Active reallocation	0.274	−0.127	−0.213*	−0.026	−0.063	0.176*	−0.123	0.001
Flows (% of TNA)	2.915*	−0.260	−0.276	0.787	0.673	5.583**	−0.564	0.538
Institutional fund shares								
Active reallocation	−0.212	−0.546**	−0.136	0.206	−0.108	0.080	0.537*	0.263
Flows (% of TNA)	−0.658	−2.768	−0.067	1.686	0.111	3.799	4.709**	2.954
Additional Information								
Surprises	60	60	60	60	60	60	60	60
Observations	1162	1162	1162	1162	1162	1162	1162	1162

(b) Impact of a surprise change in EA ST rates – before September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
All Funds								
Active reallocation	−0.210	−0.294	−0.166	−0.018	0.049	0.180	0.324*	0.065
Flows (% of TNA)	−1.346	−1.750	−0.200	0.531	1.378	5.554*	1.801*	0.430
Retail fund shares								
Active reallocation	0.143	−0.182	−0.236	−0.097	0.264	0.210*	−0.037	−0.045
Flows (% of TNA)	1.538	−0.747	−0.411	0.234	3.026*	6.008*	−0.185	−0.364
Institutional fund shares								
Active reallocation	−0.584	−0.512	−0.042	−0.104	−0.255	0.216	0.892***	0.395
Flows (% of TNA)	−3.438	−3.064	0.555	0.271	−2.446	7.751	6.647***	2.834
Additional Information								
Surprises	36	36	36	36	36	36	36	36
Observations	686	686	686	686	686	686	686	686

(c) Impact of a surprise change in EA ST rates – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
All Funds								
Active reallocation	0.371	−0.302	−0.255	0.088	−0.080	−0.103	−0.212	0.127
Flows (% of TNA)	3.865	−0.915	−0.807	1.470	1.375	−2.975	0.212	3.691
Retail fund shares								
Active reallocation	0.377	0.126	−0.048	0.068	−0.609	0.083	−0.378	0.046
Flows (% of TNA)	3.415	1.419	0.209	0.515	−4.809	3.724	−1.845	1.400
Institutional fund shares								
Active reallocation	0.731	−0.698*	−0.556	0.162	0.408	−0.333**	−0.268	0.217
Flows (% of TNA)	6.183	−2.063	−3.243	3.438	6.714	−8.246	0.968	4.891
Additional Information								
Surprises	24	24	24	24	24	24	24	24
Observations	471	471	471	471	471	471	471	471

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

Table B.15: **Retail vs. Institutional investors: Main results Euro area 10-year yields (impact over 4 lags)**

The table shows the (cumulative) effect associated with the surprise change in Euro area 10-year yields. Each line in the table refers to a different regression with different dependent variables as indicated in the table (see Section 4.2 in the main text for the definition of dependent variables). For instance, the first coefficient on the top-left corner of the table indicates the one-week impact of the surprise change in Euro area 10-year yields on the active reallocation to Western European equity funds.

(a) Impact of a surprise change in EA 10Y yields – full sample

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
All Funds								
Active reallocation	−0.099	−0.061	0.004	0.124*	−0.019	0.010	0.043	0.015
Flows (% of TNA)	−0.207	−0.040	0.533	0.769**	−0.052	0.736	0.533	0.440
Retail fund shares								
Active reallocation	−0.024	−0.014	0.012	0.048	−0.076	0.030	0.004	0.003
Flows (% of TNA)	−0.272	−0.064	0.194	0.155	−0.861	0.868	−0.077	−0.464
Institutional fund shares								
Active reallocation	−0.183	−0.128	0.018	0.191	0.047	−0.021	0.112	−0.019
Flows (% of TNA)	−0.140	0.019	1.125*	1.471***	1.021	0.667	1.642*	0.752
Additional Information								
Surprises	63	63	63	63	63	63	63	63
Observations	1162	1162	1162	1162	1162	1162	1162	1162

(b) Impact of a surprise change in EA 10Y yields – before September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
All Funds								
Active reallocation	−0.178	−0.003	0.049	0.194**	−0.149**	0.025	0.034	0.058
Flows (% of TNA)	−1.083	0.191	0.757	0.798	−1.698***	1.146	0.259	0.638
Retail fund shares								
Active reallocation	−0.069	0.028	0.042	0.048	−0.169**	0.021	−0.027	0.068
Flows (% of TNA)	−0.955	0.080	0.166	−0.176	−2.034***	0.375	−0.602	0.346
Institutional fund shares								
Active reallocation	−0.356	−0.065	0.074	0.339**	−0.117	0.014	0.155	−0.006
Flows (% of TNA)	−1.479	0.193	1.563	1.926**	−1.080	2.352	1.844	0.743
Additional Information								
Surprises	36	36	36	36	36	36	36	36
Observations	686	686	686	686	686	686	686	686

(c) Impact of a surprise change in EA 10Y yields – after September 2014

	Equity				Bonds			
	WE	USAPJ	GLOB	EM	WE	USAPJ	GLOB	EM
All Funds								
Active reallocation	−0.002	−0.120	−0.040	0.003	0.178	−0.037	0.054	−0.047
Flows (% of TNA)	0.895	−0.125	0.304	0.764*	2.238**	−0.248	1.082	0.252
Retail fund shares								
Active reallocation	0.001	−0.031	−0.027	0.010	0.097	0.022	0.053	−0.102
Flows (% of TNA)	0.636	0.252	0.248	0.603	1.328	1.793*	0.759	−1.725
Institutional fund shares								
Active reallocation	0.046	−0.182	−0.042	0.010	0.235	−0.103**	0.033	−0.024
Flows (% of TNA)	1.524	−0.237	0.691	1.188**	3.029**	−2.803	1.343	0.954
Additional Information								
Surprises	27	27	27	27	27	27	27	27
Observations	471	471	471	471	471	471	471	471

Note: For coefficients the stars indicate the p-Value of an F-Test of the sum of the contemporaneous effect of the monetary policy surprise and lags 1 to 4 (* implies $p < 0.1$, ** implies $p < 0.05$, *** implies $p < 0.01$).

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