Drivers of global liquidity and global bank flows: A view from the euro area

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Abstract

This paper exploits a novel bank-level monthly dataset to assess the effects of global liquidity on the global flows of euro area banks. The period associated with the European sovereign debt crisis has witnessed increased growth in euro area bank claims on extra-euro area residents, against a background of contracting euro area credit supply. Controlling for bank risk, global credit demand, and price effects such as interest rate differentials and exchange rates, empirical evidence supports a range of determinants of global liquidity - including global risk, global bank equity and unconventional monetary policy in the US, UK, Japan and euro area - as drivers of the global flows of euro area banks. Moreover, regression analysis indicates heterogeneity in the influence of global liquidity on global flows across euro area bank type, defined by their balance sheet composition and country of residence (stressed versus non-stressed euro area countries). The results highlight the importance of exogenous factors as drivers of global bank flows and the potential for international leakages of unconventional monetary policy.

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1 Introduction

This paper investigates the effects of global liquidity on the global flows of euro area banks.[1] Since the early stages of the sovereign debt crisis, euro area banks (henceforth EA banks) have been rebalancing their asset portfolios away from euro area credit and towards external assets vis-à-vis extra-euro area residents. Greater understanding of the determinants of the global flows of banks and the spillover effects of global financial conditions, including unconventional monetary policy, is important for researchers and policymakers alike, given it offers important insights to identifying the build-up of future imbalances and potential transmission of financial shocks.

The period associated with the sovereign debt crisis in Europe has witnessed a restructuring of EA bank balance sheets. While credit growth to euro area households and non-financial corporates (private non-financial sector) has contracted - reflecting subdued credit demand, tightening credit standards and lack of liquidity in the euro area banking system - credit flows to extra-euro area debtors have been increasing.[2] These developments pose potential cause for policy concern should the reduction in euro area credit, have resulted in a preference by EA banks for extra-euro area debtors. This is despite implementation of non-standard monetary policy measures by the European Central Bank (ECB) targeted at alleviating stress in the sovereign bond and interbank markets. Analysing the factors driving these developments provides insight to the effectiveness of unconventional monetary policy.

Controlling for bank risk, global credit demand, and price effects such as interest rate differentials and exchange rates, the objective of this paper is to analyse the influence of global liquidity on the global flows of EA banks. Exploiting a bank-level monthly dataset of 198 EA banks the empirical analysis shows that global factors are indeed significant determinants of the global flows of EA banks and euro area credit growth to the private non-financial sector, between 2010 and 2014. Specifically, the empirical analysis shows that lower global risk and improved funding conditions for global banks positively influence the global flows of EA banks. Moreover, the empirical evidence suggests heterogeneity in the influence of global liquidity on the global flows of EA banks. The estimates indicate that the global flows of smaller banks, less well capitalised banks, banks with smaller deposit funding, and banks resident in

[1] In the context of this paper the term "global flows" refers to the net flows of euro area banks vis-à-vis extra-euro area residents. This definition differs slightly from "cross-border" bank flows, in that it refers to transactions between euro area banks and residents outside of the euro area. The adoption of this definition of the international capital flows of euro area banks is driven by the construct of the proprietary bank-level dataset employed in the empirical analysis.

[2] Credit growth to euro area residents includes both credit to domestic borrowers and non-domestic borrowers resident in the euro area. Extra-euro area bank assets refers to the claims of EA banks on residents outside of the euro area.

non-stressed euro area countries are most affected by developments in global financial markets.

The empirical evidence also supports the "risk-taking channel" of monetary policy, whereby lower interbank interest rates and a flatter yield curve in the euro area are associated with greater global flows of EA banks. A lower return on local investment opportunities incentivises EA banks in their "search for yield" to expand credit to extra-euro area debtors, which are likely to provide opportunities for relatively higher returns.[3] Further to the findings that ECB unconventional monetary policy affects the global flows of EA banks and euro area credit growth, the empirical evidence suggests there are international spillovers of advanced economies unconventional monetary policy via the global activities of EA banks.

In response to the global financial crisis and the European sovereign debt crisis, central banks of major economies, including the ECB, implemented a range of non-standard monetary policy measures in light of constraints at the zero lower bound, to mitigate deflationary concerns and alleviate pressures in the interbank and sovereign debt markets. In this context, asset purchases by major central banks acted as a substitute for policy interest rates (Cour-Thimann and Winkler, 2012). Central bank asset purchases exerted downward pressure on long-term interest rates at announcement, pointing towards a signalling channel of unconventional monetary policy. Empirical studies, aiming to identify the sellers of securities to central banks show that for the UK, Japan and US a significant portion of sellers were global investors.[4] The subsequent response of these sellers via the portfolio rebalancing channel has potential consequences for international capital flows. Mixed empirical support is found for the portfolio rebalancing channel of monetary policy. The results show that asset purchases by the Bank of England and the Bank of Japan as part of their respective quantitative easing programmes is associated with increased investment by EA banks in extra-euro area assets consistent with the portfolio rebalancing channel of central bank asset purchases. In contrast the effect of ECB asset purchases is negatively correlated with global flows suggesting additional central bank liquidity is employed to repay foreign debt sourced from extra-euro area creditors.

The focus of the empirical analysis on the net external assets of EA banks is motivated by two complementary analytical frameworks: (i) the counterpart analysis to the monetary aggregates in the euro area, and (ii) the relation between the current account and the international capital flows of banks. In terms of the former, the counterpart analysis of the euro area broad monetary aggregate, M3, provides a framework for examining the relation between EA bank liabilities, credit and global financial conditions.[5] To gain insight to the relation between

[3]Extra-euro area credit comprises both loans and investment in securities, irrespective of currency denomination.

[4]Joyce et al. 2014, Hogen and Saito 2014, Carpenter et al. 2015.

[5]$M3_t = Credit_t + Net\ external\ assets_t - Longer\ term\ financial\ liabilities_t +$

monetary aggregates, credit, international aspects of EA bank balance sheets and global financial conditions, recent developments observed in the counterparts to M3 in the euro area are presented in Figure 1. Since the sovereign debt crisis in Europe, EA banks have been re-balancing their asset portfolios away from euro area credit and towards net external assets, also reflected in the increased contribution of net external assets to the monetary aggregate M3 (Figure 2). The significant increase in the net external assets of EA banks since 2010 is predominantly driven by a stemed decline in external assets exceeding the contraction in external liabilities (Figure 3). The factors attributable to the global contraction in international capital flows of banks are detailed in Bussière et al. (2016).[6] The increased contribution of net external assets to M3, driven by external assets, during a period of reduced holdings of euro area credit, motivates the focus of the empirical analysis on the growth in net external assets, termed global flows.

Developments in the net external assets of banks do not solely reflect transactions on their own portfolio but also those of their clients. The link between transactions in the net external assets (i.e. net global flows) of EA banks and transactions of the euro area money-holding sector with extra-euro area residents is based on the assumption that these transactions are settled via banks resident in the euro area. The ECB's Monetary Presentation of the Balance of Payments establishes a framework which highlights the relation between transactions in the net external assets of banks and those of the money-holding sector (Bê Duc et al. 2008).

Additional motivation for focussing the majority of the empirical analysis on the net external assets of EA banks is provided by developments on the euro area current account. The period post the global financial crisis has seen significant adjustment of the euro area current account driven by the correction of foreign borrowing in stressed euro area countries coupled with declining domestic investment (Dées et al. 2016). Consistent with the growing current account surplus in the euro area international capital has been flowing to extra-euro area creditors. Decomposing international capital flows - the counterpart to the current account - into its functional categories reveals the current account surplus in the euro area between 2010 and 2014 was mirrored by net other investment outflows mainly comprising the

Net other counterparts$_t$. Following the definition of Hahm et al. (2013) as closely as possible, EA bank core liabilities consist of the monetary aggregates M1 and M2. The non-core liabilities of EA banks comprise the difference between M3 and M2, longer-term financial liabilities and external liabilities. These non-core liabilities are expected to be most exposed to global financial conditions. A detailed description of the construction of euro area monetary aggregates and bank balance sheets is provided in the ECB's Manual on Monetary Financial Institutions' Balance Sheet Statistics (2012).

[6]Bank deleveraging through a contraction in longer-term financial liabilities is also a feature of the latter part of the sovereign debt crisis (Figure 1). In Figure 1 an increase in longer-term financial liabilities represents a decline in their outstanding amount.

international capital flows of banks (Figure 4).

The findings in this paper are relevant for the related literature and inform policy debate concerning the international monetary system. First, consistent with the empirical findings of Bruno and Shin (2015), the paper highlights the role of private sector sourced global factors, global risk and global bank equity, in driving the global flows of EA banks. Second, the results in this paper indicate empirical support for the "risk-taking channel" of monetary policy through a "search for yield" process. Furthermore, the global flows of EA banks and euro area credit supply are not solely influenced by ECB unconventional monetary policy but also that of other advanced economies, suggesting that international spillovers of unconventional monetary policy do not just matter for emerging economies but also affect advanced economies and their banks, thereby having the potential to spillover to the domestic real economy.

The remainder of the paper is structured as follows. Section 2 provides a brief overview of the literature on global liquidity, monetary policy, and cross-border bank flows. The data sources drawn upon are described in Section 3. Section 4 presents the econometric specification and the empirical approach. The empirical results are presented and discussed in Section 5. Finally, Section 6 concludes.

2 Related literature

In recent years the concept of global liquidity has received increased attention from both policy makers and the literature focussing on international capital flow and banks. This is attributable to its role in transmitting the financial and monetary conditions of major advanced economies internationally, combined with its potential risk to financial stability.[7] Traditional measures of global liquidity, e.g. the sum of narrow money created by central banks and international reserves of advanced economies, fail to account for global financial integration, financial innovation and the increasing role of liquidity generated by the private sector (Committee on the Global Financial System, 2011). A growing body of literature now considers that global liquidity captures the channel through which financial and monetary conditions in globally systemic economies, the euro area, US, UK and Japan, are transmitted to other economies through international capital flows (Committee on the Global Financial System 2011, Cerutti et al. 2014, BIS 2015).

The theoretical motivation underpinning this research relates to the global factors that determine global liquidity, quantified in international capital flows, encompassing cross-border bank flows and portfolio investment flows, and its consequences for domestic economies and

[7] Borio and Drehmann 2009, Borio, McCauley and McGuire 2011, Committee on the Global Financial System 2011, Schularick and Taylor 2012, Rey 2013, IMF 2014, Bruno and Shin 2015.

their economic agents. While there is no official definition of global liquidity, it is commonly referred to as "an ease of funding" in global financial markets (Committee on the Global Financial System 2009, Eickmeier et al. 2014). The theoretical model of global liquidity transmission developed in Bruno and Shin (2015) highlights the role of global banks and their interaction with domestic banking systems in disseminating global liquidity across borders. The relation between currency appreciation in debtor countries, the international leverage of banks and cross-border bank flows is also a feature of this model.

Building on the Bruno and Shin (2015) theoretical model of global liquidity, a number of empirical papers have borne out their predictions. The country-level study of Cerutti et al. (2014) highlights that factors driving global liquidity are determinants of cross-border bank flows. They assert the global financial cycle is largely influenced by bank conditions in the UK and euro area, and monetary policy in the US. Reinhardt and Riddiough (2015) distinguish between inter-bank and intra-bank cross-border flows and analyse their reaction to fluctuations in global risk across a panel of 25 advanced and emerging market economies. They conclude that, during periods of greater volatility in global risk, interbank cross-border funding contracts. In contrast, intra-bank cross-border funding remains stable and even increases, a development attributable to the role of internal capital markets.

Risk appetite of financial market participants is also a key factor of global liquidity conditions. A period of calm in global financial markets, when risk aversion of global investors is low, is associated with increased bank leverage and higher levels of cross-border bank flows (Bruno and Shin 2015). In contrast, "risk-off" periods are associated with reduction or retrenchment by global investors (Forbes and Warnock 2012, McCauley 2012).

The "risk-taking channel" of monetary policy transmits the monetary policy stance of major advanced economies across borders via the activities of internationally active banks. In addition to influencing domestic short-term interest rates and, therefore, domestic credit growth, monetary policy affects long-term interest rates and yield curves via financial market participants expectations. The relation between real interest rates and bank risk-taking is considered by Borio and Zhu (2012), whereby the "risk-taking channel" of monetary policy, operates through asset prices and valuation effects, the "search for yield", and the communication and transparency policies of the central bank. The nexus between bank risk-taking and liquidity has the potential for a multiplier effect on the transmission of monetary policy (Borio and Zhu 2012, Borio 2009).

Jimenez et al. (2014) address the question of whether an environment of lower interest rates induces bank risk-taking. In their study on the impact of the overnight interest rate, a measure of the monetary stance, on risk-taking, they find a low interest rate environment is associated with greater lending to risker firms by lesser-capitalised banks. Reduced funding costs for globally-active banks leads to expanded equity and leverage which results in greater

risk-taking behaviour and expanded cross-border bank flows (Bruno and Shin, 2015). Rey (2013) also considers that it is the monetary policy stance in major economies, particularly the US, which drives the global financial cycle in international capital flows, asset prices and in credit growth.

This research also expands upon the branch of literature which explores the relation between global financial conditions, bank liabilities and domestic credit. Specifically this paper adds to the literature that decomposes bank liabilities into two dimensions, core and non-core liabilities, and studies the interconnectedness of the latter to the global financial system. Kim et al. (2013) highlight the interconnectedness between monetary aggregates, a counterpart to bank credit, and financial vulnerability. These authors conclude that monitoring developments in monetary aggregates can provide an early warning signal of risks to financial stability. In their study of bank liabilities, Hahm et al. (2013) show that increases in non-core bank liabilities indicate greater vulnerability to currency and credit crises, an indicator which has greater predictive power than the credit-to-GDP ratio.[8] Chung et al. (2013) examine the relation between non-core bank liabilities and global financial conditions. Specifically, they conclude non-core bank liabilities, in the form of non-financial corporate deposits, arising from their international capital inflows are likely to reflect global financial conditions. Global financial conditions may also affect the international balance sheet of non-financial corporates in addition to those of domestic banking systems.

By exploiting a micro-level dataset to study the relation between global liquidity and global bank flows this paper contributes to these strands of literature. In addition, relative to the existing literature which focuses on analysis at a country-level, to the best of this author's knowledge this is the first paper that employs bank-level data to examine the influence of global liquidity on the international activities of banks.

3 Data

This section describes the data sources employed in the empirical analysis.

3.1 Bank balance sheets

Individual bank balance sheet data for EA banks are taken from a proprietary ECB database (IBSI). As of 2015 this database contains monthly balance sheet information, from mid-2007 onward for 264 banks resident in 19 euro area countries. These data are collected on the residency principle, which covers the subsidiaries and branches of banks located on an

[8]Non-core bank liabilities are categorised as those not included in core liabilities - defined as retail deposits - and display relatively greater procyclicality.

economy, irrespective of the nationality of their parent. Balance sheet information is reported in respect of their resident offices only. This implies intra-group positions and transactions are captured in these data, for example the extra-euro area assets of a bank can reflect its claims on another bank subsidiary within its banking group located outside the euro area.

Both flow and balance sheet data are available from this database at individual bank level. These flow and stock data are collated according to a methodology similar to balance of payments and international investment position statistics (IMF BPM6, 2011). A primary advantage of this approach is that it provides for the exclusion of securitisations, write-offs and valuation effects (price and exchange rate movements), thereby facilitating an accurate measure of global flows of EA banks and the supply of credit to euro area borrowers. This is an important feature of the dataset given the extent of non-transaction based effects on bank balance sheets during the period under review. The annual growth rate a_t for balance sheet items is calculated using the following formula:

$$a_t = [\prod_{i=0}^{11}(1 + \frac{F_t^{M}{}_{-i}}{L_{t-1-i}}) - 1] * 100 \tag{1}$$

where F^M is the monthly flow or transactions of the balance sheet item in question and L represents the outstanding stock of total assets.[9] Variables sourced from this database include external assets, external liabilities, total assets, and credit to the non-financial private sector. Also sourced from this database are capital and reserves, private sector deposits, and liquid assets. The measure of capital and reserves, based on a residency concept, differs from Tier 1 capital on a consolidated bank basis in that it comprises all capital (including capital contributions, i.e., payments into the reserves of a reporting institution by its parent for no consideration, which are not repayable except at the option of the reporting institution), reserves (except taxation reserve), accumulated retained profits, preference shares and subordinated loan capital. Banks with extreme changes in net external assets (external assets minus external liabilities) are excluded from the data. Accounting for bank mergers and closures, data cleaning reduces the sample of banks to 198 individual banks.

To examine whether there is heterogeneity in the effect of global bank factors on the global flows of EA banks in the empirical analysis, the sample of EA banks is categorised by size, capital, deposit funding base and whether they are resident in a stressed or a non-stressed country. The size filter is based on the size of EA bank i's balance sheet relative to the median EA bank. Large banks are considered as those with balance sheets greater than the median

[9]This calculation of annual growth rates is outlined in the Technical Notes accompanying the statistical tables reported in the ECB's Economic Bulletin.

bank, and small banks are those with balance sheets smaller than the median bank.

In terms of banks classified as being highly capitalised and those with a large deposit funding base, the median bank provides the cut-off point. The sample of EA banks is also split between those resident in stressed countries and non-stressed countries. Included in the category of stressed countries are Cyprus, Greece, Ireland, Italy, Portugal and Spain. The non-stressed countries are defined as Austria, Belgium, Estonia, Finland, France, Germany, Luxembourg, Malta, Netherlands, Slovakia and Slovenia.[10]

3.2 Global factors, global and domestic controls

A range of global factors identified in the theoretical and empirical literature as drivers of global liquidity is employed. Global risk is proxied using the VIX index from the Chicago Board Options Exchange (CBOE), where the VIX index is a measure of US stock market volatility compiled from the prices of short-dated options on the S&P 500. The empirical counterpart to global bank balance sheets is the equity growth of US broker-dealers motivated by their reflection of the wholesale activities of global banks (Bruno and Shin, 2015). Additional price relevant drivers of global liquidity also employed include the short-term interest rate given this is the rate which monetary policy targets either directly or indirectly and the slope of the yield curve. Two measures of central bank unconventional monetary policy are considered, balance sheet size and composition. In terms of composition, the focus is on central bank holdings of private and public sector securities purchased as part of non-standard monetary policy measures.

Global control variables included are the effect of exchange rates and the differential cost of assets between the debtor and creditor countries. The macroeconomic conditions of extra-euro area debtors are also included to control for credit demand in the debtor country. Unemployment is included in parts of the empirical analysis as a control variable for domestic demand in the euro area. The definitions and sources of the variables used are detailed in the Appendix. Table 1 provides the summary statistics of the variables employed in the empirical analysis.

4 Econometric specification and empirical approach

The econometric model considers that the global flows of bank i are influenced by drivers of global liquidity, controlling for macroeconomic conditions, observable and unobservable characteristics of bank i, and year t. The baseline specification is given as:

[10]Latvia and Lithuania are excluded from the dataset due to lack of data for the period under review.

$$\begin{aligned}\Delta L_{ijt} &= \beta Global_t + \rho \Delta REER_t + \alpha Global\ credit\ demand_{jt} + \psi Interest\ rate\ spread_t \\ &\quad \theta X_{ijt-1} + \gamma B_i + \delta C_j + \epsilon_{ijt} \end{aligned} \tag{2}$$

where ΔL is the global flows of EA bank i resident in country j at time t, scaled by total assets of bank i at time $t-1$.

Global represents a range of determinants of global liquidity including *Global risk*, Δ*Global bank equity*, Δ*Global interest rate*, and $\Delta Major\ CB\ balance\ sheets$.

The risk appetite of global investors has consequences for the supply of international investor and bank flows, given decreased investor uncertainty is associated with increased international bank flows.[11] Cross-border bank flows are also determined by global bank balance sheets. One of the factors driving bank leverage is bank equity growth and plays a role as a determinant of cross-border bank flows. An increase in bank capital, increases risk-taking by the banking system, reflected in lower risk premia and greater credit supply. An increase in global bank equity, $\Delta Global\ Equity$, representing an ease in funding for global banks, is correlated with increased cross-border bank flows (Bruno and Shin, 2015).

The inclusion of the short-term interbank interest rate, $\Delta Global\ interest\ rate$, is motivated by the "risk-taking channel" of monetary policy, which operates through a number of channels. First, a change in the central bank policy rate affects interbank short-term interest rates, which in turn affects the slope of the yield curve. A flatter yield curve reduces bank net interest rate margins and incentives a greater "search for yield" and, therefore, greater risk-taking (Borio and Zhu, 2008). Returns on foreign assets (loans and securities) are likely to be greater than those earned on domestic assets, therefore, a decline in the policy rate, reflected in declines in short-term interbank interest rates is associated with an increase in the global flows of EA banks.

Lower interest rates also positively influences asset prices, income and profits. An increase in asset prices positively affects the net worth of banks, permitting them to expand their balance sheets by purchasing additional assets (Adrian and Shin 2011, Bruno and Shin 2015, Borio and Zhu 2008).

Since the global financial crisis constraints imposed by the zero lower bound necessitated many central banks to shift from traditional monetary policy towards unconventional monetary policy in the form of public and private sector asset purchases. A key channel through which unconventional monetary policy operates is the portfolio rebalancing channel, whereby

[11] Reinhardt and Riddiough 2015, Cerutti et al. 2014, Cerutti 2014, Bruno and Shin 2015.

the purchases of securities by the central bank induces investors to rebalancing their portfolios towards alternative assets, therefore driving up asset prices. An increase in central bank balance sheets reflecting these purchases that drives up global asset prices may induce EA banks to invest in them incentivised by their greater value. An alternative explanation is that an expansion in central bank balance sheets reduces the availability to the private sector of relatively safe assets and may result in a contraction in the global flows of EA banks due to their unwillingness to hold relatively riskier foreign assets.

Global control variables are captured by (i) the real effective exchange rate, $\Delta REER$; (ii) the credit demand of extra-euro area creditors is denoted by *Global credit demand*, and (iii) the change in the price differential between euro area and extra-euro area sourced credit is represented by *Interest rate spread*. The motivation for their inclusion follows in detail.

Currency fluctuations matter for cross-border bank flows. The Bruno and Shin (2015) model of global liquidity provides key insight to the relation between the foreign currency and cross-border bank flows. This model highlights that a shift in the exchange rate of a debtor country can affect its financial conditions and the international leverage of its banking system. An appreciation of the currency in a debtor country vis-à-vis the euro reduces the value of euro denominated liabilities issued by the debtor country's non-financial corporates, leading to a strengthening of their balance sheets and rises the probability of loan repayment to their local bank. As a consequence the probability of default by the local bank on its liabilities decreases as result of the positive shock to its balance sheet and they have the capacity to expand their international borrowing.

$\Delta Credit\ Demand_{jt}$ is the weighted average of GDP growth in the debtor country of creditor country $j's$ aggregate banking system at time t. The full geographic profile of EA bank $i's$ external balance sheet is unavailable from the bank-level dataset. Similar to Cerutti (2014), country-level bank data is combined with the individual bank-level data. For example, consider "Bank ABC PLC" (bank i) resident in Ireland (country j). The bilateral profile of the Irish banking system's external assets and liabilities are drawn from the BIS locational banking statistics, and the net external assets are compiled by country pairs. The weight for Ireland's banking system (country j) vis-à-vis its debtor banking systems is built as function of its net claims to each of its borrowing countries.

To account for the role of interest rate differentials between domestic and foreign credit as a determinant of the global flows of EA banks, the spread between the Euribor and the average LIBOR for the US Dollar, UK Sterling and Japanese Yen is included. A compressed interest rate spread due to an increase in foreign interest rates is correlated with greater global flows of EA banks.

The unemployment rate, measured as the annual change in the unemployment rate of country j at time t, is considered as a macroeconomic factor that measures the state of the

economy and is a driving factor of credit demand (Bassett et al., 2014).

X_{ij} is a vector of bank-specific time-varying characteristics to account for heterogeneous developments across bank balance sheets. *Size* represents the size of EA bank i and is given by the log of total assets. The capital of EA bank i is denoted by *Capital* and is constructed from its capital and reserves. Larger and better capitalised banks are expected to be better equipped in terms of monitoring external debtors ability to repay.

An indicator of the funding stability of EA bank i is also included, *Deposits*, whereby relatively weaker banks are less likely to be international creditors. Alternatively banks with a smaller deposit funding base may have relatively greater reliance on international wholesale funding and therefore have a tendency to have larger international balance sheets. The liquidity of EA bank i, *Liquidity*, is also considered. Liquid assets are defined as securities issued by the private sector and banks, as well as interbank lending. Banks with higher holdings of liquid assets are better placed to increase their investment in foreign assets. All control variables are included with a lag to account for potential simultaneity of the explanatory variables.

To account for the possibility that the global flows of EA banks are driven by time-invariant bank-specific unobservable factors (e.g. risk appetite, business model or balance sheet management strategy) bank fixed effects, B_i are included. Unobservable country characteristics are captured by country fixed effects, C_j to account for time invariant country factors that affect global flows. Finally, ϵ is the error term.

5 Empirical results

The regressions are estimated over the period 2010 to 2014 on a monthly unbalanced panel dataset of 198 EA banks. Included in the regression estimations are robust standard errors, clustered at bank level. Controls for global credit demand, price determinants of the international capital flows of banks, exchange rates, and bank specific time-varying characteristics are included in each regression.

5.1 Influence of global factors

The results of the baseline regressions based on specification (2) are reported in Table 2, where the dependent variable is the growth in the net external assets of EA bank i scaled by total assets from the previous period, and global factors enter the regressions sequentially.

Overall, the empirical results indicate that global factors are statistical significant determinants of the global flows of EA banks. In column (1), when the relation between global flows and control variables is considered, the coefficients on $\Delta REER$ and *Liquidity* are sig-

nificant. This suggests an appreciation of the euro vis-à-vis the currencies of debtor countries and greater levels of bank liquidity are associated with increased global flows. A time dummy variable replaces the common global factors, $\Delta Reer$ and $\Delta Global\ interest\ rate$, in column (2). The coefficient on *Liquidity* continues to be positive and significant, indicating liquidity is a dominant characteristic for the global flows of euro area banks. When *Global risk* enters column (3) as the sole explanatory global variable, a low level of investor uncertainty is associated with an increase in the global flows of EA banks. The size of the coefficient, -0.02, indicates a ten per cent decrease in global risk is associated with a 0.2 per cent increase in the global flows of EA banks. An increase in global bank equity is associated with an increase in the global flows of EA banks, indicating that an improvement in bank funding conditions is associated with an increase in global liquidity generated by EA banks.

The coefficient on the global interest rate has a negative sign indicating a decline in interbank interest rates is associated with an increase in the global flows of EA banks.[12] Expansionary monetary policies in the form of larger balance sheets of major central banks are negatively associated with the global flows of EA banks. In the column (7), when all global variables are included, global risk, global bank equity growth and the global interest rate continue to retain their statistical significance.

Motivated by the potential for portfolio rebalancing by EA banks, the difference between the growth in net external assets and private non-financial sector credit replaces global flows as the dependent variable in column (8). The aim of its inclusion is to examine developments on the extra-euro area portfolio relative to growth in euro area credit. A decline in global risk and improved global bank funding conditions are significant in explaining increased differences between flows vis-à-vis extra-euro area residents and euro area residents. This indicates favourable global financial conditions are associated with a compositional shift in the portfolios of EA banks toward extra-euro area assets.

To test the robustness of these results, a sensitivity analysis is conducted for a range of alternate drivers of global liquidity, the results of which are presented in Table 3. In columns (1) to (3), alternative measures of global risk are considered, namely the VXO, Global Risk Aversion Indicator (GRAI) and VDAX. The negative and significant signs on these coefficients confirm the importance of the relation between global risk and the global flows of EA banks. Of the global risk variables, the VDAX has the largest explanatory power, suggesting EA bank response to investor risk appetite is most sensitive to measures of global risk based on a euro area stock exchange index.

[12]One possible interpretation of this is that during a period of greater stress in financial markets, where looser monetary policy resulted in lower interest rates in the unsecured interbank market, which incentivised banks to take on greater risk through increased credit growth to extra-euro area borrowers.

In column (4), global bank leverage replaces global bank equity as a measure of global bank funding conditions, motivated by the global liquidity model of Bruno and Shin (2015), which predicts bank leverage as influencing cross-border bank flows. Lower global bank leverage is associated with an increase in the global flows of EA banks, suggesting evidence of a substitution effect between global bank credit and EA bank credit driven by a contraction in balance sheets of global banks.

The role of the slope of the yield curve, as opposed to the interbank rate, as a driver of the global flows of EA banks is also examined. The average global slope, the slope of the yield curve for the euro area and other major economies are considered in columns (5) to (7), respectively. The slope of the yield curve for the euro area enters the regressions reported in columns (6) and (7) with negative and significant signs. This suggests a smaller spread between long-term and short-term interest rates, representing a flatter yield curve in the euro area, incentivises EA banks to expand their credit to extra-euro area debtors.

The influence of global liquidity on the global flows of the external assets (global outflows) of EA banks is next considered, motivated by the potential effects the extra-euro area transactions of the money-holding sector can have on the transactions in the net external assets of EA banks. While client driven transactions will continue to affect these gross external asset flows, they predominantly influence the loan and deposit component of the extra-euro area assets of EA banks and not the extra-euro area securities held in the portfolios of EA banks. In this context, the global flows of the external assets of EA bank i at time t, normalised by the total assets in $t-1$ enters column (8) as an alternative dependent variable. Larger major central bank balance sheets are significant in explaining increased in the global flows in external assets. In column (9) the difference between the growth in external assets and private non-financial sector credit enters the regression as the dependent variable. A decline in global risk, increased global bank equity and larger major central bank balance sheets are significant in explaining increased differences between global flows vis-à-vis extra-euro area residents and euro area residents.

Next explored is whether there is heterogeneity in the response of the global flows of EA banks to global factors by bank type. In Table 4, the sample of EA banks is split by the key characteristics described in Section 2.1 i.e., by size, capital, deposit funding base, and banks resident in stressed euro area countries versus non-stressed euro area countries. Bank size, capital, funding structure and residency all matter for the influence of global factors on the global flows of EA banks.

None of the global factors are significant in explaining the global flows of relatively larger EA banks but the model specification is successful in explaining 53 per cent of the variation in the global flows of large EA banks. Global risk is a significant determinant of the global flows of comparatively smaller banks, less capitalised banks, banks with a relatively smaller deposit

funding base and banks resident in non-stressed euro area countries. The magnitude of the coefficient on $Global\,risk$ is largest for less capitalised banks, where a ten per cent decrease in global risk is associated with a 0.5 per cent decline in global flows. During the sovereign debt crisis many weak EA banks necessitated capital injections from their sovereigns, resulting in banks with relatively higher capital representing weaker banks. Banks with lower capital, therefore, may be EA banks with healthier balance sheets. EA banks resident in non-stressed countries are more sensitive to global risk than banks in stressed euro area countries.

Global equity also matters for banks with these characteristics. An improvement in global bank funding conditions is associated with an increase in global bank flows for smaller and less capitalised banks, banks with a smaller deposit funding base, as well as banks resident in non-stressed countries. The empirical results also provide support for the "risk-taking channel" of monetary policy for smaller EA banks, EA banks with comparatively smaller deposit funding and those resident in non-stressed euro area economies, where declining interbank interest rates are correlated with increased global flows for these categories of banks.

5.2 Spillovers of unconventional monetary policy

The growth in major central bank balance sheets as an important determinant of the global flows of EA banks motivates the focus of the next phase of the analysis. Given the period under review witnessed significant expansion in major central bank balance sheets reflecting unconventional monetary policy in the form of asset purchases from public and private investors the research addresses the question of whether there were spillovers of these activities.

The regression results reported in Table 5 replicate the baseline regression but the central bank balance sheet growth variable is replaced with a measure of unconventional monetary policy, proxied by the growth in major central bank holdings of public and private securities. Central bank growth in securities assets in the UK and Japan, representing the quantitative easing programmes implemented by the Bank of England and Bank of Japan, are significant and positive determinants of the global flows of EA banks.

Asset purchases by central banks drive up the price of comparatively riskier assets given the supply of high quality and highly rated assets has declined due to central bank intervention. Increased foreign asset prices can increase the attractiveness of these assets for EA banks. In turn, greater global flows of EA banks, therefore, reflect a preference for higher priced assets pointing towards an international transmission channel for unconventional monetary policy.

ECB purchases of securities under its Asset Purchase Programmes, comprising the Securities Markets Programme, Covered Bond Purchase Programme, and Covered Bond Purchase Programme 2, negatively affect the global flows of EA banks. This effect continues to hold in column (6) when the growth in each major central bank holdings of securities enters the

regression.

If EA banks were those investors engaged in selling to the ECB under its Asset Purchase Programme, they may have employed the funds received in exchange to deleverage their foreign liabilities. A decline in growth in net external assets can be driven by declines in foreign liabilities exceeding growth in foreign assets. Alternatively, EA banks could have rebalanced their investment portfolios towards domestic assets as a consequence of sales of securities to the ECB and other major central banks.

In this context, Table 6 reports the effects of global factors and unconventional monetary policy on credit growth to the real economy, namely to non-financial corporates and households in the euro area. The results in Table 6 suggest that EA bank credit growth to the non-financial private sector responds to development in global factors. The coefficient on *Global risk* enters the regressions reported in columns (1) to (4) with a significant and positive sign, implying a decline in global risk is associated with a decline in credit growth to euro area households and non-financial corporates. This is consistent with previous findings that lower global risk increases EA bank credit growth to extra euro area debtors, which are likely to be higher yielding assets.

In the regressions reported in columns (1) to (3) an improvement in global bank funding conditions is correlated with a decline in euro area non-financial private sector credit growth between 2010 and 2014. Declining interbank interest rates are a significant determinant of decreased credit growth to the real economy. Looser monetary policy conditions in major economies driven by unconventional monetary policy instruments, with the notable exemption of the ECB, significantly and negatively affect credit growth to the non-financial private sector. These results suggest that ECB unconventional monetary policy, as opposed to conventional monetary policy instruments, is positively associated with credit growth to the real economy in the euro area during the period under review.

5.3 Discussion of results

Controlling for bank risk, global credit demand, and exchange rate effects, overall the formal analysis confirms that global factors matter for the global flows of EA banks. The empirical analysis shows that the global flows of EA banks are inversely related to global risk, implying a decline in the perception of global risk reflecting a period of calm in global financial markets, induces an expansion of credit to extra-euro area debtors from EA banks. In addition, the results provide support for the idea that global bank equity growth, representing accommodative bank funding conditions, positively affects the willingness of banks to expand their balance sheets by taking on board more risk, i.e. by extending credit to extra-euro area residents. The econometric support for global private sector factors as determinants of cross-

border bank flows is consistent with the empirical burgeoning literature on global liquidity (Cerutti et al. 2014, Reinhardt and Riddough 2015, Bruno and Shin 2015).

The bank characteristic, liquidity, emerges as a highly significant indicator of both the global flows of EA banks and euro area credit supply to the private non-financial sector. The greater effect on the former asset category implies that relatively more liquid banks display a greater tendency towards international assets, increasing both their exposure to global shocks and potential to transmit such.

Bank type matters for the effects of global liquidity on developments in the international balance sheets of banks. Global liquidity is important for smaller banks, lesser capitalised banks, and banks with a relatively smaller retail deposit funding base. Residency in a non-stressed country is correlated with increased exposure of banks to developments in global financial markets. The variation in the effect of global liquidity across banks implies the potential for divergence in the impact and consequences of exogenous financial shocks on EA banks.

Empirical evidence is found in support of the "risk-taking channel" of monetary policy, whereby lower interbank interest rates and a flatter yield curve in the euro area is associated with greater global flows of EA banks. A lower return on local investment opportunities incentivises EA banks to "search for yield" and expand credit to extra-euro area debtors which most likely provide opportunities for relatively higher returns. These empirical findings are in line with related findings, that interest rates play a role in bank risk-taking (Adrian and Shin 2010, Borio and Zhu 2012).

Furthermore, evidence of spillovers of unconventional monetary policy from the UK and Japan, but surprisingly not the US, is found. An expansion of Bank of England and Bank of Japan balance sheets, reflecting quantitative easing, is a positive determinant of the global flows of EA banks. In contrast, asset purchases by the ECB are associated with a decline in the global flows of EA banks, most likely reflecting deleveraging of extra-euro area held liabilities. These findings contribute to the debate on the relation between the global financial cycle and the monetary policy of major economies of global systemic importance (Rey, 2013).

Similar to Fratzscher et al. (2014) the results indicate that ECB unconventional monetary policy has consequences for global financial markets. The transmission mechanism of ECB unconventional monetary policy differs across the instruments employed, where reducing policy interest rates towards the zero lower bound affects interbank interest rates and the slope of the yield curve (price effects) and asset purchases affect the balance sheet size (quantity effects), a distinction highlighted by Adrian and Shin (2009). The price effects of ECB unconventional monetary policy positively affect the global flows of EA banks where a lower interest rate motivates the "risk-taking channel" of monetary policy. Unconventional monetary policy in the form of asset purchases, however, has a negative influence on EA bank

cross-border flows. Finally, while the domestic banking system provides a layer of financial intermediation between the domestic private non-financial sector and international financial markets, the empirical evidence suggests that the domestic private non-financial sector credit growth is not insulated from developments in global financial markets and advanced economies unconventional monetary policy.

6 Conclusions

Greater international expansion by EA banks during the sovereign debt crisis, when domestic credit growth has been contracting, has increased the impetus to understand how global factors influence the global flows of EA banks. Employing a bank-level monthly dataset of 198 EA banks between 2010 and 2014, this paper investigates the influence of global factors on EA banks. Controlling for bank risk, global credit demand and exchange rates, the empirical analysis finds that global factors are determinants of the global flows of EA banks and credit growth to the private non-financial sector in the euro area.

Lower volatility in global risk and greater global bank equity positively affect global flows, an effect that is particularly felt by smaller, relatively less capitalised banks, banks with a smaller deposit funding base and those resident in non-stressed euro area countries. This highlights that the effect of global liquidity is heterogeneous across banks. The rationale underpinning this variation provides motivation for future research.

In addition, support for the "risk-taking channel" of monetary policy is evident in the empirical analysis. Furthermore, the global flows of EA banks and euro area credit growth are affected not just by ECB unconventional monetary policy but also that of advanced major economies, providing empirical evidence for international spillovers of unconventional monetary policy. These findings have direct policy implications, particularly in light of expected diverging monetary policy cycles among advanced economies over the coming years. The differential influences between the effects of US, UK and Japanese unconventional monetary policy and that implemented in the euro area provides support for monetary policy autonomy. This is an important finding in the wake of the discussions of global financial cycle and reduced monetary policy independence.

These findings also have direct implications for international banking research. In terms of this strand of research, the increased role of global factors in determining EA bank cross-border flows highlights the need for these factors to be considered in addition to traditional factors, such as informational asymmetry and monitoring costs.

Overall, these results warrant deeper investigation of the inter-linkages between global factors, advanced economies unconventional monetary policy, and the international activities

of banks.

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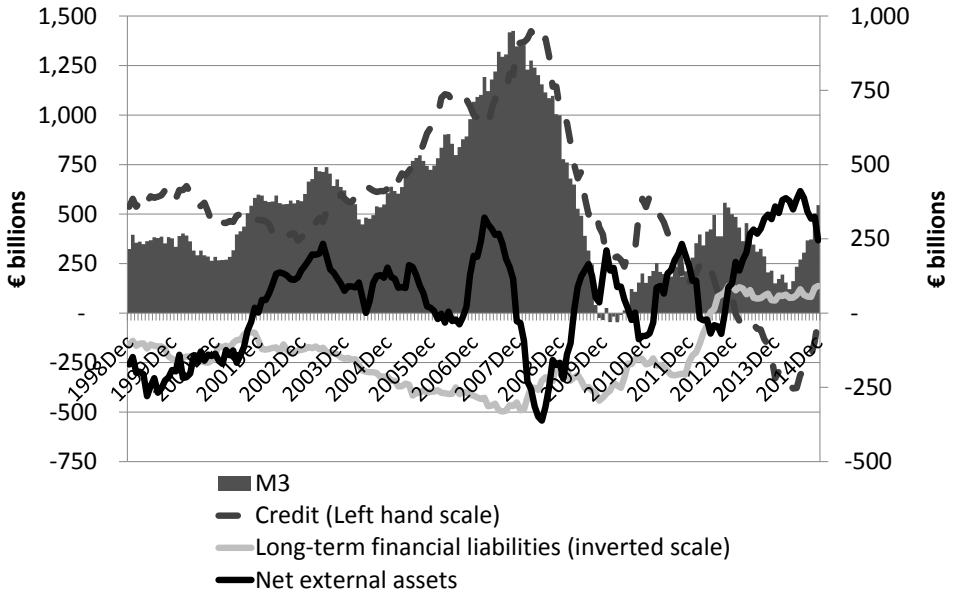
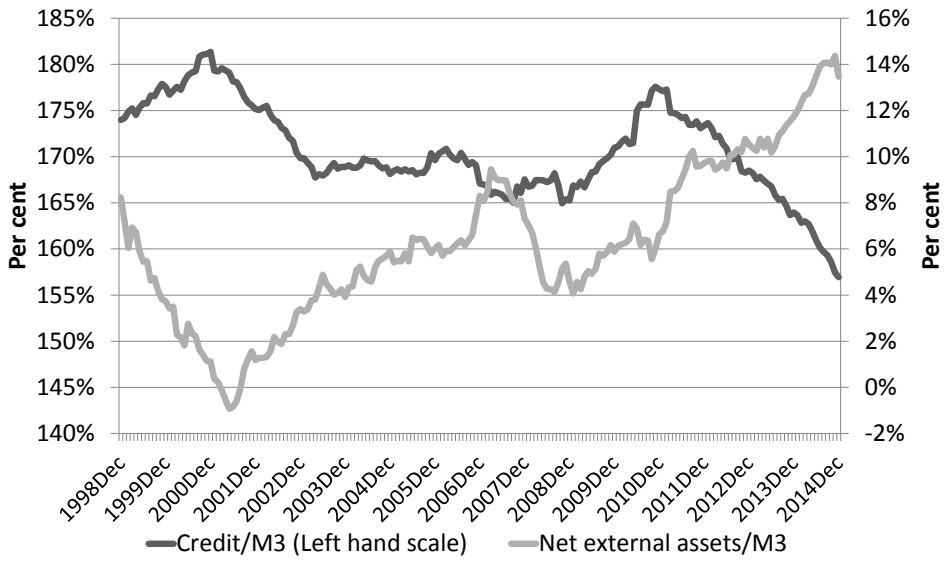
Figures and tables

Figure 1: Main counterparts to M3 (flows), 1998 to 2014



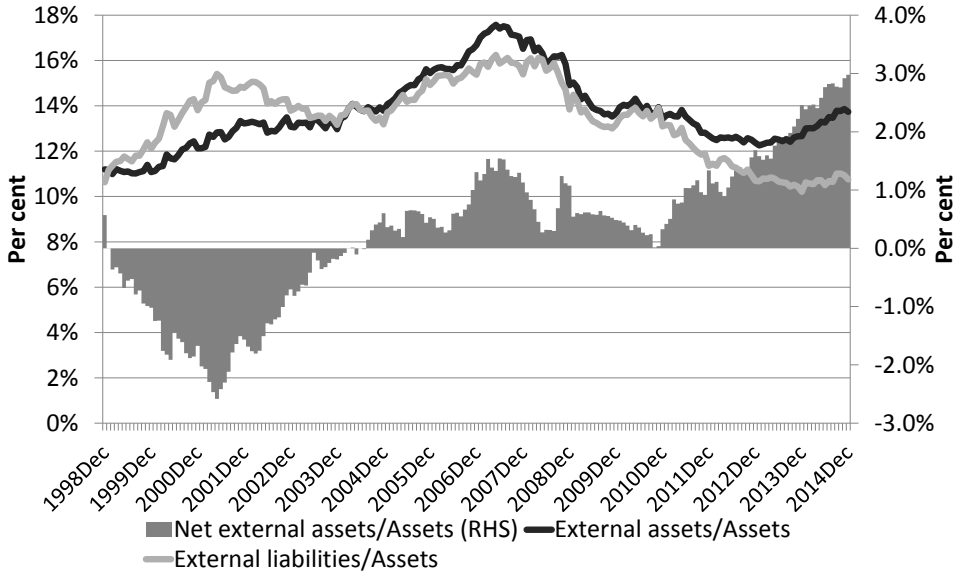
Notes: (i) Data are sourced from the ECB's Statistical Data Warehouse, (ii) a decrease in the long-term financial liabilities series indicates greater debt leveraging, and an increase represents deleveraging away from long-term financial liabilities, (iii) credit defined in the context of the M3 counterpart analysis reflects total credit including both loans and securities to non-MFI sectors.

Figure 2: Contribution of credit and net external assets to M3 (stocks), 1998 to 2014



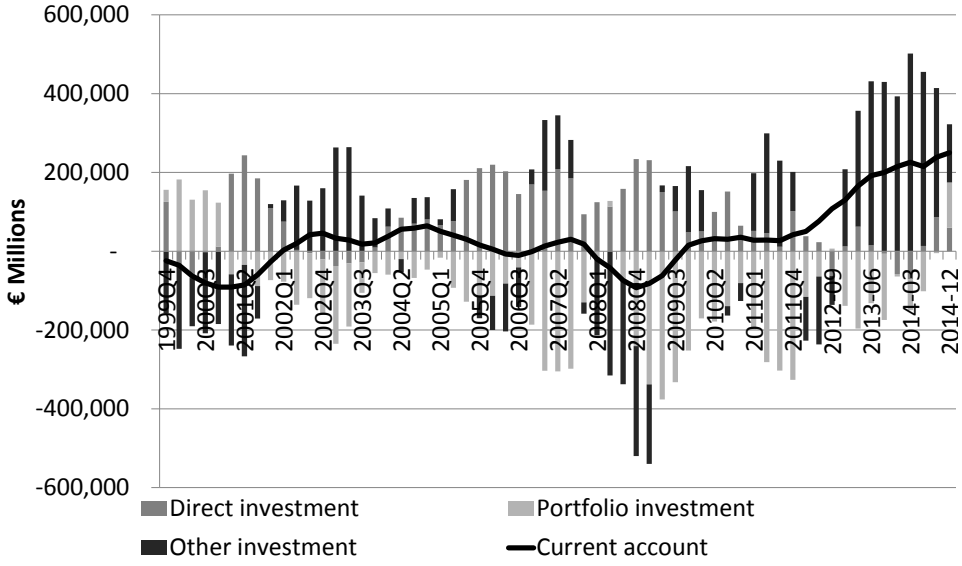
Data source: ECB's Statistical Data Warehouse

Figure 3: International balance sheet of EA banks (stocks), 1998 to 2014



Data source: ECB's Statistical Data Warehouse

Figure 4: International capital flows and the current account surplus



Data source: ECB's Statistical Data Warehouse. Data pre-2008 are compiled according to the IMF's Balance of Payments' Manual, Version 5 and post-2008 data are based on Version 6 of the Manual.

Table 1: Summary Statistics

Variable	Mean	Std.Dev.	Min.	Max.
	No. of observations = 11636			
Dependent variables				
Global flows	-0.01	0.26	-7.58	3.56
Gross global flows	0.00	0.12	-0.97	3.41
Euro area credit	0.00	0.05	-0.62	1.01
Global factors				
Global risk (VIX)	2.90	0.28	2.43	3.76
Global risk (VXO)	2.85	0.31	2.26	3.79
Global risk (GRAI)	-0.26	1.51	-2.64	5.08
Global risk (VDAX)	3.03	0.24	2.63	3.85
Global bank equity	0.00	0.07	-0.15	0.05
Global bank leverage	3.15	0.10	0.00	3.26
Slope of yield curve (average)	2.13	0.42	1.32	2.98
Slope of yield curve (US)	2.41	0.60	1.38	3.67
Slope of yield curve (UK)	2.55	0.70	1.30	3.94
Slope of yield curve (Japan)	0.79	0.23	0.33	1.27
Slope of yield curve (Euro area)	2.75	0.61	1.09	3.99
Interbank interest rate	-0.18	0.37	-1.25	0.42
Major central bank balance sheets	0.11	0.05	0.00	0.23
Major central bank UMP	0.24	0.15	0.00	0.77
US UMP	0.27	0.25	-0.02	1.29
UK UMP	0.05	0.09	-0.12	0.26
Japan UMP	0.26	0.11	0.00	0.51
Euro area UMP	0.13	0.15	-0.08	0.34
Control variables				
Credit demand	0.19	0.14	-0.16	0.76
REER	-0.01	0.03	-0.11	0.06
Interest rate spread	-0.09	0.44	-1.03	0.90
Unemployment	0.01	0.12	-0.30	0.50
Bank characteristics				
Total assets	10.33	1.71	0.00	13.64
Capital	0.09	0.16	-8.50	0.97
Deposit funding	0.32	0.26	0.00	1.00
Liquid assets	0.29	0.20	0.00	1.00

Table 2: Global liquidity and the net global flows of EA banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Global factors								
Global risk			-0.024**				-0.025**	-0.034**
			(0.012)				(0.011)	(0.011)
Δ Global equity				0.400**			0.353**	0.388**
				(0.154)			(0.119)	(0.120)
Δ Global interest rate					-0.131**		-0.068**	-0.051
					(0.052)		(0.033)	(0.034)
Δ Major CB balance sheet						-0.311**	-0.033	-0.034
						(0.147)	(0.113)	(0.115)
Global control variables								
Δ REER	0.241**		0.176**	0.213**	0.053	0.279**	0.054	0.134
	(0.085)		(0.076)	(0.081)	(0.090)	(0.094)	(0.087)	(0.092)
Global credit demand	-0.047	-0.105*	-0.044	-0.075	-0.011	-0.025	-0.048	-0.091**
	(0.040)	(0.055)	(0.040)	(0.046)	(0.041)	(0.040)	(0.044)	(0.045)
Δ Interest rate spread	0.019		0.023	-0.015	0.132**	0.007	0.050*	0.028
	(0.018)		(0.018)	(0.011)	(0.058)	(0.014)	(0.027)	(0.028)
Bank control variables								
Size	-0.017	-0.015	-0.017	-0.016	-0.016	-0.016	-0.015	-0.010
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capital	0.124	0.069	0.103	0.123	0.147	0.124	0.113	0.026
	(0.186)	(0.194)	(0.192)	(0.184)	(0.185)	(0.187)	(0.188)	(0.217)
Deposits	0.059	0.032	0.052	0.053	0.062	0.053	0.047	-0.010
	(0.212)	(0.214)	(0.213)	(0.210)	(0.211)	(0.211)	(0.210)	(0.213)
Liquidity	0.643***	0.648***	0.641***	0.650***	0.643***	0.643***	0.648***	0.567**
	(0.175)	(0.173)	(0.174)	(0.174)	(0.174)	(0.173)	(0.173)	(0.178)
Observations	11593	11593	11593	11593	11593	11593	11593	11593
R^2	0.150	0.161	0.150	0.156	0.152	0.154	0.157	0.155
Adj R^2	0.134	0.142	0.135	0.141	0.136	0.138	0.142	0.140
Bank fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Time fixed effects	N	Y	N	N	N	N	N	N

This table shows the effect of global factors on the net global flows of EA banks. The dependent variable in columns (1) to (7) is growth in net external assets normalised by total assets in the previous period. The dependent variable in column (8) is the difference between the growth in net external assets and euro area private non-financial credit of EA banks. All regressions are estimated with a constant (not reported). Standard errors are clustered by bank. Robust standard errors appear in the parentheses and ***, **, * correspond to significance at the one, five and ten per cent level of significance, respectively.

Table 3: Global liquidity and the net global flows of EA banks, sensitivity analysis

	(1) VXO	(2) GRAI	(3) VDAX	(4) Leverage	(5) Yield curve	(6) Yield curve	(7) Yield curve	(8) Global outflows	(9) Global outflows
Global factors									
Global risk	-0.021**	-0.005**	-0.038**	-0.025**	-0.020**	-0.011	-0.013	-0.002	-0.011*
	(0.010)	(0.002)	(0.013)	(0.012)	(0.010)	(0.009)	(0.010)	(0.004)	(0.006)
Δ Global equity	0.343**	0.343**	0.357**		0.369**	0.316**	0.234**	0.032	0.066*
	(0.118)	(0.120)	(0.123)		(0.113)	(0.117)	(0.096)	(0.031)	(0.035)
Δ Global interest rate	-0.069**	-0.060*	-0.066**	-0.026				-0.038	-0.022
	(0.033)	(0.032)	(0.033)	(0.026)				(0.024)	(0.027)
Δ Major CB balance sheet	-0.045	-0.041	0.003	-0.181	-0.088	-0.058	-0.054	0.136**	0.135**
	(0.114)	(0.109)	(0.094)	(0.145)	(0.110)	(0.109)	(0.120)	(0.062)	(0.064)
Global bank leverage				-0.284**					
				(0.104)					
Interest rate slope (average)					-0.006				
					(0.006)				
Interest rate slope euro area						-0.013**	-0.018**		
						(0.004)	(0.009)		
Interest rate slope US							-0.022		
							(0.020)		
Interest rate slope UK							0.032		
							(0.022)		
Interest rate slope Japan							-0.008		
							(0.035)		
Global control variables									
Δ REER	0.064	0.084	0.059	0.297**	0.160**	0.156**	0.200**	-0.162**	-0.081
	(0.087)	(0.089)	(0.088)	(0.124)	(0.074)	(0.074)	(0.081)	(0.053)	(0.062)
Global credit demand	-0.048	-0.050	-0.053	-0.038	-0.063	-0.069	-0.069	0.028	-0.015
	(0.044)	(0.044)	(0.044)	(0.044)	(0.045)	(0.045)	(0.046)	(0.020)	(0.024)
Δ Interest rate spread	0.050*	0.046*	0.048*	0.011	-0.011	-0.009	-0.013	0.017	-0.006
	(0.027)	(0.027)	(0.027)	(0.020)	(0.011)	(0.011)	(0.012)	(0.017)	(0.018)
Observations	11593	11593	11593	11593	11593	11593	11593	11593	11593
R^2	0.157	0.157	0.158	0.156	0.157	0.157	0.158	0.203	0.204
Adj R^2	0.142	0.142	0.142	0.141	0.141	0.142	0.142	0.188	0.190
Bank control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y

This table shows the effect of global factors on the net global flows and global outflows of EA banks. The dependent variable is growth in net external assets normalised by total assets in the previous period in columns (1) to (7), and the growth in external assets normalised by total assets in the previous period in columns (8) and (9). In columns (1) to (3) global risk is measured by the VXO, GRAI and VDAX, respectively and by the VIX in columns (4) to (9). Bank-level control variables are included in all regressions but not reported owing to space constraints. All regressions are estimated with a constant (not reported). Standard errors are clustered by bank. Robust standard errors appear in the parentheses and ***, **, * correspond to significance at the one, five and ten per cent level of significance, respectively.

Table 4: Global liquidity and the net global flows of EA banks, by bank type

	(1) Large	(2) Small	(3) High capital	(4) Less capital	(5) Large deposit base	(6) Small deposit base	(7) Stressed country	(8) Non-stressed country
Global factors								
Global risk	0.001	-0.046**	-0.007	-0.051**	-0.009	-0.037*	-0.010	-0.029*
	(0.006)	(0.021)	(0.007)	(0.023)	(0.007)	(0.020)	(0.011)	(0.015)
ΔGlobal equity	-0.013	0.639**	0.033	0.845**	-0.015	0.819**	-0.051	0.511**
	(0.029)	(0.225)	(0.048)	(0.272)	(0.028)	(0.261)	(0.068)	(0.159)
ΔGlobal interest rate	-0.022	-0.152**	-0.024	-0.116	-0.009	-0.134**	-0.036	-0.113**
	(0.015)	(0.065)	(0.019)	(0.072)	(0.009)	(0.067)	(0.024)	(0.048)
ΔMajor CB balance sheet	0.022	-0.068	0.085	-0.083	0.039	-0.002	0.151	-0.080
	(0.034)	(0.219)	(0.062)	(0.224)	(0.028)	(0.230)	(0.101)	(0.151)
Global control variables								
ΔREER	-0.037	0.053	-0.007	0.002	-0.026	0.026	-0.317**	0.154
	(0.053)	(0.155)	(0.075)	(0.205)	(0.041)	(0.169)	(0.115)	(0.121)
Global credit demand	-0.031	0.043	-0.001	-0.061	-0.013	-0.141	0.006	0.111
	(0.024)	(0.116)	(0.030)	(0.143)	(0.020)	(0.098)	(0.044)	(0.190)
ΔInterest rate spread	0.023	0.106*	0.001	0.102	-0.004	0.116**	0.018	0.081**
	(0.014)	(0.057)	(0.016)	(0.065)	(0.015)	(0.057)	(0.019)	(0.037)
Bank control variables								
Size	-0.004	-0.007	-0.003	-0.014	-0.003**	-0.026	0.001	-0.023
	(0.003)	(0.027)	(0.005)	(0.017)	(0.002)	(0.019)	(0.003)	(0.018)
Capital	-0.048	0.246	-0.001	-2.005	-0.143	0.341	0.105	0.284
	(0.081)	(0.319)	(0.146)	(2.277)	(0.206)	(0.506)	(0.086)	(0.488)
Deposits	0.076	-0.075	-0.096	0.570	0.061**	0.428	-0.095	0.094
	(0.056)	(0.383)	(0.097)	(0.347)	(0.025)	(0.620)	(0.112)	(0.357)
Liquidity	0.122	0.892***	0.143	1.024***	-0.003	1.053***	-0.039	0.864***
	(0.093)	(0.244)	(0.087)	(0.255)	(0.031)	(0.211)	(0.042)	(0.226)
Observations	6027	5566	6429	5164	6074	5519	3165	8428
R^2	0.539	0.186	0.194	0.257	0.300	0.216	0.153	0.186
Adj R^2	0.529	0.167	0.175	0.236	0.284	0.197	0.135	0.171
Bank fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y	Y	Y

This table shows the effect of global factors on the net global flows of EA banks. The dependent variable is growth in net external assets normalised by total assets in the previous period. All regressions are estimated with a constant (not reported). Standard errors are clustered by bank. Robust standard errors appear in the parentheses and ***, **, * correspond to significance at the one, five and ten per cent level of significance, respectively.

Table 5: International spillovers of unconventional monetary policy

	(1)	(2)	(3)	(4)	(5)	(6)
Global factors						
Global risk	-0.026**	-0.026**	-0.025**	-0.004	-0.009	-0.003
	(0.010)	(0.009)	(0.012)	(0.008)	(0.009)	(0.007)
Δ Global equity	0.380**	0.383**	0.332**	0.342**	0.333**	0.273**
	(0.146)	(0.156)	(0.135)	(0.136)	(0.133)	(0.120)
Δ Global interest rate	-0.076**	-0.078**	-0.110**	-0.123**	-0.054*	-0.094**
	(0.035)	(0.037)	(0.048)	(0.049)	(0.032)	(0.046)
Δ Major CB UMP	-0.006					
	(0.024)					
Δ UMP US		-0.005				0.004
		(0.019)				(0.021)
Δ UMP UK			0.077**			0.083
			(0.037)			(0.054)
Δ UMP Japan				0.147**		0.020
				(0.058)		(0.047)
Δ UMP Euro area					-0.091*	-0.096*
					(0.050)	(0.057)
Global control variables						
Δ REER	0.037	0.034	-0.082	-0.213	-0.081	-0.245
	(0.091)	(0.087)	(0.122)	(0.151)	(0.120)	(0.157)
Global credit demand	-0.049	-0.049	-0.057	-0.062	-0.053	-0.063
	(0.044)	(0.044)	(0.045)	(0.044)	(0.044)	(0.044)
Δ Interest rate spread	0.056*	0.057*	0.090**	0.112**	0.051*	0.094**
	(0.032)	(0.032)	(0.043)	(0.048)	(0.030)	(0.042)
Bank control variables						
Size	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capital	0.109	0.110	0.117	0.072	0.076	0.076
	(0.197)	(0.198)	(0.191)	(0.199)	(0.203)	(0.205)
Deposits	0.045	0.045	0.049	0.032	0.032	0.033
	(0.213)	(0.213)	(0.211)	(0.212)	(0.213)	(0.214)
Liquidity	0.648***	0.648***	0.649***	0.646***	0.646***	0.647***
	(0.173)	(0.173)	(0.173)	(0.173)	(0.173)	(0.173)
Observations	11593	11593	11593	11593	11593	11593
R^2	0.157	0.157	0.157	0.158	0.158	0.158
Adj R^2	0.142	0.142	0.142	0.143	0.143	0.143
Bank fixed effects	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y

This table shows the effect of global factors on the net global flows of EA banks. The dependent variable is growth in net external assets normalised by total assets in the previous period. All regressions are estimated with a constant (not reported). Standard errors are clustered by bank. Robust standard errors appear in the parentheses and ***, **, * correspond to significance at the one, five and ten per cent level of significance, respectively.

Table 6: International spillovers of unconventional monetary policy to the euro area real economy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global factors							
Global risk	0.015***	0.013***	0.012***	0.011***	0.001	0.002	0.000
	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Δ Global equity	-0.046**	-0.037**	-0.054**	-0.025	-0.027	-0.004	-0.020
	(0.015)	(0.017)	(0.019)	(0.017)	(0.017)	(0.017)	(0.018)
Δ Global interest rate	0.010***	0.010***	0.012***	0.010***	0.008***	0.004	0.007**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Δ Major CB Balance Sheet	-0.026						
	(0.017)						
Δ Major CB UMP		0.003					
		(0.005)					
Δ UMP US			0.007**				0.001
			(0.004)				(0.003)
Δ UMP UK				-0.024**			-0.002
				(0.008)			(0.006)
Δ UMP Japan					-0.052***		-0.036**
					(0.012)		(0.014)
Δ UMP Euro area						0.038***	0.017*
						(0.009)	(0.009)
Domestic control variables							
Domestic credit demand	0.001	0.001	0.001	0.002	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank control variables							
Size	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Capital	0.091	0.091	0.093	0.094	0.113	0.106	0.114
	(0.118)	(0.118)	(0.118)	(0.118)	(0.119)	(0.118)	(0.119)
Deposits	0.060**	0.060**	0.061**	0.061**	0.069**	0.067**	0.070**
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Liquidity	0.082***	0.082***	0.083***	0.083***	0.084***	0.084***	0.084***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Observations	11593	11593	11593	11593	11593	11593	11593
R^2	0.361	0.361	0.361	0.363	0.369	0.367	0.369
Adj R^2	0.350	0.350	0.350	0.351	0.357	0.356	0.358
Bank fixed effects	Y	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y	Y

This table shows the effect of global factors on credit to the euro area private non-financial sector by EA banks. The dependent variable is growth in credit to private non-financial sector normalised by total assets in the previous period. All regressions are estimated with a constant (not reported). Standard errors are clustered by bank. Robust standard errors appear in the parentheses and ***, **, * correspond to significance at the one, five and ten per cent level of significance, respectively.

Appendix: Variable definitions and sources

Table A: Variable definitions and sources

Variable	Definition	Source
Dependent variables		
Global flows	Annual growth in net external assets scaled by total assets from the previous period	ECB proprietary dataset (IBSI)
Gross global flows	Annual growth in gross external assets scaled by total assets from the previous period	ECB proprietary dataset (IBSI)
Euro area credit	Annual growth in private sector credit scaled by total assets from the previous period	ECB proprietary dataset (IBSI)
Global factors		
Global risk (VIX)	The log of the VIX index	Chicago Board Options Exchange
Global risk (VXO)	The log of the VXO index	Chicago Board Options Exchange
Global risk (GRAI)	Global risk aversion indicator	ECB's Statistical Data Warehouse
Global risk (VDAX)	The log of the VDAX index	Thomson Reuters Datastream
Global bank equity	Annual growth in the equity of US broker dealers	US Flow of Funds
Global bank leverage	Equity scaled by assets of US broker dealers	US Flow of Funds
Slope of yield curve (average)	Average 10 year government bond yield/3 month treasury bill	Thomson Reuters Datastream and Bloomberg
Slope of yield curve (US)	Average 10 year government bond yield/3 month treasury bill (US)	Thomson Reuters Datastream and Bloomberg
Slope of yield curve (UK)	Average 10 year government bond yield/3 month treasury bill (UK)	Thomson Reuters Datastream and Bloomberg
Slope of yield curve (Japan)	Average 10 year government bond yield/3 month treasury bill (Japan)	Thomson Reuters Datastream and Bloomberg
Slope of yield curve (Euro area)	Average 10 year government bond yield/3 month treasury bill (euro area)	Thomson Reuters Datastream and Bloomberg
Interbank interest rate	Annual average growth of overnight interbank interest rate in US, UK, Japan and euro area	Thomson Reuters Datastream
Major central bank balance sheets	Average annual growth in central bank balance sheets of the US, UK, Japan and euro area	National central bank websites
Major central bank UMP	Average annual growth in central bank securities assets of the US, UK, Japan and euro area	National central bank websites
US UMP	Annual growth in central bank securities assets of the US	National central bank websites
UK UMP	Annual growth in central bank securities assets of the UK	National central bank websites
Japan UMP	Annual growth in central bank securities assets of the Japan	National central bank website
Euro area UMP	Annual growth in central bank securities assets of the euro area	National central bank website
Control variables		
Credit demand	Weighted average of the GDP growth of the main debtor countries of creditor banking systems	IMF IFS and BIS Locational Banking Statistics
REER	Annual change in log of REER index.	Eurostat
Spread	Change in difference between euro area and average international interbank interest rates	Thomson Reuters Datastream
Unemployment	Annual change in the unemployment rate	Eurostat
Bank characteristics		
Total assets	The log of total assets	ECB proprietary dataset (IBSI)
Capital	Capital and reserves/total liabilities	ECB proprietary dataset (IBSI)
Deposit funding	Household and non-financial corporate deposits/total liabilities	ECB proprietary dataset (IBSI)
Liquid assets	Private sector and bank debt securities, interbank lending/total assets	ECB proprietary dataset (IBSI)