International capital flows at the security level – evidence from the ECB's asset purchase programme

Katharina Bergant, Michael Fidora and Martin Schmitz

International capital flows at the security level –
evidence from the ECB's asset purchase programme

Katharina Bergant, Michael Fidora and Martin Schmitz*

No. 7 / October 2018

We analyse euro area investors' portfolio rebalancing during the ECB's Asset Purchase Programme (APP) at the security level. Based on net transactions of domestic and foreign securities, we observe euro area sectors' capital flows into individual securities, cleaned from valuation effects. Our empirical analysis – which accounts for security-level characteristics – shows that euro area investors (in particular investment funds and households) actively rebalanced away from securities targeted under the Public Sector Purchase Programme (PSPP) and other euro-denominated debt securities, towards foreign debt instruments, including 'closest substitutes', i.e. certain sovereign debt securities issued by non-euro area advanced countries. This rebalancing was particularly strong during the first six quarters of the programme. Our analysis also reveals marked differences across sectors as well as country groups within the euro area, suggesting that quantitative easing has induced heterogeneous portfolio shifts.

Keywords: International Investment Patterns, Capital Flows, Sovereign Debt, Investor Heterogeneity, Quantitative Easing

JEL Classification: F21, F42, E52, G15

Contents

1   Introduction

Large scale asset purchase programmes (LSAPs) by central banks have become a popular tool of unconventional monetary policy since the global financial crisis to stimulate economic growth and fulfil inflation objectives in a zero lower bound environment. A major transmission channel of these policies to the real economy is portfolio rebalancing, induced by a decrease in long-term bond yields resulting from a scarcity of securities in the secondary market triggered by the central bank's purchases. Moreover, LSAPs exhibit spillovers to bonds with similar characteristics via "preferred-habitat investors" (Vayanos and Vila, 2009). Lower yields should induce investors to rebalance their portfolio to higher yielding assets, both domestic and foreign.

The ECB's unconventional monetary policy measures, covering the large scale asset purchase programme (APP), a negative deposit rate and targeted longer-term refinancing operations (TLTROs), reduced euro area long-term risk-free rates by around 80 basis points since June 2014 (ECB, 2017b). The resulting yield differentials between euro area and foreign government bonds have played an important role for euro area capital flows since then (ECB, 2017a). Evidence from the euro area balance of payments shows that the introduction of the main component of the APP – namely the Public Sector Purchase Programme (PSPP) – was followed by significant net capital outflows (Figure 1).[1] At their peak in mid-2016, net outflows of portfolio investment reached an all-time high of nearly 5% of euro area GDP (Coeure, 2017). While non-residents account for sizable share of bond sales to the Eurosystem, euro area investors have been a major driving force behind the observed net outflows (Figure 2). Since the start of the PSPP in March 2015, net purchases of foreign securities by domestic investors have been almost entirely in the form of long-term bonds suggesting that domestic investors partly rebalanced their portfolios towards the closest substitute to PSPP eligible assets outside the euro area. In addition, the APP triggered substantial intra-euro area liquidity flows related to portfolio rebalancing which were partly reflected in rising TARGET balances (Eisenschmidt et al., 2017).

This macro-based evidence shows that LSAPs can trigger substantial cross-border capital flows by way of the portfolio rebalancing channel. In an integrated international financial system, monetary policy impacts both domestic investment patterns and international capital flows. The growing complexity and interconnectedness of the international financial system as well as sector heterogeneity provide a strong case for incorporating micro data for policy analysis (Lane, 2015). Limitations of macro data pertain for instance to the limited extent of sectoral information on holders and issuers of assets, both in a domestic and cross-border context. Consistent country-level capital *flows* data are usually only available unilaterally, while bilateral data merely cover investment *positions*, are available at low frequencies and do not include the holdings of domestic securities (e.g. the IMF's Coordinated Portfolio Investment Survey, CPIS). Finally, only security-by-security data allow to identify important asset specific characteristics such as the issuing entity, the yield and market prices, as well as the currency denomination, rating or

---

[1]The PSPP accounts for approximately 80% of the entire asset purchase programme

the maturity.

In this paper we use security-by-security data from the European System of Central Banks (ESCB) Securities Holding Statistics by sector (SHSS) which offers a comprehensive, fully integrated, granular dataset of the security holdings of euro area residents.[2] Our dataset allows for providing a detailed account of euro area portfolio rebalancing - both at the country and sector level, incorporating domestic, euro area and global capital flows of euro area residents – over the first eight quarters of the PSPP period (2015Q1 to 2016Q4).[3] Our paper is the first – to the best of our knowledge – to analyse actual capital flows (i.e. net purchases or net sales) at the security level in a bilateral cross-country setting. While Boermans and Vermeulen (2016) also use SHSS data, they focus on the cross-sectional determinants of security holdings before the APP, rather than on transactions. With our empirical model of sectoral, bilateral capital flows at the security level, we are able to test several hypotheses with regard to the impact of the APP on portfolio rebalancing. Moreover, as our dataset also comprises the holdings of individual securities, we are able to decompose the overall portfolio rebalancing of euro area investors into 'active' (i.e. capital flows) and 'passive' components (i.e. valuation changes due to fluctuations in security prices and exchange rates), in line with the theoretical model of Tille and van Wincoop (2010).

The SHSS data encompass the security holdings and transactions of all economic sectors in euro area countries (with the exception of the monetary authorities), rather than singling out a specific sector. Exploiting this allows for examining heterogeneity among investors along various dimensions such as country of residence and sector. We argue that it is crucial to consider sectoral heterogeneity, especially when analysing the PSPP due to differing initial positions at the start of the programme (most notably in terms of exposure to public sector bonds, ECB (2017c)) and different degrees of investor sophistication, informational frictions, or different asset and liability management strategies as well as regulatory constraints which may imply heterogeneous responses across countries and sectors to policies such as the PSPP.

Our paper draws on the literature analysing international investment patterns, which typically uses gravity-type models that explain the observed proximity biases in international finance with information asymmetries. This framework relies on the theoretical models proposed by Martin and Rey (2004) and Okawa and van Wincoop (2012) and was empirically applied for instance by Portes and Rey (2005) and Lane and Milesi-Ferretti (2008) and recently by Boermans and Vermeulen (2016) using SHSS data. While much of the literature focuses on the cross-sectional determinants of bilateral portfolio investment patterns, the factors behind portfolio shifts over time have been less explored. A strand of the literature focused on financial market aspects such as return chasing (Bohn and Tesar, 1996), while more recently the drivers

---

[2]This dataset is collected according to Regulation ECB/2012/24, see http://www.ecb.europa.eu/ecb/legal/pdf/l_30520121101en00060024.pdf.

[3]As such we are able to integrate the analysis of domestic and international sectoral portfolios, similar to Heipertz et al. (2016) who use data on French sectoral portfolios to estimate how different sectors are affected by balance sheet contagion.

of portfolio investment dynamics after the global financial crisis (Galstyan and Lane, 2013) and euro area sovereign debt crisis (Beck et al. (2016)) have been examined. The literature on portfolio rebalancing using microdata has grown over time, but usually focuses only on a particular sector. While Calvet et al. (2008) examine the portfolio rebalancing of Swedish households, Hau et al. (2017) find that international equity funds rebalance from foreign investment after making excess returns relative to their domestic equity investment.

Our paper also contributes to the literature on the cross-border impact of LSAPs, which was initially triggered by the first rounds of the Federal Reserves' quantitative easing (QE). Neely (2010) shows that the Fed's QE significantly reduced not only domestic, but also foreign long-term bond yields, while Moore et al. (2013) find that QE also resulted in a significant increase in the foreign ownership of emerging market debt securities. There is a broad consensus that the ECB's APP persistently reduced euro area long-term bond yields, both of targeted and other debt securities, while also boosting equity prices due to confidence effects (Altavilla et al. (2015), Andrade et al. (2016), and Fratzscher et al. (2016)). Event-studies focusing on the ECB's APP announcement show that these confidence effects had significant spillovers to the rest of the EU and global equity markets (Falagiarda et al. (2015); Georgiadis and Graeb (2016)). Examining the impact of monetary policy surprises associated with the ECB's APP, Bubeck et al. (2017) present high-frequency event-study evidence on the investment behaviour of mutual funds based in Luxembourg. They distinguish between an active channel (transactions) and a passive channel (changes in the value), of which they found only the latter to be a significant driver of portfolio rebalancing at the daily frequency.

In contrast to other contributions using the SHSS dataset, we are the first to employ actual data on net transactions at the euro area level: Koijen et al. (2018) assess rebalancing by using information on changes in security holdings and show for the period 2015Q2 until 2016Q4 that foreign investors rebalanced most in response to the ECB's PSPP purchases, followed by euro area banks and mutual funds. Albertazzi et al. (2018) find that portfolio rebalancing played a relevant role in the transmission of the ECBs APP, but with important differences across countries. Boermans and Vermeulen (2018) suggest that euro area investors preference ("preferred habitat") for holding bonds with certain characteristics remained stable during the APP programme. Analysing net transactions by Irish investment funds, Bua and Dunne (2017) find significant evidence of portfolio rebalancing away from euro area government bonds, but only after the PSPP was scaled up in June 2016.

The rest of the paper is organized as follows: In Section 2, we explain our dataset and the empirical framework. We provide descriptive evidence on the portfolio rebalancing of euro area investors since the launch of the APP in Section 3. Section 4 presents our econometric results and Section 5 concludes.

2 Empirical Framework

2.1 Data

We use data on security-level portfolio holdings and transactions of all 19 euro area Member States from the European System of Central Banks (ESCB) Securities Holding Statistics by sector (SHSS).[4] The data are collected by National Central Banks from (i) financial investors and (ii) custodians.

It covers all short-term and long-term debt securities, listed shares, as well as investment fund shares that are identified with an unique International Securities Identification Number (ISIN). This split into financial instruments is in line with the instruments contained in National Accounts or Balance of Payments Statistics. The data are collected on a quarterly basis since 2013Q4 and we use releases until 2016Q4 for this analysis. The SHSS data consist of *directly* and *indirectly* reported securities. A financial institution resident in the euro area is obligated to report securities that it holds as its own investment ("direct reporting") as well as securities that it holds in custody ("indirect reporting"). In order to avoid double reporting, only assets held in custody for non-financial investors are included in the SHSS.[5] Investors in the data are defined by their country of domicile and sector. We follow the European System of Accounts (2010) and aggregate the data to six sectors: monetary and financial institutions (MFI) excluding monetary authorities, insurance companies and pension funds (ICPF), other financial institutions (OFI),[6] non-financial corporations (NFCs), general government and households. Using the ISIN for every security, we merge the SHSS data to individual asset characteristics obtained from the ESCB's Centralised Securities Database (CSDB) which contains information on more than six million debt and equity securities issued globally. Therefore, we can use information at the security-level, such as the instrument type, issuer country and institutional sector, currency of denomination, yields and original maturity.

2.2 Econometric approach

Our paper builds on the literature estimating the determinants of international investment patterns and extends it by analysing the drivers of euro area investors' international capital flows at the security-level for the APP period. The underlying framework relies on the theoretical models proposed by Martin and Rey (2004) and Okawa and van Wincoop (2012)) which focus on incomplete asset markets and transaction costs in international asset trade. Crucially, frictions in asset trade due to asymmetric information costs between home and foreign agents induce home

---

[4]This dataset is collected according to Regulation ECB/2012/24, see http://www.ecb.europa.eu/ecb/legal/pdf/l_30520121101en00060024.pdf

[5]Double counting would happen if there are several intermediate financial institutions between the final non-financial investor and the financial institution holding assets in custody.

[6]These include important intermediaries such as mutual funds which represent the largest subgroup of this sector.

and proximity biases in investors' portfolios. While Okawa and van Wincoop (2012) provide an encompassing formal theoretical framework to justify the use of gravity models in 'levels' (i.e. focusing on cross-border investment *positions*), Galstyan and Lane (2013) show empirically – for the global financial crisis – that a gravity-type framework also holds in 'first-differences'. We build on such a dynamic, first-difference macro-data approach, but take it to the security-level of sectoral investment patterns. Boermans and Vermeulen (2016) follow a similar approach, by estimating a gravity model of the cross-sectional determinants of security holdings, rather than transactions.

We specify the model

$$ln(flow_{a,i,j,t}) = \beta_d^0 ln(A_{a,i,j,t-1}) + \beta_d^1 * x_{a,t}^1 + ... + \beta_d^k * x_{a,t}^k + \gamma_{i,j} + \alpha_i + \alpha_j + \epsilon_{a,i,j} \qquad (1)$$

where $ln(flow_{a,i,j,t})$ represents the ln of country i's net transactions (i.e. net sales or purchases) cumulated over t (i.e. the PSPP period 2015Q1-2016Q4) of security a (either a debt instrument, listed share or investment fund share) issued by country-sector j and purchased or sold by country-sector i.[7]

To our knowledge, our paper is the first attempt to estimate the determinants of actual capital flows (i.e. net purchases and sales) at the security level which allows us to capture the *active* component of portfolio rebalancing rather mixing it with passive investment changes, such as valuation effects due to movements in prices or the exchange rate (on which we focus in the final part of our analysis).

$ln(flow_{a,i,j,t})$ is regressed on pre-PSPP holdings of a security $ln(A_{i,j,t-1})$ – defined as holdings at the end of 2014Q4, which are included in order to control for the pre-existing 'level' of a sectors' investment in a specific security.[8] Due to the granularity of our dataset, we are able to control for asset specific characteristics $(x_{a,t}^k)$ that may influence investment behaviour directly. Specifically, we include the change in the outstanding amount of a security (at market prices) which signifies to what extent investors follow shifts in the market-portfolio, which should be the case under the assumptions of identical investor preferences, no financial frictions and efficient asset pricing. In case investors follow the predictions of the CAPM, the estimated coefficient should be equal to unity. Moreover, our model comprises the currency denomination of a security using a binary variable for euro-denominated securities. In the case of debt securities, we also control for the original maturity of a security and in additional estimations we include the average yield and rating of a security over the PSPP period.

We further include bilateral fixed effects $\gamma_{i,j}$ between holder country i and issuer-country

---

[7] If net transactions over 2015Q1 - 2016Q4 are negative (indicating net sales of a security by a sector), we take the logarithm of the absolute value and multiply it with -1 to allow for a log distribution also in the case of net sales.

[8] Galstyan and Lane (2013) find that during the Global Financial Crisis bilateral cross-border positions were reduced most where pre-crisis bilateral holdings were the largest which they interpret as a "reversion to the mean".

j to capture all bilateral factors affecting capital flows (such as geographic distance).[9] We also saturate our regression with fixed effects that capture unobserved holder sector-country characteristics (α_i) and unobserved issuer sector-country characteristics (α_j). The purpose is to capture financial frictions or multilateral resistance which differs across countries, but also between holder and issuer sectors. In all regressions, we cluster the standard errors at the holding country*sector pair level as the residual might be correlated with country and sector specific demand factors.

Our empirical set-up allows for assessing heterogeneity between different groups of investors by estimating varying ($\beta_s^1,...,\beta_s^k$) coefficients across sectors or country groups. The advantage of this approach is to be able to estimate the heterogeneous coefficients in a single regression so that one can directly infer statistical differences between the various coefficients.

2.3 Empirical implementation

2.3.1 Main hypotheses

Our econometric approach allows for isolating the role of security-specific drivers of euro area capital flows since the launch of the PSPP, for which we specify a set of testable hypotheses in line with "textbook" portfolio rebalancing:[10]

1. *We expect euro area investors to be net sellers of the assets targeted by the Eurosystem under the PSPP and to rebalance into the closest substitutes.* As the price of bonds targeted in the PSPP increased significantly since the start of the programme, with the Eurosystem absorbing sizeable volumes of these securities, investors 'searching for yield' are expected to rebalance into debt securities that allow them to achieve a certain average yield in their portfolios.[11] Moreover, investors also consider the risk profile of their portfolios which – apart from individual investment strategies – is influenced by regulatory restrictions, such as risk weights or eligibility for collateral. The security-level of our dataset allows to construct two exogenous variables which enable us to directly investigate our hypothesis, namely *PSPP eligibility* and *PSPP substitute*. The former is equal to 1 for those debt securities which are eligible to be purchased by the Eurosystem under the PSPP.[12] The

---

[9]In supplementary estimations, we employ the following gravity variables instead of bilateral fixed effects: (i) a dummy variable for domestic holdings (*home*) which is equal to 1 if holder and issuer country are identical for a security; (ii) distance between i and j, retrieved from the CEPII database (which includes measures of domestic distance); (iii) bilateral trade data on goods imports from the IMFs Direction of Trade Statistics (for domestic holdings, we set imports equal to 0); (iv) an index capturing the similarity of two countries' languages from Melitz and Toubal (2014).

[10]For a discussion of portfolio rebalancing as a transmission channel of QE, see e.g. Coeure (2015).

[11]By December 2016, the stock of securities purchased by the Euosystem under PSPP summed up to 1.25 trillion EUR.

[12]The Eurosystem distributes the volume of bond purchases across countries according to each national central bank's share in the ECB capital key, which in turn is determined by a country's GDP and population shares. Securities eligible to be bought under the PSPP are (i) securities issued by euro area governments or (ii) securities of international or supranational institutions. In addition, they need fulfil certain requirements, e.g. a maturity

latter dummy variable equals 1 for securities issued by the public sector in non-euro area advanced economies which otherwise fulfil all the requirements of the PSPP, e.g. a 10-year US treasury bond.[13] Hence, we do not impose any priors on the definition of *PSPP substitutes*, but use the exogenously-defined characteristics of PSPP-eligible assets at the security level to gauge if there has been a shift from eligible assets to assets with the same characteristics across all dimensions (with the exception of being issued by sovereigns outside the euro area), which in turn would have important implications for monetary policy spillovers via international capital flows. If this mechanism is at play, we should find a significantly negative coefficient for *PSPP eligible* and a positive coefficient for *PSPP substitute*.

2. *We expect investors to rebalance into securities with longer maturities.* As the euro area yield curve shifted downwards but did not reverse during APP (ECB (2017b), De Santis (2016)), we suggest that investors need to increase the average maturity of their debt securities in order to achieve a certain yield.

3. *We expect a weakening of the euro-denomination bias in <u>debt</u> securities, but a continued preference for euro-denominated <u>equity</u>.* For the period before 2014, Boermans and Vermeulen (2016) show that there is a significant home as well as euro denomination bias in the euro area holdings of securities. During the PSPP period, euro area yields declined not only for those debt securities targeted under the PSPP, but also more broadly for euro-denominated securities issued by the private sector. In the case of euro area NFCs, yields were directly impacted by the Corporate Sector Purchase Programme (CSPP) in the last six months of our period of observation. Moreover, net sales of debt securities issued by MFIs may reflect to some extent negative net issuance due to the broad-based deleveraging and funding substitution towards the Eurosystem's targeted longer-term refinancing operations (TLTROs).[14] As regards euro area equity securities, we expect net purchases in light of increasing prices during the APP period, which were partly driven by the confidence boost associated with the APP as well as improved economic growth expectations in the euro area (Coeure, 2017). As we analyse debt and equity in separate estimations, we expect to find a significant positive euro denomination bias for equity, but not for debt securities. We test this hypothesis by including a euro denomination dummy in our regressions.

---

between 2 and 30 years, ratings above credit quality step 3 in the Eurosystem's harmonised rating scale (i.e. at least a rating *BBB-* from Standard&Poor's or Fitch, *BBBL* from DBRS, or *Baa3* from Moody's) and the yield to maturity has to be above the deposit facility rate, which was equal to -20bp at the time of the launch of the programme in January 2015. More detailed information and the full list of eligible international or supranational institutions can be found at `https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html`.

[13]These include sovereign debt securities issued by Australia, Canada, Czech Republic, Denmark, Hong Kong, Japan, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom, and the United States

[14]Under this open market operation, the ECB has offered long-term funding at attractive conditions to banks since June 2014.

For all hypotheses, we expect significant heterogeneity among sectors within the euro area for several reasons. First, sectors vary in their degree of professionalism with regard to portfolio allocations which implies a larger role for information asymmetries for certain sectors, in particular in changing financial market conditions as during the APP period. Second, the model of Brunnermeier and Sannikov (2016) shows that accommodative monetary policy that boosts the prices of assets held by balance sheet-impaired sectors relaxes their financial constraints and allows them to increase their lending activity. Different investment behavior can also be due to due to regulatory restrictions, such as risk weights attached to particular securities (such as sovereign bonds) or eligibility for collateral. Finally, different sectors might manage assets heterogeneously under different business models, e.g. due to different restrictions on the liability side of their balance sheet in terms of maturity or currency denomination. Timmer (forthcoming) shows that German banks and investment funds respond in a pro-cyclical manner to price changes, while insurance companies and pension funds act counter-cyclically, which can be explained by differences in sectors' balance sheet structure. While banks have a need for liquid assets as deposits are easily redeemable, pension funds might prefer to hold longer-term assets to match their longer-term liabilities. Hence, our hypotheses may differ across sectors. We expect "less restricted" sectors such as insurance companies and pension funds, but also households to show a positive coefficient for the maturity variable as these sectors in particular need to purchase longer-term assets in order to keep yield constant. On the other hand, banks might not be willing or able to sell PSPP eligible assets due their "risk free"-classification in the Basel regulations and their eligibility as collateral in the Eurosystem's refinancing operations.

2.3.2 Extensions of baseline approach

In order to shed more light on the mechanisms of international portfolio rebalancing, we provide two extensions to our baseline approach, focusing on different time horizons of portfolio reallocations and isolating not only the active part of portfolio rebalancing (i.e. net purchases and sales), but also considering the determinants of the passive rebalancing such as changes in valuation and the overall impact on portfolio rebalancing.

In order to grasp time dynamics, we vary the time frame of the analysis. While our baseline approach covers the 8 quarters since the start of the PSPP, we also analyse the short term (2 quarters) and medium-term (6 quarters) rebalancing. Most empirical studies on the financial impact of these policies argues that the largest movements in yields took place at the moment of the announcement of the PSPP (e.g. see Krishnamurthy and Vissing-Jorgensen (2011) for the US or Altavilla et al. (2016) and De Santis (2016) for the euro area). Therefore, we want shed light on the question of whether or not portfolio rebalancing occurred instantaneously, or with a time lag, and whether it has been maintained throughout the duration of the programme. Moreover, we test whether our analysis gives different result for the period before the PSPP was

launched (2014Q3 and 2014Q4), which includes the ECB's credit easing package of June 2014[15] and potential anticipation effects for an LSAP in the euro area following Draghi (2014) in his speech at Jackson Hole.

Furthermore, as put forward in the theoretical model of Tille and van Wincoop (2010), we distinguish the *active* (i.e. net purchases) and the *passive* channel of portfolio rebalancing and substitute to this end our dependent variable $ln(flow_{a,h,s})$ with (i) $\Delta ln(stock_{a,h,s})$ which represents the change in the stock of the holding and (ii) $[\Delta ln(stock_{a,h,s}) - ln(flow_{a,h,s})]$ which are the passive changes in holdings that are not due to transactions, but due to valuation changes resulting from fluctuations in security prices and exchange rates. Ahmeda et al. (2016) apply this concept to US capital flows targeting EMEs and Bubeck et al. (2017) implement it for an event-study analysis following ECB monetary policy announcements.

3 Descriptive evidence on euro area rebalancing during the PSPP

3.1 Debt securities

We provide descriptive evidence on the 'active' portfolio rebalancing (i.e. in terms of net transactions) of euro area investors since the launch of the PSPP. By constructing these statistics from the security-level SHSS dataset we are able to provide additional insights compared to analysis which rests entirely on aggregate statistics such as the balance of payments statistics presented in Figures 1 and 2. Starting with transactions in debt securities, Figure 3 shows that euro area investors were net sellers of securities eligible to be bought by the Eurosystem under the Public Sector Purchase Programme (PSPP) in the period 2015Q1 to 2016Q4, which is in line with our hypothesis 1. In fact, more than EUR 250 bn PSPP eligible securities were sold in net terms by euro area investors in the period 2015Q1 to 2016Q4. However, even larger net sales by euro area residents were recorded for other debt securities issued in the euro area, of which the largest share was those issued by euro area banks. These net sales can be mainly attributed to spillovers from the PSPP programme on yields as well as negative net issuance of bonds by the euro area banking sector.

Net sales of euro area debt instruments were mirrored in sizeable net purchases of foreign debt securities by euro area residents. In line with hypothesis number 1, we observe in particular significant net purchases (around 350bn EUR) of foreign sovereign debt securities, of which around 40% qualify as the closest substitutes for PSPP eligible assets. Net purchases of foreign debt securities issued by the private sector were even slighly higher, thus closely matching the net sales of private euro area area debt securities.

Figure 4 shows which sectors drove these overall patterns: MFIs, households and OFIs accounted for the largest net sales of PSPP eligible and other euro area debt securities, while ICPFs were net buyers of both types of euro area debt securities. OFIs bought the largest

---

amounts of PSPP substitutes as well as foreign debt securities in general, followed by MFIs and ICPFs. In terms of investors' country of residence, the rebalancing towards non-euro area debt securities was driven by the financial centres Ireland and Luxembourg as well as to a lesser extent Germany and France, while Spanish investors sold the largest amount of PSPP eligible securities, followed by the Netherlands, Germany, France, and Italy (see Figure 5). Italy stands out as resident investors were the largest net sellers of other euro area debt securities, followed by Germany and France.

3.2 Equity securities

Figure 6 also includes equity securities, i.e. investment fund shares and listed shares, to investigate the transmission of quantitative easing from targeted securities towards other instruments. In our analysis, securities are split into those issued by euro area residents and foreign securities in Figures 6 - 8. Euro area investors were overall net sellers of euro area debt securities and mainly rebalanced their portfolios towards euro area investment fund shares, debt securities issued outside the euro area, and to a lesser extent to euro area and foreign listed shares. Figure 7 provides important insights into the sectoral 'flow-of-funds' behind these aggregate flows: the net sales of euro area debt securities were driven by MFIs and households, while insurance companies and pension funds (ICPFs), households and OFIs bought the largest amounts of euro area investment fund shares as shown on the left hand side of Figure 7. On the right hand side, we observe that OFIs were by far the largest net buyers of foreign debt securities, followed by MFIs and ICPFs. This suggests that MFIs and to a lesser extent also ICPFs were buying foreign debt securities directly, while in particular households channelled their investments into overseas debt securities via investment funds. Figure 8 shows that the largest net purchases of euro area investment fund shares originated from Germany, Italy, Spain and France.[16]

Figure 9 sheds more light on euro area flows into investment fund shares. Based on security-level information from the ESCB's Centralised Securities Data Base (CSDB), we differentiate investment funds by their main investment mandate. The graph shows that the largest net inflows by euro area residents went into 'mixed' investment funds, followed by investment funds with explicit mandates to invest in bonds. Particularly households and ICPFs were large net buyers of 'mixed' funds, while for OFIs bond funds constituted the largest type. Aggregate ECB investment fund statistics show that euro area investment funds mainly bought shares of other investment funds, debt securities and listed shares in our period of analysis. Combining the evidence contained in Figures 7 and 9 confirms that at the end of the investment chain, OFIs channelled large funds towards the acquisition of non-euro area debt securities.

---

[16]The large purchases of investment fund shares were driven by ICPFs in Germany and France and by households in Italy and Spain. In turn, Luxembourg-based OFIs accounted for 86% of all euro area OFI net purchases of extra-euro area government bonds.

3.3 Geography, currency and maturity

In terms of geographical composition, Figure 10 shows that euro area residents were net sellers of debt securities issued in their home countries, while they invested heavily into US debt securities, followed by those issued in the United Kingdom and in the rest of the world. Large net purchases of US debt securities can be explained by the substantial yield differentials between the euro area and the US since the start of the start of the ECB's unconventional monetary policy. Indeed, the largest net purchases of debt securities by euro area residents were recorded for those issued by the US government sector, followed by US NFCs. This is in line with the evidence presented by Ammer et al. (2018) who find that non-US investors faced with low interest rates at home rebalanced towards riskier US corporate bonds. MFIs and households in particular sold domestic securities, while OFIs' net purchases focused almost entirely on extra-euro area debt securities, with the US and UK accounting for the largest shares. On the right hand side of Figure 10, we see that the majority of net equity purchases consisted of those issued by domestic and other euro area residents, which mainly reflect investment fund shares.

The geographic composition is mirrored in changes in currency exposures. Figure 11 shows sizeable net sales of euro-denominated debt securities – in line with our third hypothesis, suggesting a decline euro preference in debt securities. Furthermore, one observes an increase in the exposure to debt securities denominated in US dollar, but also the British pound, while net purchases of equities were to a large extent euro-denominated. Strikingly, all sectors were net buyers of US dollar-denominated debt, with more than half of net purchases being conducted by OFIs as shown in Figure 12. ICPFs and to a much smaller extent also OFIs were net buyers of euro denominated debt securities.

With regard to our second hypothesis, i.e. that investors will rebalance their portfolio to longer-term securities, Figure 13 reveals that the majority of net purchases of debt securities fell within the bucket of assets with an original maturity of more than 10 years. Moreover, the vast majority of net sales consisted of assets with a maturity between 2 to 5 years after origination. Figure 14 shows that the large net purchases of assets with a minimum maturity of 10 years is driven by ICPFs and OFIs. In particular for the latter, we suggest that the switch to longer-term maturities is due to a "search for yield" while for ICPFs these purchases are likely due to the inherent need to match longer-term liabilities with longer-term assets. The large net sales of 2-5 year securities were – just like the sales of PSPP eligible assets – mainly driven by MFIs and households.

Summing up, we find strong support for our hypotheses by looking at descriptive evidence. Euro area investors rebalanced their portfolios from euro area debt securities to foreign debt. As large net purchases of euro area investment fund shares were also recorded, the acquisition of foreign debt appears to have been partly channelled – in particular for households – through mutual funds. Overall, this confirms that investors were "searching for yield" and investing partly in the "closest substitutes" to securities targeted under the PSPP, i.e. sovereign debt

of advanced countries outside the euro area. We also find evidence for portfolio rebalancing towards longer-term maturities as more than 50% of net purchases consisted of securities with a maturity exceeding 10 years. While the aggregate patterns for the euro area are in line with "textbook portfolio rebalancing", we observe sector heterogeneity as for instance ICPFs were net buyers of PSPP eligible assets and other euro area debt securities since the launch of the PSPP.

4 Econometric evidence on euro area rebalancing during the PSPP

4.1 Overall results

4.1.1 Debt securities

Table 1 presents the overall estimation results for equation (3) focusing on euro area country-sectors' net transactions in individual debt securities cumulated over the PSPP period 2015Q1 to 2016Q4. We observe in column (1) that the *PSPP eligibility* dummy is significantly negative. This confirms hypothesis number 1, i.e. that euro area investors significantly rebalanced their portfolios away from those individual securities targeted under the PSPP, even controlling for a vast array of security-specific as well as country and sector specific factors. In column (2), we add our *PSPP substitute* variable which turns out to be insignificant. The descriptive evidence suggests that this might be the case because euro area investors gained exposure to *PSPP substitutes* through an indirect channel, i.e. via net purchases of investment fund shares.

Across Table 1, we can confirm hypothesis number 2, as the coefficient on the original maturity variable is significantly positive. This indicates that euro area investors were net buyers of relatively more long-term securities which might be driven by the general decrease in yields, enticing investors to shift to longer-term securities in order to achieve a certain yield within one asset class. The euro dummy fails to be significant, which is in line with hypothesis 3 and therefore suggests an increased rebalancing towards foreign-currency denominated debt securities, especially considering that Boermans and Vermeulen (2016) find evidence for a strong preference for holding euro-denominated debt securities in the pre-APP period.

We further obtain a negative coefficient for the pre-PSPP holding variables, confirming the "mean reversion" found by Galstyan and Lane (2013), as investors sold (bought) assets that they held relatively large (small) amounts of before the programme started, i.e. in 2014Q4. For the change in the outstanding amount (at market prices) over the PSPP period, we observe a significantly positive coefficient of around 0.5 which is in line with the predictions of the CAPM as investors were partly following developments of the overall market portfolio.[17]

---

[17]Boermans and Vermeulen (2016) find similar (or lower) coefficients for cross-sectional holdings before APP. The authors suggest that an explanation for these relatively low values – compared to a predicted coefficient of 1 derived from the CAPM – might be that individual bonds may have several substitutes.

In columns (3) to (8), we perform various modifications to the baseline results. In column 3, we exclude all domestic securities (i.e. the net purchases of those securities issued in an investor's country of residence), which shows overall similar results, but a slightly lower coefficient on *PSPP eligibility*. This indicates that euro area investors were selling in particular those securities to the Eurosystem that were issued by governments of their country of residence. In column (4), we exclude all observations that feature Ireland and Luxembourg – both as investor or issuing countries – due to their large importance as financial centres in the euro area. The results show a more negative coefficients on *PSPP eligibility* and a larger coefficient for the maturity variable. In column (5), we include only long-term debt securities (i.e. those with an original maturity of more than 12 months), which delivers very similar results, likely driven by their large share in overall debt securities (around 95% in our sample).

Next, we explore some evidence with regard to the question if the PSPP has led to more risk-taking of euro area investors in terms of purchases of debt securities. In column (6), we introduce a dummy variable that indicates if the average yield of a security over the PSPP period was within the highest decile of yields. The variable turns out to be insignificant, which also remains the case if we replace it – in unreported regressions available upon request – with a dummy for the upper 25% of yields or the yield itself. In column (7) we define a dummy variable for those securities with a rating of the worst rating category (out of four standardised categories in the Eurosystem's harmonised rating scale). This corresponds to a credit rating of $BB+$ and below for Standard & Poor's and Fitch.[18] As this variable also turns out to be insignificant, we do not observe any evidence that euro area investors were taking on more risk by investing significantly into lower-rated, high-yield debt securities.[19] Finally in column (8), we use a set of gravity variables, rather than country-pair dummies which leaves our results intact.[20]

4.1.2 Equity securities

In Table 2, we present the main specification results for equity securities, split into investment fund shares (columns 1 to 4) and listed equity (columns 5 to 8).

We observe a significant positive coefficient on the euro denomination dummy in the case of investment fund shares (column 1), which is in line with our descriptive analysis and hypothesis 3. However, this variable is insignificant for listed equity (column 5). Taken together with the descriptive evidence, euro area investor seem to seek higher returns via rebalancing into

---

[18]Specifically, we use the worst rating across the four major rating agencies.

[19]Our sample size shrinks by more than 50% in the estimations displayed in columns (6) and (7) due to limited data availability. In further unreported estimations, we include a dummy variable indicating if a security matured during the PSPP period. As anticipated this variable is significant with a negative sign, but leaves our main results unchanged.

[20]We observe for the 'home' variable a significantly positive coefficient, indicating that euro investors were more than proportionally buying domestic assets over the PSPP period. While the volume of trade exhibits a positive sign as expected, the distance between countries is insignificant, which might be due to the high correlation of these two variables. Moreover, we find language similarity to be insignificant.

investment fund shares, which are largely denominated in euro and hence shielded to some extent from exchange rate fluctuations.

In line with results for debt, we find the pre-PSPP holdings and the change in the market capitalisation to be significantly negative and positive, respectively. Both variables exhibit larger (absolute) coefficients for investment fund shares. All results are robust to excluding domestic securities (columns 2 and 6), excluding Ireland and Luxembourg (columns 3 and 7) and using gravity variables rather than country-pair dummies (columns 4 and 8).[21]

4.2   Sector heterogeneity

4.2.1   Debt securities

In Table 3, we report our main specification but estimated with heterogeneous coefficients across sectors. As outlined in Section 2.3.1, we expect significant heterogeneity among sectors due to different regulatory restrictions, asset management strategies and sophistication with regard to financial market developments. This heterogeneity is clearly reflected in our results, especially considering the coefficients which respond to our main hypotheses.

In particular, with regard to hypothesis 1, OFIs show "textbook portfolio rebalancing" as we find a significant negative coefficient for PSPP eligibility, while at the same time investing significantly in *PSPP substitutes*.[22] Combining this with our descriptive evidence (see Figures 6 - 8) and taking into account the "flow-of-funds" within the euro area, these investment patterns reflect to a large extent the "channelling" of the underlying, ultimate investors' preferences via investment funds. This also implies that the insignificance of the closest substitute in Table 1 is likely to be driven by the fact that other sectors are channelling their investments into closest substitutes via mutual funds rather than investing directly into foreign sovereign debt. German households, for example, are more likely to purchase a Luxembourg-based investment fund with a mandate to invest in overseas sovereign debt than buying a US treasury directly.

Moreover, we find that non-financial corporations and households were significant net sellers of euro denominated assets and especially PSPP eligible assets. For MFIs and insurance companies and pension funds on the other hand the PSPP eligible coefficient is insignificant, while the one for euro-denomination is significantly positive. This is in line with banks having an incentive to hold PSPP eligible assets because of the zero risk weight attached to them and due to their role as collateral in monetary policy operations. The fact that the PSPP eligibility coefficient is not significant for MFIs, while Figure 4 showed that MFIs were the sector with

---

[21]The gravity variables (trade and common language) as well as home bias are significant with the expected signs for listed equity. This shows that investors prefer domestic shares and those from countries with strong trade ties and similar languages. Net transactions of investment fund shares are conversely not influenced by gravity factors, which is intuitive as the domicile of an investment fund appears to be of secondary (if any) importance compared to the mandate or target of a fund.

[22]In unreported estimations, we find evidence that OFIs rebalanced even stronger away from those PSPP eligible securities which exhibited average negative yields during the PSPP period.

the largest net sales of PSPP securities may be puzzling at first sight. However, it is important to note that the regression analysis controls for a vast array of factors, such as the pre-PSPP level of PSPP-eligible assets which were the largest for MFIs. Moreover, the regression results are further underpinned by the fact that MFIs' net sales of other euro area debt securities were three times larger than those of PSPP eligible debt securities (Figure 4).

Insurance companies and pension funds naturally prefer PSPP eligible and euro denominated debt securities to match their long-term, euro-denominated liabilities. This is also reflected in a strong preference for net purchases of longer-term securities, which is particularly large for this sector, followed by NFCs and households, which is thus in line with our second hypothesis, while failing to be significant for MFIs and OFIs. Finally, the negative coefficient on pre-PSPP holdings and the positive sign on changes in the outstanding amounts of a security remain significant across all sectors.

4.2.2 Equity securities

In Table 4, we present the sectoral specification for equities, again split into net purchases of investment fund shares (columns 1 to 5) and listed equity (columns 6 to 10). We find a significant euro-denomination preference across all sectors for investment fund shares, which reveals the broad-based nature of these type of capital flows among euro area investors during the PSPP period. In listed equity on the other hand, MFIs exhibit significant net sales of euro-denominated equity. The negative coefficient on pre-PSPP holdings and the positive sign on changes in the outstanding amounts of a security remain significant across all sectors.

4.3 Country heterogeneity

The euro area sovereign debt crisis exposed significant country-differences in terms of macroeconomic and financial stability within the euro area. Accordingly, Albertazzi et al. (2018) and Koijen et al. (2018) analyse the impact of the PSPP focusing on a potential difference in the transmission between the (formerly) stressed and the other 'non-stressed' euro area countries.[23] Table 5 reports the estimation results with heterogeneous coefficients across these country groups and split by debt and equity securities. With regard to hypothesis number 1, we observe that both country groups were significant net sellers of PSPP eligible securities, but the coefficient is almost three times as large for stressed countries, which indicates that investors from these countries rebalanced away more strongly from PSPP-eligible assets. This in line with Albertazzi et al. (2018) who report evidence of portfolio rebalancing towards riskier securities in the (formerly) stressed economies where risk-premia remained relatively higher.

As regards our second hypothesis, only investors of non-stressed countries were significant net buyers of longer-term maturity bonds, which may be driven by the fact that yields were lower

---

[23]The group of (formerly) stressed countries consists of Cyprus, Greece, Italy, Portugal and Spain. We exclude Ireland and Luxembourg from these estimations due to their large financial intermediation role.

in these countries, thus the pressure to shift into longer-term maturities was more pressing. With respect to hypothesis number 3, both country groups were significant net buyers of euro-denominated equity (with a twice as large coefficients for stressed countries), which is not the case for debt, reflecting the overall rebalancing from euro area debt towards euro area equity. Moreover, the 'reversion to the mean' is significantly stronger for stressed countries, showing that investors from these countries were more active in cutting overweight pre-PSPP positions.

4.4 Time dynamics

Next we consider the time dynamics in euro area portfolio rebalancing for debt securities during the PSPP period in Table 6. In column (1), we analyse the period before the announcement of the PSPP (2014Q3 to 2014Q4) which includes the ECB's credit easing package of June 2014[24] and to account for potential anticipation effects for an LSAP in the euro area following Draghi (2014)'s speech at Jackson Hole. In contrast to our benchmark results for the whole PSPP period (column 4), euro area investors were significant net buyers of PSPP eligible assets in the two quarters before the programme was announced, which hints at the game-changing nature of the PSPP for euro area financial flows. This is likely being driven by the growing expectation of an impending quantitative easing programme in the euro area, suggesting that investors were betting on valuation gains in the run-up to the PSPP. This is in line with Lemke and Werner (2017) who argue that the decline in yields of German sovereign debt before the PSPP points to a portfolio rebalancing towards eligible assets in anticipation of the programme.[25]

Column (2) considers the determinants of 'short-term' rebalancing (in the two quarters since the start of the PSPP, 2015Q1 to 2015Q2) for which we observe a significantly negative coefficient on PSPP eligible assets and euro-denominated debt securities. Thus, already immediately after the launch of the programme, euro area investors started to rebalance in line with our hypotheses. Moreover, for net purchases in this short-term period, we find a relatively strong positive coefficient on changes in the outstanding amount of a security – suggesting that investors generally follow the market portfolio – and a less pronounced reversion to the mean.

In the third column we analyse net purchases cumulated over the medium-term (6 quarters), in which the negative coefficients on PSPP eligibility and euro-denomination turn larger than in the short term, suggesting that in this period the rebalancing forces of euro area investors were the strongest. Importantly, net sales of euro denominated assets were only significant in the short- and medium-term, but not in column 4, which might reflect the strong announcement effects of the programme (Georgiadis and Graeb, 2016). Moreover, the need of certain sectors to hold euro-denominated securities might prevent a protracted rebalancing away from those securities. The coefficient on the original maturity of a security exhibits a larger positive sign over time, suggesting that investors gradually switched to longer-term maturities, likely reflecting

---

[24]https://www.ecb.europa.eu/mopo/implement/omo/tltro/html/index.en.html
[25]Interestingly, this period is also associated with (marginally) significant net purchases of *PSPP substitutes*.

the extended low yield environment.

To explore the time dynamics across sectors we zoom in on the PSPP eligibility coefficients for each sector (Table 7). The phenomenon of "loading up" eligible assets before the start of the programme is driven by investment funds (column 1), suggesting that these relatively more sophisticated investors were speculating on valuation gains before the start of PSPP. In the short term (column 2), MFIs and household exhibit significant negative coefficients. Thus, while MFIs do not appear as significant net sellers of PSPP eligible assets over the entire period considered, this was different in the early days of the programme. The observed strongest rebalancing in the medium term (6 quarters, column 3) is driven by households, OFIs and NFCs, which also holds true for the baseline period in column 4.

4.5 Active vs. passive rebalancing

Motivated by the theoretical model of Tille and van Wincoop (2010), we shed light on the different dynamics of the *active* (i.e. net purchases) and the *passive* channels of portfolio rebalancing. We analyse euro area investors' active versus passive portfolio rebalancing as changes in the holdings of a security can arise both from net transactions and due to capital gains resulting from fluctuations in security prices and exchange rates.[26]

In Table 8 column (1), our dependent variables are, respectively, the cumulated net purchases of debt securities over 2015Q1-2016Q4 $ln(flow_{a,h,s})$, the corresponding change in holdings from 2014q4 until 2016q4 $\Delta ln(stock_{a,h,s})$ in column (3) and in column (2) the difference – i.e. $[\Delta ln(stock_{a,h,s}) - ln(flow_{a,h,s})]$ as valuation changes. While running a full regression analysis, we zoom in on hypothesis 1 and observe – as in our baseline estimation – a negative coefficient on PSPP eligibility for transactions. Moreover, we obtain a positive coefficient in the 'passive' rebalancing estimation implying that euro area investors recorded significant positive valuation gains in PSPP eligible assets relative to all other debt securities held during this period. For changes in overall holdings, we do not find a significant coefficient for PSPP eligible asset during our period of analysis (column 3). This emphasises the importance of analysing actual transactions rather than proxying these with changes in holdings.

Across sectors, the second panel of Table 8 shows that the observed aggregate patterns are driven by OFIs, MFIs and households, albeit to varying degrees. Significant net sales and positive valuation gains in PSPP-eligible securities are found for all three sectors, while a significant (and negative) coefficient in the overall change in holdings estimation is only obtained for households.[27]

Descriptive evidence on the aggregate volumes of the active and passive rebalancing components by sector (Figure 15) highlights that sizeable valuation gains in PSPP eligible assets were

---

[26] A subsample is used as this analysis is only possible for those securities (1) that were held by a certain sector both before the launch of the PSPP (i.e. at the end of 2014Q4) as well as at the end of our sample period (i.e. 2016Q4) and (2) for which holdings as well as transactions were reported.

[27] In this subsample, significant (at the 10% level) net sales of PSPP-eligble securities are recorded for MFIs.

achieved by ICPFs, i.e. the sector that continued to be a net buyer of these assets, while MFIs and households recorded large net sales of these assets and only small valuation gains during the PSPP period. OFIs on the other hand, generated more sizeable valuation gains, while selling PSPP eligible assets, thereby offsetting part of the net sales.

The results in this subsection highlight that the *active* (i.e. net purchases) and *passive* channels of portfolio rebalancing in PSPP eligible securities were working in opposite directions during the PSPP period. Thereby, overall net sales of these securities by euro area investors were only partly offset by positive valuation gains.

5   Conclusion

Our paper analyses is – to the best of our knowledge – the first to analyse actual international capital flows (i.e. net purchases or net sales) at the security level. Using a model of bilateral capital flows at the security level, we are able to test three main hypotheses with regard to the impact of the APP on portfolio rebalancing, for which we emphasize significant sector and country heterogeneity within the euro area:

First, we expected euro area investors to be net sellers of the assets targeted by the Eurosystem under the PSPP and to rebalance into "closest substitutes." Descriptively, we observe that euro area investors rebalanced their portfolios from domestic and other euro area debt securities towards foreign debt. Our regression analysis confirms that euro area investors significantly rebalanced away from individual securities targeted under the PSPP. In particular, OFIs show "textbook portfolio rebalancing" as they invested significantly in the assets defined as closest substitute to the PSPP-eligible securities, which shows the impact on international capital flows from the PSPP. Moreover, we find that non-financial corporations and households were significant net sellers of euro denominated assets and especially PSPP eligible assets. Households in particular made use of investment funds to gain exposure to foreign sovereign debt. MFIs and ICPFs on the other hand are not found to be significant net sellers of PSPP eligible assets and were significant net buyers of euro denominated securities, due to regulatory and balance sheet management reasons. We find that both the (formerly) stressed and non-stressed euro area countries were significant net sellers of PSPP eligible securities, but the impact has been larger for stressed countries.

Second, we expected investors to rebalance into securities with longer maturities, for which we find significant evidence as euro area investors were net buyers of relatively more long-term securities. This was particularly pronounced for ICPFs, followed by NFCs and households, while failing to be significant for MFIs and OFIs. Overall, net purchases of securities with a maturity exceeding 10 years made up 50% of net debt purchases.

Third, we expected a weakening of the euro-denomination bias in <u>debt</u> securities, but a continued preference for euro-denominated <u>equity</u>. Indeed, we observe evidence for a rebalancing

away from euro-denominated debt securities, but not across all sectors, while there is a positive bias for euro denominated investment fund shares. Taken together with the descriptive evidence, this suggests that euro area investors wanted to achieve higher yields — via investment fund shares – while at the same time buying these shares in euros so as to being shielded from exchange rate fluctuations.

We also investigated potential anticipation effects of the PSPP following Draghi (2014) speech at Jackson Hole and find that euro area investors were net buyers of PSPP eligible securities in anticipation of the programme.

Finally, as our dataset also comprises the holdings of individual securities, we are able to decompose overall portfolio rebalancing of euro area investors into 'active' (i.e. capital flows) and 'passive' components (i.e. valuation changes due to fluctuations in security prices and exchange rates) in line with Tille and van Wincoop (2010). This analysis reveals the importance of analysing actual transactions rather than proxying these with changes in holdings. Moreover, we find that active net sales of PSPP-eligible securities by euro area investors were only partly offset by positive capital gains.

References

Ahmeda, S., S. E. Curcurua, F. E. Warnock, and A. Zlatea (2016): "Decomposing International Portfolio Flows," Tech. rep., Prepared for the SUERF/PSE/CEPII Conference Rethinking Capital Controls and Capital Flows.

Albertazzi, U., B. Becker, and M. Boucinha (2018): "Portfolio Rebalancing and the Transmission of Large-Scale Asset Programs: Evidence from the Euro Area," *ECB Working Paper*.

Altavilla, C., F. Canova, and M. Ciccarelli (2016): "Mending the broken link: heterogeneous bank lending and monetary policy pass-through," ECB Working Papers 1978.

Altavilla, C., G. Carboni, and R. Motto (2015): "Asset purchase programmes and financial markets: lessons from the euro area," Ecb working paper series.

Ammer, J., S. Claessens, A. M. Tabova, and C. Wroblewski (2018): "Searching for Yield Abroad : Risk-Taking Through Foreign Investment in U.S. Bonds," International Finance Discussion Papers 1224, Board of Governors of the Federal Reserve System (U.S.).

Andrade, P., J. Breckenfelder, F. D. Fiore, P. Karadi, and O. Tristani (2016): "The ECB's asset purchase programme: an early assessment," Ecb working paper series.

Beck, R., G. Georgiadis, and J. Graeb (2016): "The geography of the great rebalancing in euro area bond markets during the sovereign debt crisis," *Journal of Empirical Finance*, 38, 449–460.

Boermans, M. and R. Vermeulen (2016): "International investment positions revisited: Investor heterogeneity and individual security characteristics," DNB Working Papers 531, Netherlands Central Bank, Research Department.

——— (2018): "Quantitative easing and preferred habitat investors in the euro area bond market," DNB Working Papers 586, Netherlands Central Bank, Research Department.

Bohn, H. and L. L. Tesar (1996): "U.S. Equity Investment in Foreign Markets: Portfolio Rebalancing or Return Chasing?" *American Economic Review*, 86, 77–81.

Brunnermeier, M. K. and Y. Sannikov (2016): "The I Theory of Money," Working Paper 22533, National Bureau of Economic Research.

Bua, G. and P. G. Dunne (2017): "The Portfolio Rebalancing Effects of the ECB's Asset Purchase Programme," Research Technical Papers 07/RT/17, Central Bank of Ireland.

Bubeck, J., M. M. Habib, and S. Manganelli (2017): "The Portfolio of Euro Area Fund Investors and ECB Monetary Policy Announcements," ECB Working Paper 2116.

CALVET, L. E., J. Y. CAMPBELL, AND P. SODINI (2008): "Fight or Flight? Portfolio Rebalancing by Individual Investors," NBER Working Papers 14177, National Bureau of Economic Research, Inc.

COEURE, B. (2015): "Embarking on public sector asset purchases," Speech by Benoit Coeure, Member of the Executive Board of the ECB, at the Second International Conference on Sovereign Bond Markets, Frankfurt, 10 March 2015.

——— (2017): "The international dimension of the ECB's asset purchase programme," Speech by Benoit Coeure at the Foreign Exchange Contact Group meeting, 11 July 2017.

DE SANTIS, R. A. (2016): "Impact of the asset purchase programme on euro area government bond yields using market news," ECB Working Paper 1939.

DRAGHI, M. (2014): "Unemployment in the euro area," Speech by Mario Draghi, President of the ECB, Annual central bank symposium in Jackson Hole, 22 August 2014.

ECB (2017a): "Analysing euro area net portfolio investment outflows," Economic Bulletin 2.

——— (2017b): "Impact of the ECBs non-standard measures on financing conditions: taking stock of recent evidence," Economic Bulletin 2.

——— (2017c): "Who holds what? New information on securities holdings," Economic Bulletin 4.

EISENSCHMIDT, J., D. KEDAN, M. SCHMITZ, R. ADALID, AND P. PAPSDORF (2017): "The Eurosystems asset purchase programme and TARGET balances," Occasional paper series.

FALAGIARDA, M., P. MCQUADE, AND M. TIRPAK (2015): "Spillovers from the ECB's non-standard monetary policies on non-euro area EU countries: evidence from an event-study analysis," Working Paper Series 1869, European Central Bank.

FRATZSCHER, M., M. L. DUCA, AND R. STRAUB (2016): "ECB Unconventional Monetary Policy: Market Impact and International Spillovers," *IMF Economic Review*, 64, 36–74.

GALSTYAN, V. AND P. R. LANE (2013): "Bilateral portfolio dynamics during the global financial crisis," *European Economic Review*, 57, 63–74.

GEORGIADIS, G. AND J. GRAEB (2016): "Global financial market impact of the announcement of the ECB's asset purchase programme," *Journal of Financial Stability*, 26, 257–265.

HAU, H., N. CAMANHO, AND H. REY (2017): "Global Portfolio Rebalancing under the Microscope," Sfi working paper.

HEIPERTZ, J., R. RANCIERE, AND N. VALLA (2016): "Domestic and international sectoral portfolios: Network structure and balance sheet effects," mimeo.

KOIJEN, R. S. J., F. KOULISCHER, B. NGUYEN, AND M. YOGO (2018): "Inspecting the Mechanism of Quantitative Easing in the Euro Area," *Banque de France Working Paper*.

KRISHNAMURTHY, A. AND A. VISSING-JORGENSEN (2011): "The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy," NBER Working Papers 17555.

LANE, P. R. (2015): "Risk Exposures in International and Sectoral Balance Sheet Data," *World Economics*, 16, 55–76.

LANE, P. R. AND G. M. MILESI-FERRETTI (2008): "International Investment Patterns," *The Review of Economics and Statistics*, 90, 538–549.

LEMKE, W. AND T. WERNER (2017): "Dissecting long-term Bund yields in the run-up to the ECB's Public Sector Purchase Programme," ECB Working Papers 2106.

MARTIN, P. AND H. REY (2004): "Financial super-markets: size matters for asset trade," *Journal of International Economics*, 64, 335 – 361.

MELITZ, J. AND F. TOUBAL (2014): "Native language, spoken language, translation and trade," *Journal of International Economics*, 93, 351–363.

MOORE, J., S. NAM, M. SUH, AND A. TEPPER (2013): "Estimating the impacts of U.S. LSAPs on emerging market economies local currency bond markets," Tech. rep.

NEELY, C. J. (2010): "The large scale asset purchases had large international effects," Tech. rep.

OKAWA, Y. AND E. VAN WINCOOP (2012): "Gravity in International Finance," *Journal of International Economics*, 87, 205–215.

PORTES, R. AND H. REY (2005): "The determinants of cross-border equity flows," *Journal of International Economics*, 65, 269–296.

TILLE, C. AND E. VAN WINCOOP (2010): "International capital flows," *Journal of International Economics*, 80, 157 – 175.

TIMMER, Y. (forthcoming): "Cyclical Investment Behavior across Financial Institutions," *Journal of Financial Economics*.

VAYANOS, D. AND J.-L. VILA (2009): "A Preferred-Habitat Model of the Term Structure of Interest Rates," NBER Working Papers 15487.

6 Figures

Figure 1: Breakdown of euro area net portfolio investment flows
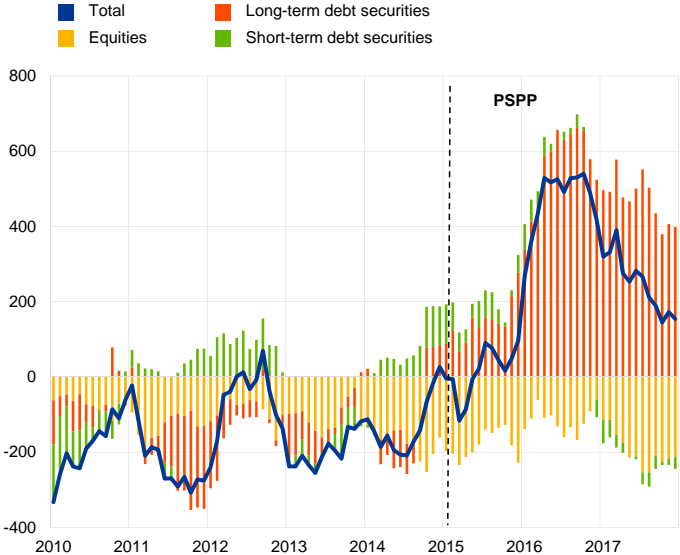
Notes: A positive (negative) number indicates net outflows (inflows) from (into) the euro area. Equity includes investment fund shares. Last observation is December 2017. 12-month cumulated sums in bn EUR.
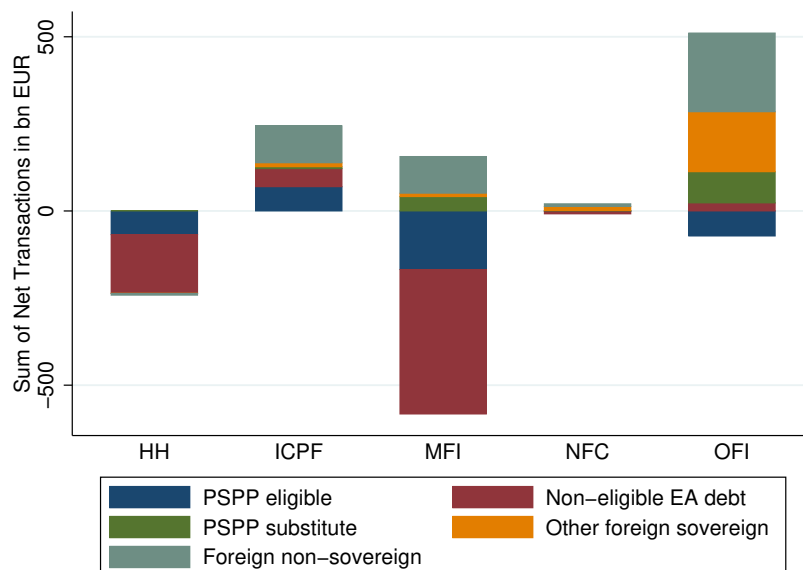
Figure 2: Breakdown of euro area portfolio investment outflows
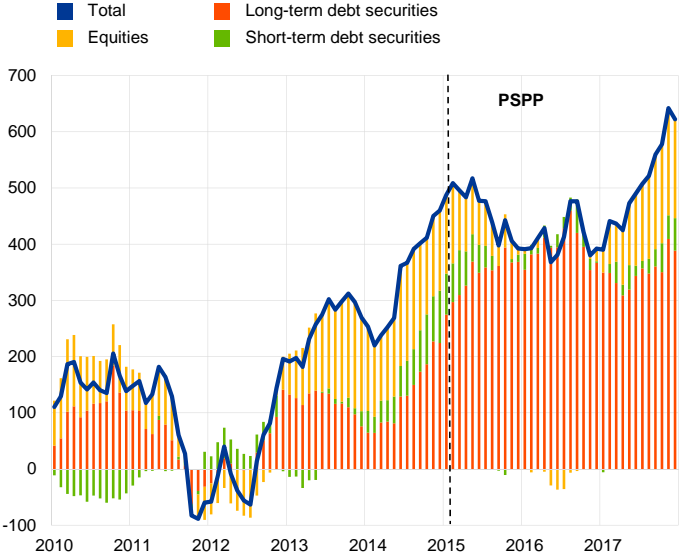
Notes: A positive (negative) number indicates net purchases (sales) of non-euro area securities by euro area investors. Equity includes investment fund shares. Last observation is December 2017. 12-month cumulated sums in bn EUR.

Figure 3: Euro area net debt transactions

Figure 4: Euro area net debt transactions by sector

Figure 5: Euro area net debt transactions by country

Figure 6: Euro area net transactions: intra-(LHS) and extra-euro area (RHS)
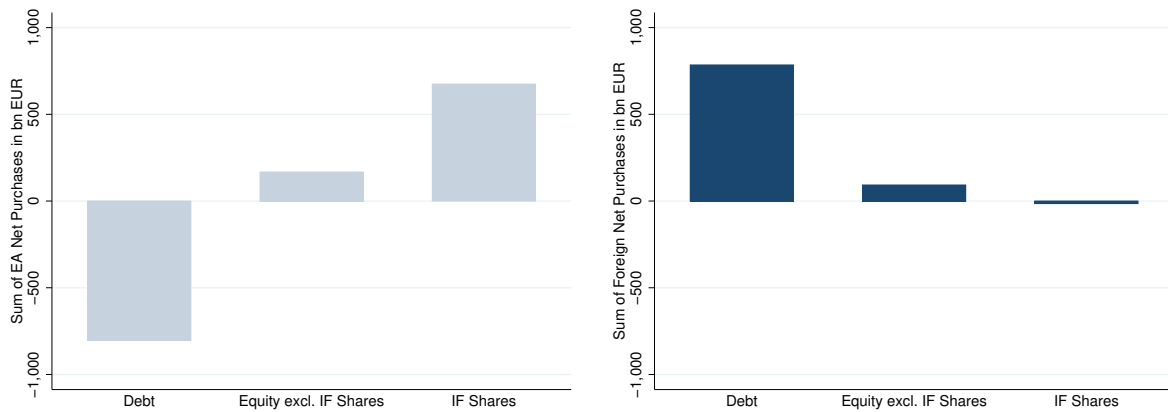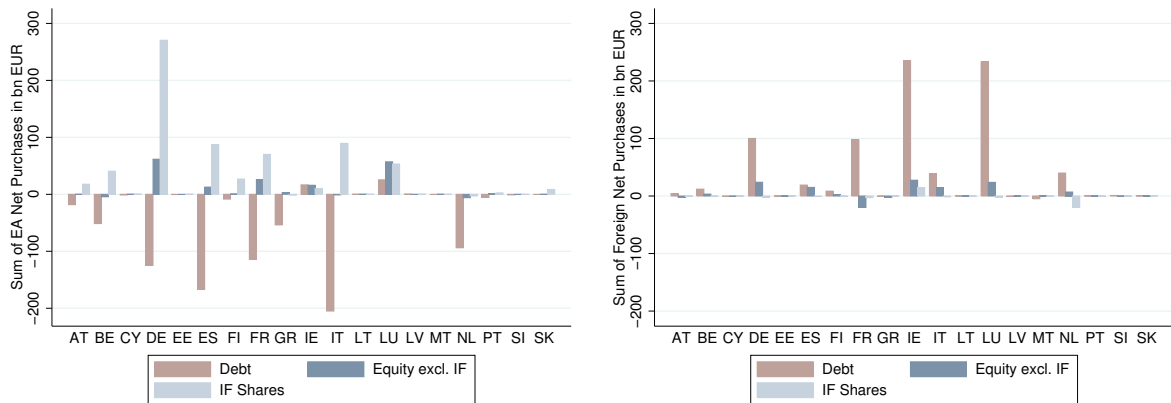
Figure 7: Euro area net transactions by sector: intra-(LHS) and extra-euro area (RHS)
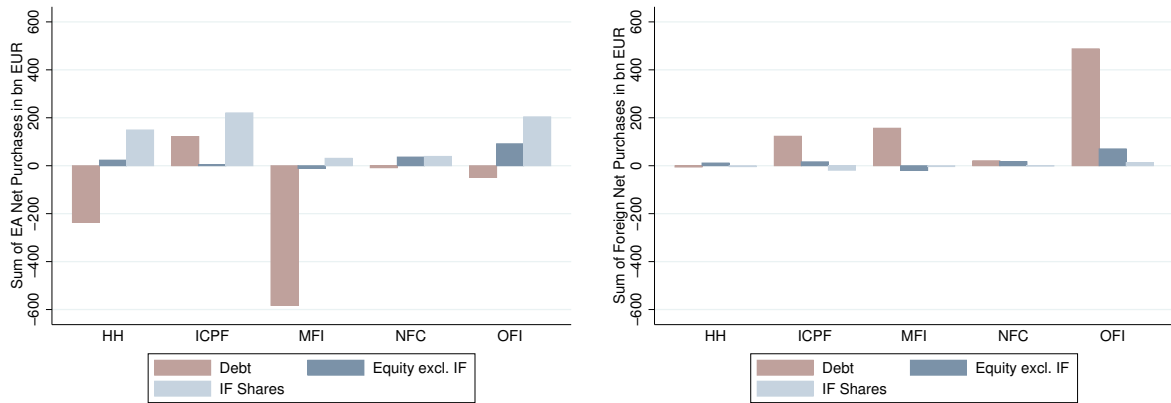
Source: ECB
Notes: Cumulated net purchases by euro area residents from 2015Q1-2016Q4 in EUR bn. Securities on the left (right) issued in (outside) the euro area.
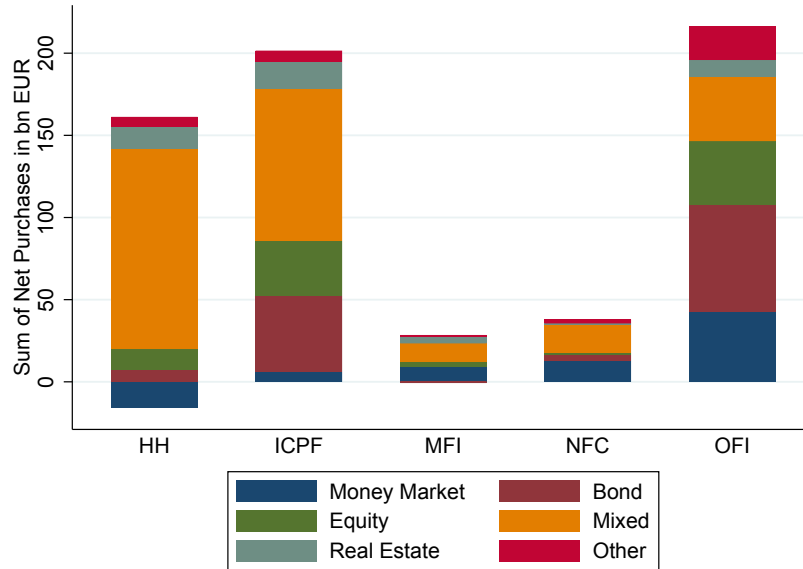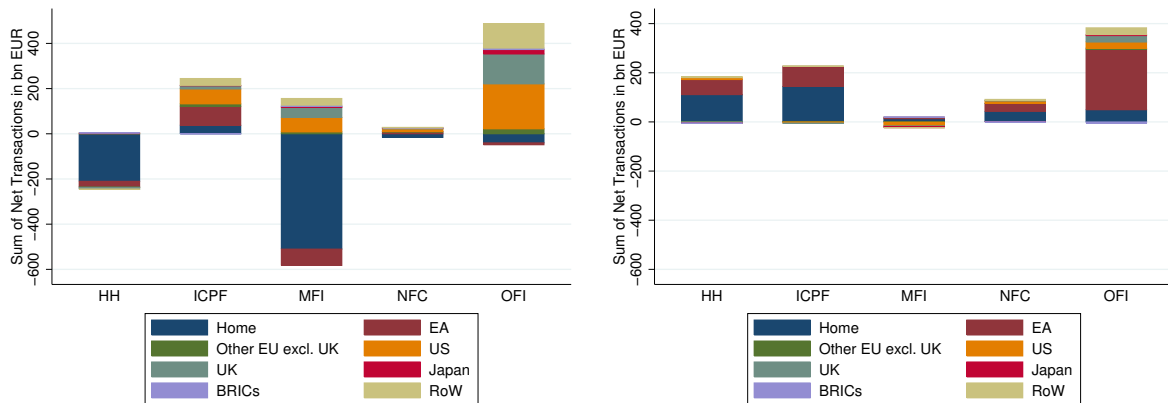
Figure 8: Euro area net transactions by country: intra-(LHS) and extra-euro area (RHS)

Source: ECB
Notes: Cumulated net purchases by euro area residents from 2015Q1-2016Q4 in EUR bn. Securities on the left (right) issued in (outside) the euro area.

Figure 9: Euro area net transactions of investment fund shares split by their main mandate

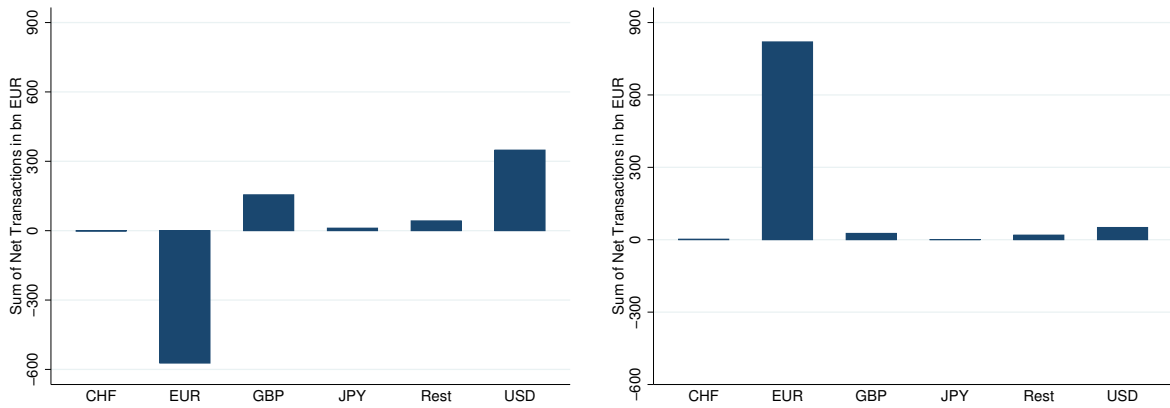Figure 10: Euro area net transactions by geography: debt (LHS) and equity (RHS)

Figure 11: Euro area net transactions by currency: debt (LHS) and equity (RHS)

Source: ECB
Notes: Cumulated net purchases by euro area residents from 2015Q1-2016Q4 in EUR bn. Debt securities on the left and equity securities on the right hand side.

Figure 12: Euro area net transactions by currency: debt (LHS) and equity (RHS)

Source: ECB
Notes: Cumulated net purchases by euro area residents from 2015Q1-2016Q4 in EUR bn. Debt securities on the left and equity securities on the right hand side.
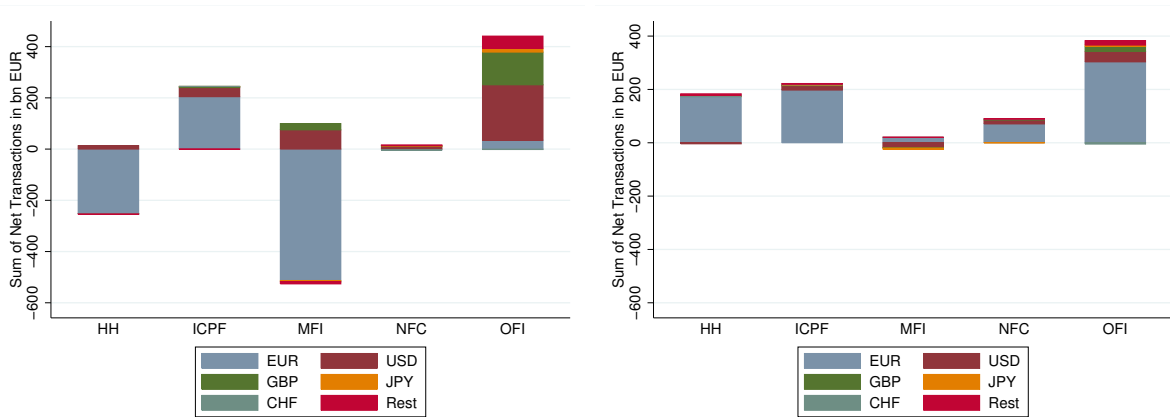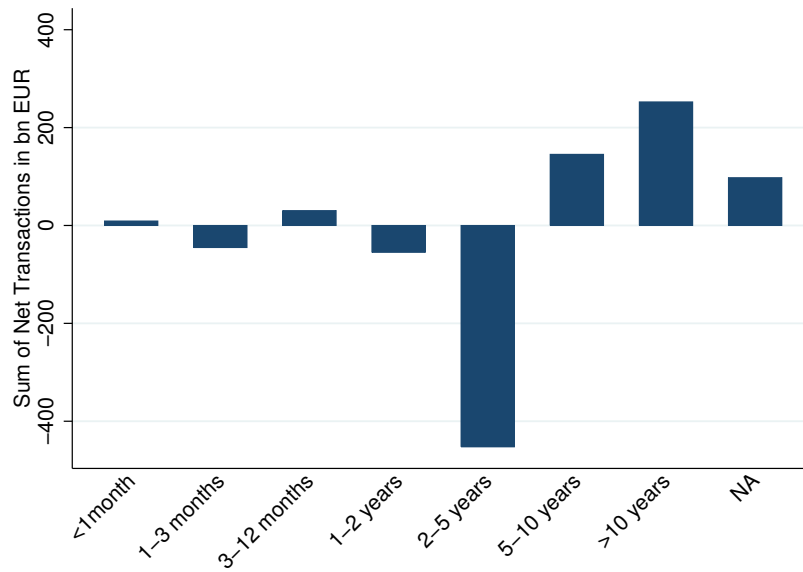
Figure 13: Euro area net debt transactions by maturity

Source: ECB
Notes: Cumulated net purchases by euro area residents from 2015Q1-2016Q4 in EUR bn.
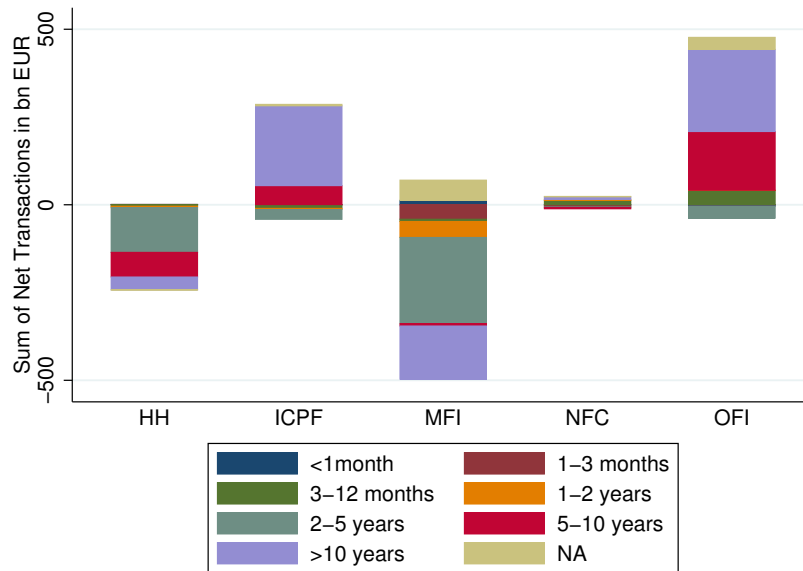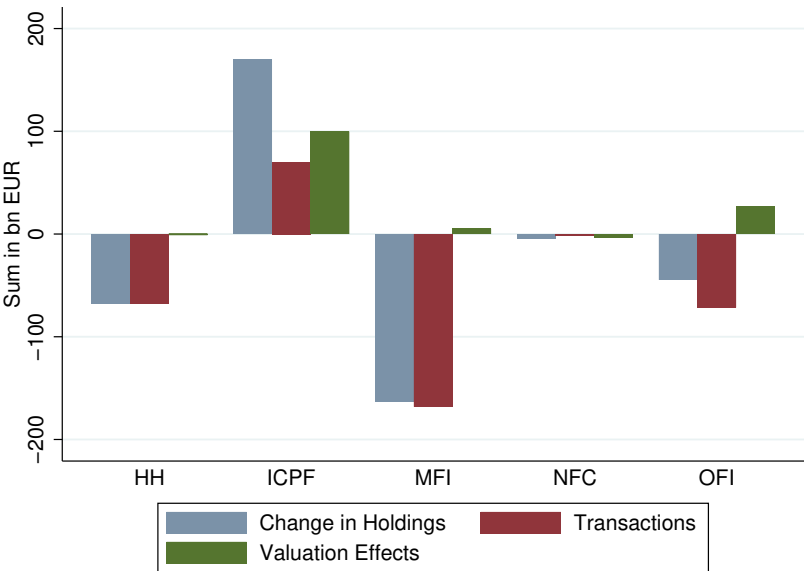

Figure 14: Euro area net debt transactions by maturity

Source: ECB
Notes: Cumulated net purchases by euro area residents from 2015Q1-2016Q4 in EUR bn.

Figure 15: Euro area net transactions, changes in holdings and valuation effects in PSPP eligible securities, by sector

7 Tables

Table 1: Baseline estimation: debt securities

	(1) All	(2) All	(3) Foreign	(4) no IE&LU	(5) only long-term	(6) All	(7) All	(8) Gravity
$\ln(\text{Hold}_{pre})$	-0.652***	-0.652***	-0.653***	-0.751***	-0.657***	-0.744***	-0.771***	-0.623***
	(-10.71)	(-10.71)	(-8.42)	(-13.61)	(-10.44)	(-9.53)	(-15.84)	(-10.07)
Δ Amount Out	0.505***	0.505***	0.471***	0.506***	0.507***	0.540***	0.479***	0.508***
	(26.80)	(26.79)	(31.26)	(23.35)	(26.78)	(26.47)	(25.57)	(26.39)
EUR	-0.327	-0.327	-0.210	-0.284	-0.324	-0.219	0.0139	-0.380
	(-1.22)	(-1.22)	(-0.81)	(-0.85)	(-1.15)	(-0.72)	(0.05)	(-1.29)
$\ln(\text{original maturity})$	0.564***	0.565***	0.350**	0.825***	0.468**	0.352	0.195	0.514***
	(3.60)	(3.59)	(2.42)	(7.03)	(2.25)	(1.65)	(1.45)	(3.08)
PSPP eligibility	-0.808***	-0.808***	-0.681**	-0.959***	-0.816***	-0.925***	-0.632**	-0.737***
	(-3.00)	(-3.00)	(-2.39)	(-3.36)	(-3.24)	(-3.27)	(-2.46)	(-2.65)
PSPP substitute		0.293	0.141	0.482	0.493	0.119	-0.475	0.223
		(0.58)	(0.29)	(1.06)	(0.68)	(0.19)	(-0.81)	(0.46)
High Yield						0.0125		
						(0.08)		
Low Quality							-0.132	
							(-0.48)	
Home								5.290**
								(2.01)
$\ln(\text{Distance})$								0.0264
								(0.15)
$\ln(\text{Trade})$								0.223**
								(2.39)
Common Language								0.0118
								(0.03)
Observations	683007	683007	460687	566399	651402	306654	290771	660745
Holder country-sector FE	yes	yes	yes	yes	yes	yes	yes	yes
Issuer country-sector FE	yes	yes	yes	yes	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	yes	yes	yes	yes	no

Notes: The dependent variable is the (adjusted) logarithm of cumulated net purchases of debt securities during the PSPP period (2015q1-2016q4). T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 2: Baseline estimation: equity securities

	Investment fund shares				Listed equities			
	(1) All	(2) Foreign	(3) no IE&LU	(4) Gravity	(5) All	(6) Foreign	(7) no IE&LU	(8) Gravity
$\ln(\text{Hold}_{pre})$	-0.550***	-0.628***	-0.567***	-0.525***	-0.237***	-0.249***	-0.247***	-0.237***
	(-10.85)	(-19.87)	(-10.16)	(-10.44)	(-6.28)	(-6.12)	(-5.55)	(-6.09)
Δ Amount Out	0.559***	0.520***	0.576***	0.555***	0.308***	0.308***	0.285***	0.307***
	(23.77)	(17.37)	(22.79)	(22.31)	(14.63)	(14.25)	(17.67)	(14.69)
EUR	1.197***	1.344***	1.340***	1.084***	0.182	0.141	0.102	0.178
	(7.72)	(8.67)	(7.98)	(7.09)	(0.76)	(0.57)	(0.37)	(0.71)
Home				-1.611				6.521*
				(-0.59)				(1.97)
$\ln(\text{Distance})$				-0.284				0.213
				(-1.22)				(1.12)
$\ln(\text{Trade})$				-0.131				0.273**
				(-1.28)				(2.16)
Common Language				-1.027				1.648***
				(-1.59)				(2.70)
Observations	307422	225246	260653	287891	285273	271115	228886	273770
Holder country-sector FE	yes	yes	yes	yes	yes	yes	yes	yes
Issuer country-sector FE	yes	yes	yes	yes	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	no	yes	yes	yes	no

Notes: The dependent variable is the (adjusted) logarithm of cumulated net purchases of equity securities during the PSPP period (2015q1-2016q4). T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 3: Sectoral estimation: debt securities

	(1) MFI	(2) ICPF	(3) OFI	(4) NFC	(5) HH
ln(Hold$_{pre}$)	-0.709***	-0.556***	-0.526***	-0.658***	-0.830***
	(-7.20)	(-5.88)	(-4.88)	(-8.58)	(-8.55)
Δ Amount Out	0.640***	0.513***	0.487***	0.476***	0.445***
	(9.37)	(11.09)	(19.86)	(26.29)	(20.88)
EUR	1.085***	0.970	-0.112	-0.454*	-2.550***
	(2.99)	(1.37)	(-0.40)	(-1.87)	(-13.18)
ln(original maturity)	-0.166	1.258***	0.290	0.877***	1.081***
	(-0.56)	(3.58)	(1.17)	(10.33)	(11.37)
PSPP eligibility	-1.370	-0.0993	-1.189***	-0.908*	-1.549***
	(-1.34)	(-0.25)	(-3.14)	(-1.92)	(-4.07)
PSPP substitute	-0.0952	-0.741	1.725***	-1.026	-0.0372
	(-0.09)	(-0.90)	(2.90)	(-1.13)	(-0.05)
Observations			683007		
Holder country-sector FE			yes		
Issuer country-sector FE			yes		
Country-pair FE			yes		

Notes: The dependent variable is the (adjusted) logarithm of cumulated net purchases of debt securities during the PSPP period (2015q1-2016q4). T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 4: Sectoral estimation: equity securities

	Investment fund shares					Listed equities				
	(1) MFI	(2) ICPF	(3) OFI	(4) NFC	(5) HH	(6) MFI	(7) ICPF	(8) OFI	(9) NFC	(10) HH
$\ln(\text{Hold}_{pre})$	-0.260***	-0.500***	-0.474***	-0.606***	-0.741***	-0.490***	-0.139	-0.297***	-0.196***	-0.192***
	(-4.06)	(-3.63)	(-7.50)	(-6.38)	(-13.11)	(-8.88)	(-1.35)	(-4.85)	(-2.95)	(-3.18)
Δ Amount Out	0.338***	0.603***	0.569***	0.541***	0.571***	0.255***	0.369***	0.423***	0.207***	0.252***
	(5.54)	(8.36)	(22.95)	(14.72)	(15.83)	(10.18)	(9.38)	(14.15)	(8.36)	(11.02)
EUR	0.716***	1.669***	1.119***	2.068***	0.972***	-2.025**	-0.0387	0.232	0.474	0.0170
	(2.99)	(7.14)	(2.93)	(5.99)	(4.44)	(-2.55)	(-0.07)	(0.42)	(1.20)	(0.05)
Observations	307422					285273				
Holder country-sector FE	yes					yes				
Issuer country-sector FE	yes					yes				
Country-pair FE	yes					yes				

Notes: The dependent variable is the (adjusted) logarithm of cumulated net purchases of equity securities during the PSPP period (2015q1-2016q4). T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 5: Country-group estimation: debt and equity securities

	(1) Debt Stressed	(2) Debt Non-stressed	(3) Equity Stressed	(4) Equity Non-stressed
ln(Hold$_{pre}$)	-0.904***	-0.712***	-0.477***	-0.356***
	(-9.89)	(-13.45)	(-10.39)	(-8.74)
Δ Amount Out	0.547***	0.495***	0.405***	0.419***
	(9.55)	(24.03)	(14.13)	(20.12)
EUR	0.178	-0.407	1.820***	0.944***
	(0.28)	(-1.08)	(6.92)	(5.42)
ln(original maturity)	0.385	0.908***		
	(1.46)	(8.63)		
PSPP eligibility	-1.750**	-0.685*		
	(-2.31)	(-1.86)		
PSPP substitute	0.728	0.300		
	(1.08)	(0.65)		
Observations	566399		489620	
Holder country-sector FE	yes		yes	
Issuer country-sector FE	yes		yes	
Country-pair FE	yes		yes	

Notes: The dependent variable is the (adjusted) logarithm of cumulated net purchases of debt/equity securities during the PSPP period (2015q1-2016q4). T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 6: Extension of the baseline estimation: Time Dimension

	(1) From 14Q3 until 14Q4	(2) From 15Q1 until 15Q2	(3) From 15Q1 until 16Q2	(4) From 15Q1 until 16Q4
ln(Hold$_{pre}$)	-0.431***	-0.298***	-0.589***	-0.652***
	(-4.79)	(-3.50)	(-9.50)	(-10.71)
Δ Amount Out	0.578***	0.661***	0.542***	0.505***
	(21.08)	(19.00)	(28.22)	(26.79)
EUR	-0.543	-0.577**	-0.626**	-0.327
	(-1.52)	(-2.45)	(-2.40)	(-1.22)
ln(original maturity)	0.307*	0.328*	0.444**	0.565***
	(1.70)	(1.68)	(2.55)	(3.59)
PSPP eligibility	1.226***	-0.425*	-1.047***	-0.808***
	(3.42)	(-1.69)	(-4.64)	(-3.00)
PSPP substitute	0.899*	0.0452	0.101	0.293
	(1.88)	(0.12)	(0.21)	(0.58)
Observations	347851	689561	684168	683007
Holder country-sector FE	yes	yes	yes	yes
Issuer country-sector FE	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	yes

Notes: The dependent variable is the (adjusted) logarithm of cumulated net purchases of debt securities during the period specified on top of the column. T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 7: Extension of the sectoral estimation: Time Dimension and PSPP eligibility

	(1) From 14Q3 until 14Q4	(2) From 15Q1 until 15Q2	(3) From 15Q1 until 16Q2	(4) From 15Q1 until 16Q4
I. Overall specification				
	1.226***	-0.425*	-1.047***	-0.808***
	(3.42)	(-1.69)	(-4.64)	(-3.00)
II. Sectoral specification				
MFI	0.760	-1.243*	-1.525	-1.370
	(0.69)	(-1.67)	(-1.61)	(-1.34)
ICPF	1.285	-0.305	-0.499	-0.0993
	(1.54)	(-0.72)	(-1.11)	(-0.25)
OFI	1.435***	-0.111	-1.035***	-1.189***
	(3.78)	(-0.31)	(-3.21)	(-3.14)
NFC	-0.0304	-0.896	-1.046*	-0.908*
	(-0.06)	(-1.44)	(-1.73)	(-1.92)
HH	0.768	-0.627*	-1.519***	-1.549***
	(1.50)	(-1.73)	(-4.09)	(-4.07)
Observations	347851	689561	684168	683007
Holder country-sector FE	yes	yes	yes	yes
Issuer country-sector FE	yes	yes	yes	yes
Country-pair FE	yes	yes	yes	yes

Notes: Excerpts from full regression tables. The same number of observations is used in both specifications. The dependent variable is the (adjusted) logarithm of cumulated net purchases of debt securities during the period specified on top of the column. T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

Table 8: Extension: Active vs. Passive Rebalancing and PSPP eligibility

	(1) Net transactions	(2) Passive rebalancing	(3) Δ Holdings
I. Overall specification			
	-1.541***	1.492***	-0.0485
	(-4.61)	(4.78)	(-1.37)
II. Sectoral specification			
MFI	-2.505*	2.541**	0.0358
	(-1.96)	(2.19)	(0.28)
ICPF	-0.351	0.379	0.0278
	(-0.75)	(0.83)	(0.69)
OFI	-1.963***	1.961***	-0.00162
	(-3.34)	(3.51)	(-0.04)
NFC	-0.920	0.906	-0.0138
	(-1.29)	(1.33)	(-0.27)
HH	-1.950***	1.738***	-0.212***
	(-3.30)	(3.23)	(-2.92)
Observations	331356	331356	331356
Holder country-sector FE	yes	yes	yes
Issuer country-sector FE	yes	yes	yes
Country-pair FE	yes	yes	yes

Notes: Excerpts from full regression tables. The same number of observations is used in both specifications. The dependent variable is for column (1) the (adjusted) logarithm of cumulated net purchases of debt securities during the PSPP period (2015q1-2016q4), for column (3) the log change in holdings from end of 2014Q4 until 2016Q4, and for column (2) the difference between (3) and (1). T-statistics in brackets. * significant at 10% level; ** significant at 5% level, *** significant at 1% level.

European Capital Markets Institute

ECMI conducts in-depth research aimed at informing the debate and policy-making process on a broad range of issues related to capital markets. Through its various activities, ECMI facilitates interaction among market participants, policymakers and academics. These exchanges are fuelled by the various outputs ECMI produces, such as regular commentaries, policy briefs, working papers, statistics, task forces, conferences, workshops and seminars. In addition, ECMI undertakes studies commissioned by the EU institutions and other organisations, and publishes contributions from high-profile external researchers.

Centre for European Policy Studies

CEPS is one of Europe's leading think tanks and forums for debate on EU affairs, with an exceptionally strong in-house research capacity and an extensive network of partner institutes throughout the world. As an organisation, CEPS is committed to carrying out state-of-the-art policy research that addresses the challenges facing Europe and maintaining high standards of academic excellence and unqualified independence and impartiality. It provides a forum for discussion among all stakeholders in the European policy process and works to build collaborative networks of researchers, policy-makers and business representatives across Europe.