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.

Keywords: Global bank flows, cross-border banking, global risk, global liquidity, European sovereign crisis, unconventional monetary policy spillovers, credit supply.
JEL Classification: F60, G15, G21

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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-á-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 euro area 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 for 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

[1] In the context of this paper the term "global flows" refers to the net flows of euro area banks vis-á-vis extra-euro area residents. This definition differs slightly from the term "cross-border" bank flows, in that it refers to transactions between euro area banks and residents outside of the euro area. 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. Transactions between euro area banks within the euro area are considered as intra-euro area transactions irrespective of whether they are between a euro area bank and a domestic client, or a euro area bank and non-domestic client resident in the euro area.

[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.

of EA banks. Moreover, the analysis distinguishes between large and small banks, better and lesser capitalised banks, banks with higher versus lower stable deposit funding bases, and banks resident in stressed and non-stressed euro area countries. The empirical evidence suggest 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, and banks resident in 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.

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. 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 (2014) analyse the reaction of bank-to-bank cross-border flows 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, intrabank cross-border funding remains stable and even increases, a development attributable to the role of internal capital markets.

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

This research also expands upon the branch of literature which explores the relation between global financial conditions, bank liabilities and domestic credit. In a simplified banking system, lending to domestic borrowers is driven by the deposits of households and non-financial corporates, the stock of which is relatively stable and fluctuates in tandem with household income and wealth. Where these deposits prove insufficient to meet the supply of domestic credit, domestic banks avail of alternative sources of external finance, namely equity capital and/or foreign funding. In this setting, the availability of foreign financing to domestic banks facilitates a greater degree of lending than would otherwise be the case (Shin 2010, Lane and McQuade 2014). This paper also 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 (Hahm et al. 2013, Kim et al. 2013, Chung et al. 2015).

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.[4] First, consistent with the 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. 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. The conceptual background is presented in Section 2. Section 3 describes the data sources drawn upon. 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 Conceptual background

In support of the motivation to analyse the relation between global liquidity, the international capital flows of banks, and credit conditions this section provides an overview of their conceptual underpinnings.

[4]To the best of this author's knowledge this is the first paper that employs bank-level data, as opposed to country-level data, to analyse the influence of global liquidity on the international activities of banks.

2.1 Global liquidity

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.[5]

While there is no official formal definition of global liquidity, the related literature and the metadata of the global liquidity indicators of the Bank for International Settlements (BIS) commonly refer to global liquidity as representing an "ease of funding" (Eickmeier et al. 2014, BIS 2015). To visually conceptualise global liquidity, Diagram 1 presents a framework distinguishing between its determinants, international transmission mechanisms, and consequences for domestic economies and their economic agents. In this stylised framework global liquidity: (i) is driven by financial and monetary conditions in major economies, including factors such as institutional, legal and financial regulatory policies, risk appetite, global bank activities, the monetary policy stance; (ii) is transmitted internationally by globally active banks and other financial institutions, and (iii) coupled with domestic macroeconomic conditions spillovers into local credit conditions.

Traditionally global liquidity was measured as the sum of narrow money created by central banks and international reserves of advanced economies. These measures 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).

In terms of financial conditions, developments in global bank balance sheets are key to their international transmission mechanism, a result of the interaction between global banks and domestic banking systems in the international interbank market (Shin 2012, Bruno and Shin 2015). Fluctuations in global liquidity closely mirror the changes in the balance sheets of global banks, reflected in the growth in the international capital flows of banks, which in turn have consequences for amplifying financial conditions in domestic economies. Understanding the factors driving global liquidity is important from a policy perspective given its pro-cyclical features.

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

[5]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.

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.

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.[6] The subsequent response of these sellers via the portfolio rebalancing channel has potential consequences for international capital flows.

In summary, domestic financial conditions are not solely determined by the domestic monetary policy stance or domestic regulatory or macroeconomic conditions but also by external

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

factors including global liquidity through the interaction between their domestic financial intermediaries and global financial markets.

2.2 Global liquidity, money and credit

In this section, the relation between global liquidity, monetary aggregates and credit conditions is outlined. Renewed attention to monetary aggregates has been given in a number of recent studies.

2.2.1 Banks

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.[7] 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.

Key to the international transmission of global financial conditions, generated from both private and public sources, are the global activities of EA banks. A useful starting point for detailing the interconnectedness between global financial conditions, monetary aggregates and bank credit is the ECB's framework of monetary analysis.[8] The foundation of this framework is the structure of the balance sheets of EA banks, which can be decomposed into components of the broad monetary aggregate, M3, and its counterparts.

Diagram 2 presents the stylised balance sheet of a euro area bank. Its liabilities are

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

[8]In the euro area monetary analysis is conducted on Monetary Financial Institutions (MFIs) which are money-issuing entities including banks (termed credit institutions), money market funds and the Eurosystem of Central Banks. To avoid methodological and empirical issues related to the complex transactions between banks, money market funds and the Eurosystem, the focus of this paper is on EA banks. In the context of the stylised framework and empirical analysis presented in this paper banks represent MFIs. A detailed description of the construction of euro area bank balance sheets can be found in the ECB's Manual on MFIs Balance Sheet Statistics, 2012.

decomposed into liabilities included in monetary aggregates and analysis (i.e., M1, M2 and M3), longer-term financial liabilities and external liabilities.[9] Following the definition of Hahm et al. (2013) as closely as possible, euro area bank non-core liabilities comprise the difference between M3 and M2 (i.e. repurchase agreements + money market fund shares/units + debt securities issued by monetary financial intermediaries with an original maturity of less than 2 years), longer-term financial liabilities and external liabilities.[10] These non-core liabilities are expected to be most exposed to global financial conditions.

An alternate approach to examining the relation between euro area bank liabilities, credit and global financial conditions is in the context of the counterpart analysis of M3. The counterparts to M3 are constructed by the following accounting identity:

$$\begin{aligned} M3_t &= Credit_t + Net\ external\ assets_t - Longer\ term\ financial\ liabilities_t \\ &\quad + Net\ other\ counterparts_t \end{aligned} \tag{1}$$

where $M3$ is defined as previously described, $Credit$ comprises credit (securities and loans) to euro area residents, $Net\ external\ assets$ are gross external assets minus gross external liabilities, where the former are holdings of non-euro denominated cash, securities issued by non-euro area residents, loans issued to non-euro area residents and IMF gold, receivables and special drawing rights (SDRs), and the latter are defined as above, as are $Longer\ term\ financial\ liabilities_t$. $Net\ other\ counterparts_t$ contains remaining items on a euro area bank balance sheet, for example, fixed assets, financial derivative positions, accrued interest receivable/payable on loans and deposits, and dividends to be received/paid.

To gain insight to the relation between monetary aggregates, credit, international aspects

[9] M1= currency + overnight deposits; M2 = M1+ deposits with an original maturity of less than 2 years + deposits redeemable with 3 months notice; M3 = M2 + repurchase agreements + money market fund shares/units + debt securities issued by monetary financial intermediaries with an original maturity of less than 2 years. Longer-term financial liabilities comprise deposits with an agreed maturity greater than two years, debt securities issued by euro area MFIs with an original maturity greater than two years, deposits redeemable with a period of notice greater than three months, and capital and reserves. External liabilities are defined as deposits claims by non-euro area residents on EA banks, loans issued by non-euro area residents to EA banks, holdings of non-euro area residents of money market fund shares/units and debt securities issued by MFIs with an original maturity greater than two years. The currency denomination of external liabilities is irrelevant. The key defining criteria is they are held by non-euro area residents.

[10] Following this approach core liabilities, consisting of M1+M2, are inclusive of deposits from other financial intermediaries. Furthermore, given the construction of euro area monetary aggregates is based on the common currency, included are intra-euro area cross-border deposits, for example the euro-denominated deposits by a French non-financial corporate in a German bank.

of euro area bank balance sheets and global financial conditions, consider the following example. An increase in M3 driven by non-financial corporate deposits via the M1 component of this broad monetary aggregate, can affect its counterparts on the right hand side of equation (1) in many combinations. A non-exhaustive example would be an increase of non-financial corporate deposits of €80 billion leads to: (i) increased credit to euro area residents of €80 billion; (ii) an increase in net external assets of €80 billion; (iii) a reduction in long-term financial liabilities of €80 billion, or (iv) a decrease in euro area resident credit of €80 billion and an increase in net external assets of €160 billion.

Example (iv) is closest to recent developments observed in the counterparts to M3 in the euro area (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 transactions of the net external assets of EA banks is predominantly driven by expanding external assets during a period of contracting external liabilities (Figure 3).[11] 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. In particular, it is examined how global financial conditions affect the global flows of EA banks quantified in terms of net external assets.

2.2.2 Banks and non-banks

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).

The sum of transactions on the balance of payments - the sum of the current account, capital account and errors and omissions - equates to zero:

$$NEA + BOP^{NonMFI} = 0 \tag{2}$$

which implies

[11] 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.

$$NEA = -BOP^{NonMFI} \tag{3}$$

so that net inflows in the net external assets of the banking sector, NEA, equate to net outflows in the net external assets of the money-holding sector BOP^{NonMFI}. To understand the relation between the extra-euro area transactions of the banking sector and the money-holding sector consider the following scenarios:

- Assume the purchase of an asset issued by an extra-euro area resident (e.g. UK corporate bond) by the money-holding sector (e.g. euro area household) is settled via a euro area bank. The euro area bank is likely to settle the transaction by reducing its deposits with the relevant extra-euro area bank (e.g UK bank). This is reflected in a reduction in the net external assets of the euro area bank and a corresponding increase in the net external assets of the euro area money-holding sector.

- Similarly, consider the purchase of an extra-euro area resident (e.g. UK bank) of a bond issued by the euro area money-holding sector (e.g. euro area non-financial corporate) which is settled through a euro area resident bank. This results in an increase in the net external assets of the euro area bank, reflecting a decline in the extra-euro area liabilities in the form of deposits due to the payment for the bond, and a decrease in the net external assets of the money- holding sector driven by an increase in its euro area liabilities.

- Extra-euro area transactions by the euro area money-holding sector will have no impact on the net external assets of EA banks if they are settled outside of the banking system. Examples include intra-group transactions, non-cash settlement of mergers and acquisitions, and settlement of transactions via extra-EA banks.

- Furthermore, the purchase of a euro area issued security by a euro area bank from an extra-euro area investor will affect transactions in the net external assets of the euro area bank but not the transactions of the money-holding sector who originally issued the security. The shift in the ownership of the liabilities of the money-issuing sector from an extra-euro area investor to a euro area bank will be reflected in the "other changes" component and stock position of the international investment position statistics of the money-holding sector, rather than in the recording of transactions on the balance of payments.

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. 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 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 euro area 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:

$$a_t = [\prod_{i=0}^{11}(1 + \frac{F_t^{M}{}_{-i}}{L_{t-1-i)}}) - 1] * 100 \tag{4}$$

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.[12] 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,

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

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 of 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 euro area bank i's balance sheet relative to the median euro area bank. Large banks are considered as those with balance sheets greater than the median 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.[13]

3.2 Global factors

A range of global factors identified in the theoretical and empirical literature as drivers of global liquidity are employed.

Global risk: 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. As part of the sensitivity analysis a range of alternative measures of global risk is considered: the VXO index of implied volatility of options on the S&P 100 index - the predecessor to the VIX index - is sourced from the CBOE; the VDAX volatility index as implied by the prices of DAX options is taken from Thomson Reuters Datastream; the Global Risk

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

Aversion Indicator (GRAI) is sourced from the ECB's Statistical Data Warehouse.[14]

Global bank balance sheets: The empirical counterpart to global bank balance sheets are represented by the top ten banks identified by the G-20's Financial Stability Board as being Global Systemically Important Banks (G-SIBs), and thereby having the potential to cause significant disruption in global financial markets owing to their size and interconnectedness. The assets and equity of G-SIBs are downloaded from Bloomberg.

Interest rates: Additional price relevant drivers of global liquidity also employed include the short-term interbank interest rate given this is the rate which monetary policy targets either directly or indirectly. Interbank interest rates, the LIBOR for the euro (i.e., EURIBOR), US dollar, UK sterling and Japanese Yen, are sourced from Thomson Reuters Datastream. The slope of the yield curve, calculated as the yield on the 10-year government bond minus the yield on a 3-month government security, is based on data from Thomson Reuters Datastream and Bloomberg.

Unconventional monetary policy: 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. This information is sourced for the four major central banks, namely the euro area, US, UK and Japan, from each central bank website, respectively.

3.3 Global and domestic control variables

Global control variables included are the effect of exchange rates, the differential cost of assets between the creditor and debtor countries and credit demand in the debtor country. Domestic controls are included to account for euro area credit demand.

Exchange rates: The real effective exchange data is sourced from Eurostat. The real effective exchange rate for is the weighted average of the euro relative to the currencies of its 42 largest trading partners, adjusted by relative consumer prices. A rise in the index implies a loss of competitiveness of the euro area relative to its largest trading partners.

[14]The DAX is the German Stock Market Index of 30 German companies. The GRAI is constructed as the first principal component of five currently available risk aversion indicators, namely Commerzbank Global Risk Perception, UBS FX Risk Index, Westpacs Risk Appetite Index, BoA ML Risk Aversion Indicator and Credit Suisse Risk Appetite Index. Similar to the better known VIX, VXO and VDAX, a rise in the GRAI indicator denotes an increase in risk aversion.

Global credit demand: The macroeconomic conditions of extra-euro area debtors are included as controls in the empirical analysis. The bilateral borrowings of debtors from euro area countries are taken from the BIS locational banking statistics. GDP data in debtor countries are sourced from the International Monetary Fund's International Financial Statistics.

Domestic credit demand: Unemployment is included in the parts of the empirical analysis as a control variable for domestic credit demand in the euro area. Data at a monthly frequency for each euro area country are sourced from Eurostat.

Table 1 provides the summary statistics and description of the main 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:

$$\begin{aligned} \Delta L_{ijt} &= \beta Global_t + \rho \Delta REER_t + \alpha Global\ credit\ demand_{jkt} + \psi Interest\ rate\ spread_t \\ &\quad \theta X_{ijt-1} + \gamma B_i + \delta C_j + \epsilon_{ijkt} \end{aligned} \tag{5}$$

where ΔL is the global flows of euro area bank i resident in country j at time t, scaled by total assets of bank i at time $t-1$. As an alternative dependent variable, the global flows of the external assets of euro area bank i at time t, normalised by total assets in $t-1$ is also used. Furthermore, to consider the relation between global factors, in particular the spillovers of unconventional monetary policy, and the real economy, a variable *Private Credit Flows* is included as a dependent variable to capture private non-financial sector credit flows (comprising loans to households and non-financial corporates). It is constructed in a similar manner to the other dependent variables.

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. The expected sign on the explanatory variable, *Global risk*, is negative, given decreased investor uncertainty is associated with increased international bank flows.[15] A minus sign on this variable is indicative that the global flows of euro area bank i are positively affected by a decline in global investor risk appetite.

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 expected effect of this variable is, therefore, positive and increased equity ought to induce an expansion in bank assets to meet its Value-at-Risk (VAR) constraint (Adrian and Shin, 2010). Also considered is global bank leverage, measured as assets divided by equity, where a positive coefficient on this variable represents an increase in bank leverage and is expected to increase the global flows of EA banks.

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. The expected sign on this coefficient is negative.

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). Should the impact of the short-term interest rate operate through this valuation mechanism of the "risk-taking channel" of monetary policy a negative sign will be expected on the $\Delta Global\ interest\ rate$ variable.

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

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

key channel through which unconventional monetary policy operates is the portfolio rebalancing channel, whereby 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. In this context, the direction on the coefficient, $\Delta Major\ CB\ Balance\ sheet$ is unclear.

Global control variables are captured by the credit demand of extra-euro area creditors, *Global credit demand*; $\Delta REER$ denotes the real effective exchange rate, and *Interest rate spread* represents the price differential between euro area and extra-euro area sourced credit.

Currency fluctuations also 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-á-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. A negative sign on the $\Delta REER$ coefficient indicates increases in the global flows of EA banks are associated with a decrease in the real effective exchange rate driven by depreciation of the euro vis-á-vis debtor currencies, or increase in competitiveness in the euro area.

$\Delta Credit\ Demand_{jkt}$ is the weighted average of GDP growth in the debtor country k of creditor country $j's$ aggregate banking system at time t. The full geographic profile of euro area bank 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-a-

vis its debtor banking systems (country k) is built as function of its net claims to each of its borrowing countries. An improvement in macroeconomic conditions in debtor countries is associated with an increase in the global flows of EA banks. The expected sign on this coefficient is, therefore, positive.

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. A positive sign on the coefficient $Interest\,rate\,spread$ is indicative that relatively greater returns on foreign assets are associated with greater global flows of EA banks, whereas a negative sign suggests that banks may be less willing to extend credit internationally if increased foreign interest rates reflect greater risk.

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). A negative sign on this variable suggests greater euro area unemployment is associated with smaller domestic private sector credit growth from EA banks.

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 euro area bank i and is given by the log of total assets. The capital of euro area 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, therefore, the expected signs on the coefficients $Size$ and $Capital$ are positive.

An indicator of the funding stability of euro area 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 expected impact of this variable could therefore be positive or negative. The liquidity of euro area 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 (5) are reported in Table 2, where the dependent variable is the growth in the net external assets of euro area 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 significant. This suggests an appreciation of the euro vis-á-vis the currencies of debtor countries and greater levels of bank liquidity are associated with increased global flows. When the VIX enters column (2) 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.[16]

[16]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

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 (6), when all global variables are included, only global risk and global bank equity growth continue to retain their statistical significance with the correct sign.

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 (7). 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-á-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, and the results are presented in Table 3. In columns (1) to (3), alternative measures of global risk are considered, namely the VXO, 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 euro area bank response to investor risk appetite is most sensitive to measures of global risk based on a euro area stock exchange index.

In column (4), global bank leverage replaces global risk, motivated by the global liquidity model of Bruno and Shin (2015), which predicts bank leverage fluctuates with shifts in global risk. 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 euro area 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 out-

incentivised banks to take on greater risk through increased credit growth to extra-euro area borrowers.

flows) 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. An increase in global bank equity is correlated with increased global flows in the external assets of EA banks indicating that an improvement in bank funding conditions is associated with an increase in euro area bank sourced global liquidity. Larger major central bank balance sheets are significant in explaining increased in the global flows in external assets. Consistent with the findings in Table 2, 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-á-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 5, the sample of EA banks is split by the key characteristics described in Section 3.1 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 relatively smaller banks, less capitalised banks, and banks resident in non-stressed euro area countries. The magnitude on *Global risk* is largest for relatively small banks, where a ten per cent decrease in global risk is associated with a 0.4 per cent decline in global flows. Global risk is also relevant for less capitalised EA banks. 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 cross border bank flows for smaller and less capitalised, banks resident in non-stressed countries, as well as banks with a smaller deposit funding base. The empirical results provide support for the "risk-taking channel" of monetary policy for smaller EA banks and those resident

in non-stressed euro area economies.

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 6 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 may 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.

In contrast, 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 is 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 securities sales to the ECB and other major central banks.

In this context, Table 7 reports the effects of global factors and unconventional monetary

policy on credit growth to the real economy, namely to non-financial corporates and households. The results in Table 7 suggest that euro area 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 euro area bank credit growth to extra euro area debtors, which are likely to be higher yielding assets.

A decline in global bank funding conditions is correlated with a decline in euro area non-financial private sector credit growth. 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, significantly and negatively affect credit growth to the non-financial private sector.

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 banks willingness 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 2014, Bruno and Shin 2015).

Bank type matters for the affect of global liquidity on developments on 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 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, but unconventional monetary policy in the form of asset purchases has a negative influence on euro area 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 domestic credit growth to the private non-financial sector.

Lower volatility in global risk and greater global bank equity positively affects global flows, an affect that is particularly felt by smaller, relatively less capitalised banks resident in non-stressed euro area countries. This highlights that the effect global liquidity is heterogenous 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 euro area 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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Diagrams, figures and tables

Diagram 1: Framework of global liquidity

Determinant	***Transmission channels***	***Consequences***
Private sector • Uncertainty and risk appetite • Global bank balance sheets *Public sector* • Monetary policy in globally systemic economies • Other policies	• Cross-border portfolio and bank flows	• Credit growth (domestic and external) of domestic banks • Credit cost and conditions • Asset prices

Source: IMF (2014)

Diagram 2: Stylised euro area bank balance sheet

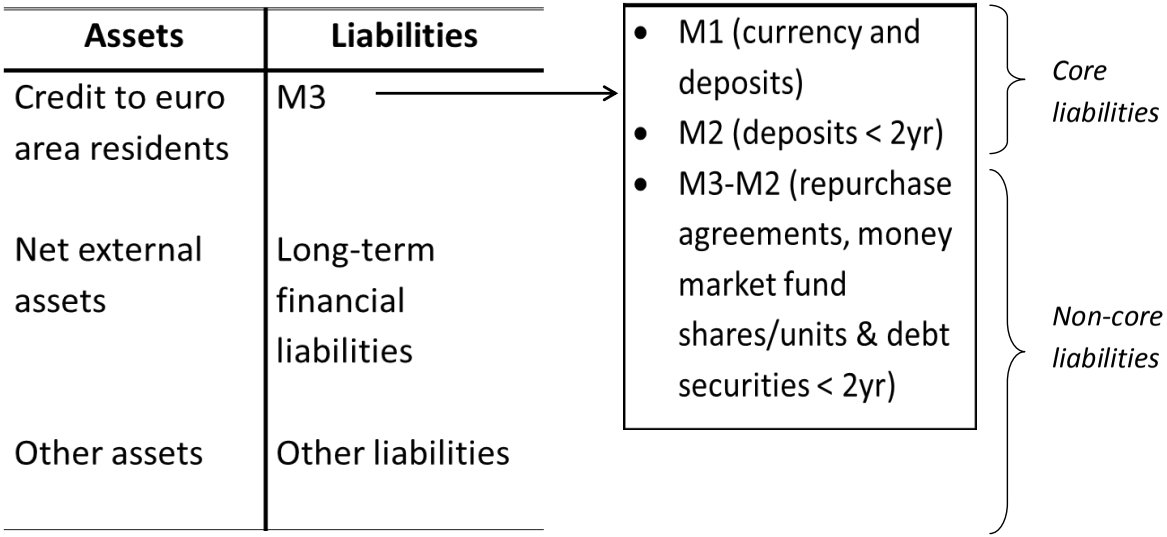
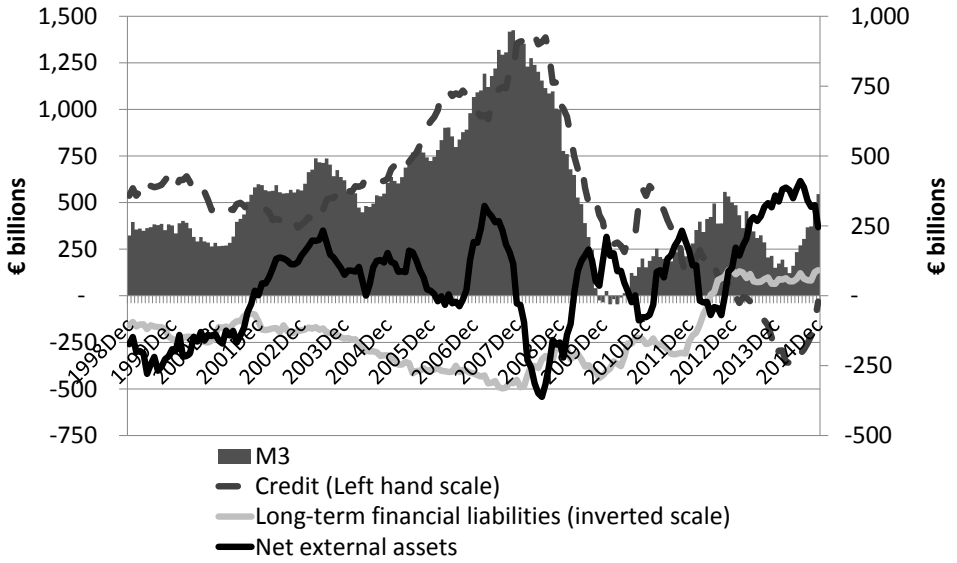
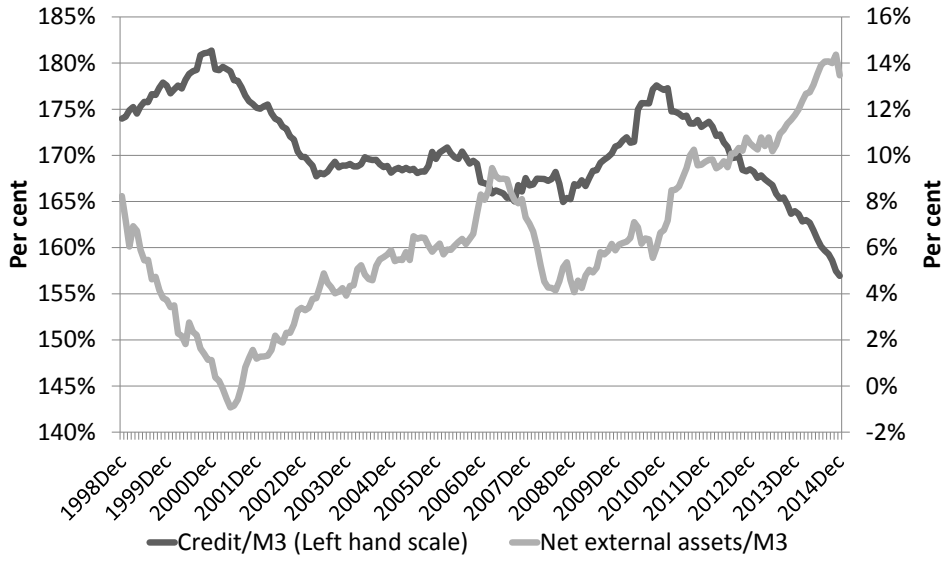


Figure 1: Main counterparts to M3 (flows), 1998 to 2014



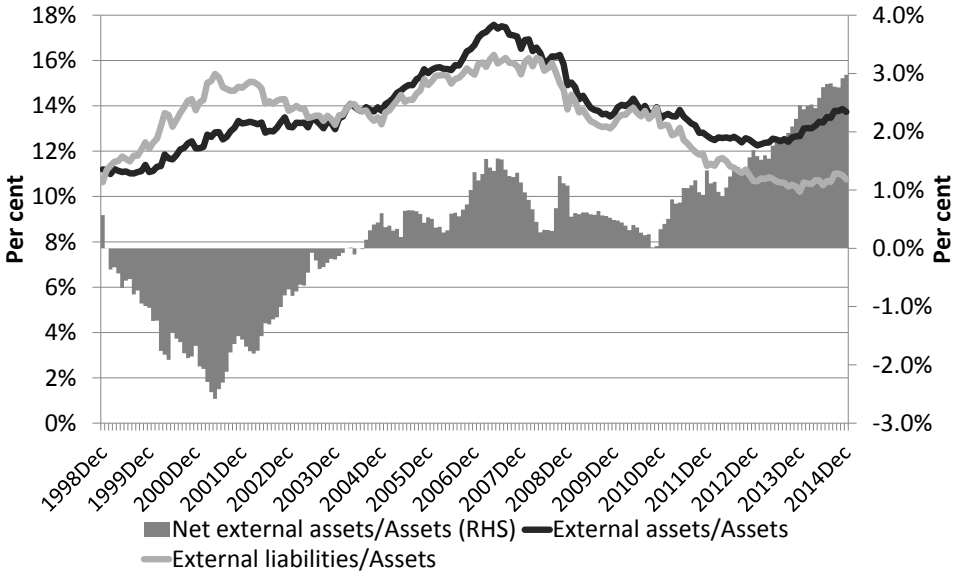
Notes: (i) Data are sourced from the ECB's Statistical Data Warehouse, (ii) a decrease in the long-term financial liabilities series indicates greater debt leveraging, and an increase represents deleveraging away from long-term financial liabilities, (iii) credit defined in the context of the M3 counterpart 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 euro area banks (stocks), 1998 to 2014



Data source: ECB's Statistical Data Warehouse

Table 1: Summary Statistics

Variable	Definition	Mean	Std.Dev.	Min.	Max.
	No. of observations = 11636				
Dependent variables					
Global flows	Annual growth in net external assets scaled by total assets from the previous period	-0.01	0.26	-7.58	3.56
Gross global flows	Annual growth in gross external assets scaled by total assets from the previous period	0.00	0.12	-0.97	3.41
Euro area credit	Annual growth in private sector credit scaled by total assets from the previous period	0.00	0.05	-0.62	1.01
Global factors					
Global risk (VIX)	The log of the VIX index	2.90	0.28	2.43	3.76
Global risk (VXO)	The log of the VXO index	2.85	0.31	2.26	3.79
Global risk (GRAI)	Global risk aversion indicator	-0.26	1.51	-2.64	5.08
Global risk (VDAX)	The log of the VDAX index	3.03	0.24	2.63	3.85
Global bank equity	Annual growth in the top ten globally systemic important banks	0.10	0.10	-0.04	0.32
Global bank leverage	The equity scaled by assets of the top ten globally systemic important banks	3.01	0.13	0.00	3.17
Slope of yield curve (average)	Average 10 year government bond yield/3 month treasury bill	2.13	0.42	1.32	2.98
Slope of yield curve (US)	Average 10 year government bond yield/3 month treasury bill (US)	2.41	0.60	1.38	3.67
Slope of yield curve (UK)	Average 10 year government bond yield/3 month treasury bill (UK)	2.55	0.70	1.30	3.94
Slope of yield curve (Japan)	Average 10 year government bond yield/3 month treasury bill (Japan)	0.79	0.23	0.33	1.27
Slope of yield curve (Euro area)	Average 10 year government bond yield/3 month treasury bill (euro area)	2.75	0.61	1.09	3.99
Interbank interest rate	Annual average growth of overnight interbank interest rate in US, UK, Japan and euro area	-0.18	0.37	-1.25	0.42
Major central bank balance sheets	Average annual growth in central bank balance sheets of the US, UK, Japan and euro area	0.11	0.05	0.00	0.23
Major central bank UMP	Average annual growth in central bank securities assets of the US, UK, Japan and euro area	0.24	0.15	0.00	0.77
US UMP	Annual growth in central bank securities assets of the US	0.27	0.25	-0.02	1.29
UK UMP	Annual growth in central bank securities assets of the UK	0.05	0.09	-0.12	0.26
Japan UMP	Annual growth in central bank securities assets of the Japan	0.26	0.11	0.00	0.51
Euro area UMP	Annual growth in central bank securities assets of the euro area	0.13	0.15	-0.08	0.34
Control variables					
Credit demand	Weighted average of the GDP growth of the main debtor countries of creditor banking systems.	0.19	0.14	-0.16	0.76
REER	Annual change in log of REER index.	-0.01	0.03	-0.11	0.06
Spread	Difference between euro area and average international interbank interest rates	-0.09	0.44	-1.03	0.90
Unemployment	Annual change in the unemployment rate	0.01	0.12	-0.30	0.50
Bank characteristics					
Total assets	The log of total assets	10.33	1.71	0.00	13.64
Capital	Capital and reserves/total liabilities	0.09	0.16	-8.50	0.97
Deposit funding	Household and non-financial corporate deposits/total liabilities	0.32	0.26	0.00	1.00
Liquid assets	Private sector and bank debt securities, interbank lending/total assets	0.29	0.20	0.00	1.00

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global factors							
Global risk		-0.024**				-0.023**	-0.031**
		(0.012)				(0.010)	(0.011)
Δ Global equity			0.257**			0.197**	0.203**
			(0.106)			(0.076)	(0.078)
Δ Global interest rate				-0.131**		-0.027	-0.008
				(0.052)		(0.028)	(0.030)
Δ Major CB balance sheet					-0.311**	-0.172	-0.191
					(0.147)	(0.133)	(0.135)
Global control variables							
Δ REER	0.241**	0.176**	0.603**	0.053	0.279**	0.438**	0.537**
	(0.085)	(0.076)	(0.198)	(0.090)	(0.094)	(0.173)	(0.177)
Global credit demand	-0.047	-0.044	-0.058	-0.011	-0.025	-0.034	-0.074*
	(0.040)	(0.040)	(0.042)	(0.041)	(0.040)	(0.041)	(0.042)
Interest rate spread	0.019	0.023	0.027	0.132**	0.007	0.045*	0.023
	(0.018)	(0.018)	(0.020)	(0.058)	(0.014)	(0.026)	(0.027)
Bank control variables							
Size	-0.017	-0.017	-0.016	-0.016	-0.016	-0.016	-0.010
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capital	0.124	0.103	0.163	0.147	0.124	0.138	0.053
	(0.186)	(0.192)	(0.185)	(0.185)	(0.187)	(0.191)	(0.219)
Deposits	0.059	0.052	0.070	0.062	0.053	0.057	0.002
	(0.212)	(0.213)	(0.211)	(0.211)	(0.211)	(0.212)	(0.214)
Liquidity	0.643***	0.641***	0.650***	0.643***	0.643***	0.647***	0.566**
	(0.175)	(0.174)	(0.175)	(0.174)	(0.173)	(0.173)	(0.178)
Observations	11593	11593	11593	11593	11593	11593	11593
R^2	0.150	0.150	0.153	0.152	0.154	0.155	0.153
Adj R^2	0.134	0.135	0.138	0.136	0.138	0.140	0.138
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 the net global flows of euro area banks. The dependent variable in columns (1) to (6) is growth in net external assets normalised by total assets in the previous period. The dependent variable in column (7) is the difference between the growth in net external assets and euro area private non-financial credit of euro area 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 euro area banks, sensitivity analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global factors							
Global risk	-0.022**	-0.005**	-0.038**		-0.022**	-0.010	-0.004
	(0.009)	(0.002)	(0.013)		(0.010)	(0.009)	(0.010)
Δ Global equity	0.194**	0.187**	0.206**	0.226**	0.242***	0.211**	0.113**
	(0.076)	(0.078)	(0.083)	(0.082)	(0.070)	(0.078)	(0.052)
Δ Global interest rate	-0.029	-0.021	-0.024	-0.060*			
	(0.029)	(0.028)	(0.028)	(0.031)			
Δ Major CB balance sheet	-0.175	-0.175	-0.133	-0.103	-0.179	-0.107	-0.088
	(0.133)	(0.129)	(0.114)	(0.126)	(0.130)	(0.121)	(0.126)
Global bank leverage				-0.188***			
				(0.052)			
Interest rate slope (average)					-0.009		
					(0.005)		
Interest rate slope euro area						-0.020***	-0.018*
						(0.005)	(0.009)
Interest rate slope US							-0.007
							(0.019)
Interest rate slope UK							0.028
							(0.021)
Interest rate slope Japan							-0.035
							(0.038)
Global control variables							
Δ REER	0.432**	0.446**	0.453**	0.200	0.525**	0.465**	0.341**
	(0.172)	(0.171)	(0.171)	(0.154)	(0.162)	(0.161)	(0.127)
Global credit demand	-0.034	-0.035	-0.039	-0.051	-0.041	-0.054	-0.066
	(0.041)	(0.041)	(0.041)	(0.043)	(0.041)	(0.042)	(0.045)
Interest rate spread	0.046*	0.042	0.042	0.086**	0.026*	0.023	0.008
	(0.026)	(0.026)	(0.026)	(0.032)	(0.014)	(0.015)	(0.013)
Observations	11593	11593	11593	11593	11593	11593	11593
R^2	0.155	0.156	0.156	0.157	0.155	0.156	0.157
Adj R^2	0.140	0.140	0.140	0.142	0.140	0.141	0.142
Bank control variables	Y	Y	Y	Y	Y	Y	Y
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 the net global flows of euro area banks. The dependent variable is growth in net external assets normalised by total assets in the previous period. In columns (1) to (3) global risk is measured by the VXO, GRAI and VDAX, respectively. In columns (4) to (7) global risk is represented by the VIX. Bank-level control variables are included in all regressions. 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 global outlflows of euro area banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global factors							
Global risk		0.007				-0.006	-0.013**
		(0.006)				(0.004)	(0.006)
Δ Global equity			0.029			0.069**	0.075**
			(0.028)			(0.028)	(0.031)
Δ Global interest rate				-0.006		-0.025	-0.007
				(0.015)		(0.022)	(0.024)
Δ Major CB balance sheet					0.086*	0.144**	0.124*
					(0.048)	(0.068)	(0.070)
Global control variables							
Δ REER	-0.082**	-0.063*	-0.041	-0.091**	-0.093**	-0.055	0.044
	(0.033)	(0.035)	(0.053)	(0.037)	(0.035)	(0.056)	(0.063)
Global credit demand	0.029	0.028	0.028	0.031	0.023	0.023	-0.017
	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)	(0.020)	(0.023)
Interest rate spread	-0.019*	-0.020*	-0.018*	-0.014	-0.016*	0.011	-0.010
	(0.010)	(0.011)	(0.010)	(0.014)	(0.009)	(0.015)	(0.017)
Bank control variables							
Size	-0.019**	-0.019**	-0.019**	-0.019**	-0.020**	-0.019**	-0.014
	(0.009)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Capital	0.456**	0.462**	0.460**	0.457**	0.456**	0.466**	0.381
	(0.189)	(0.192)	(0.189)	(0.189)	(0.189)	(0.193)	(0.233)
Deposits	0.195	0.197	0.196	0.195	0.197	0.200	0.144
	(0.179)	(0.180)	(0.179)	(0.179)	(0.179)	(0.181)	(0.186)
Liquidity	0.198**	0.198**	0.198**	0.198**	0.197**	0.199**	0.118
	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.071)	(0.081)
Observations	11593	11593	11593	11593	11593	11593	11593
R^2	0.200	0.201	0.201	0.200	0.202	0.203	0.205
Adj R^2	0.186	0.186	0.186	0.186	0.188	0.189	0.190
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 the global outflows of euro area banks. The dependent variable in columns (1) to (6) is growth in external assets normalised by total assets in the previous period. The dependent variable in column (7) is the difference between the growth in external assets and euro area private non-financial credit of euro area 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 5: Global liquidity and the net global flows of euro area 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	-0.042**	-0.007	-0.039*	-0.009	-0.029	-0.014	-0.027*
	(0.005)	(0.020)	(0.007)	(0.020)	(0.006)	(0.018)	(0.012)	(0.014)
ΔGlobal equity	-0.011	0.353**	0.019	0.455**	-0.004	0.443**	0.025	0.286**
	(0.027)	(0.141)	(0.027)	(0.165)	(0.023)	(0.160)	(0.039)	(0.106)
ΔGlobal interest rate	-0.024	-0.079	-0.020	-0.012	-0.010	-0.036	-0.032	-0.055
	(0.015)	(0.052)	(0.019)	(0.054)	(0.008)	(0.055)	(0.027)	(0.036)
ΔMajor CB balance sheet	0.026	-0.315	0.073	-0.440	0.046	-0.336	0.192	-0.280
	(0.030)	(0.262)	(0.070)	(0.268)	(0.032)	(0.261)	(0.120)	(0.172)
Global control variables								
ΔREER	-0.056	0.730**	0.028	0.915**	-0.035	0.913**	-0.300*	0.711**
	(0.057)	(0.289)	(0.090)	(0.307)	(0.028)	(0.336)	(0.155)	(0.225)
Global credit demand	-0.032	0.065	0.001	-0.027	-0.014	-0.100	-0.004	0.145
	(0.024)	(0.114)	(0.029)	(0.140)	(0.020)	(0.091)	(0.042)	(0.190)
Interest rate spread	0.024*	0.099*	0.001	0.082	-0.004	0.100*	0.014	0.075**
	(0.014)	(0.054)	(0.016)	(0.058)	(0.014)	(0.054)	(0.019)	(0.035)
Bank control variables								
Size	-0.004	-0.008	-0.003	-0.015	-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	-0.049	0.283	0.001	-1.810	-0.144	0.386	0.102	0.302
	(0.081)	(0.325)	(0.145)	(2.273)	(0.208)	(0.512)	(0.083)	(0.493)
Deposits	0.075	-0.056	-0.095	0.583*	0.061**	0.432	-0.100	0.104
	(0.056)	(0.385)	(0.097)	(0.339)	(0.025)	(0.619)	(0.112)	(0.358)
Liquidity	0.122	0.896***	0.143	1.022***	-0.003	1.051***	-0.041	0.862***
	(0.093)	(0.245)	(0.087)	(0.256)	(0.031)	(0.210)	(0.042)	(0.226)
Observations	6027	5566	6429	5164	6074	5519	3165	8428
R^2	0.539	0.183	0.194	0.252	0.300	0.211	0.153	0.183
Adj R^2	0.529	0.164	0.175	0.231	0.284	0.192	0.135	0.168
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 euro area 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

	(1)	(2)	(3)	(4)	(5)	(6)
Global factors						
Global risk	-0.039**	-0.041**	-0.031**	-0.007	-0.008	-0.006
	(0.014)	(0.014)	(0.013)	(0.007)	(0.008)	(0.007)
Δ Global equity	-0.039**	-0.041**	-0.031**	-0.007	-0.008	-0.006
	(0.014)	(0.014)	(0.013)	(0.007)	(0.008)	(0.007)
Δ Global interest rate	-0.059*	-0.051*	-0.114**	-0.117**	-0.008	-0.032
	(0.032)	(0.031)	(0.049)	(0.048)	(0.027)	(0.039)
Δ Major CB UMP	0.018					
	(0.023)					
Δ UMP US		0.027				0.029
		(0.020)				(0.021)
Δ UMP UK			0.105**			0.086
			(0.041)			(0.054)
Δ UMP Japan				0.194**		-0.020
				(0.071)		(0.049)
Δ UMP Euro area					-0.154**	-0.179**
					(0.065)	(0.080)
Global control variables						
Δ REER	0.347**	0.270**	0.166	0.089	0.254*	-0.085
	(0.140)	(0.127)	(0.142)	(0.144)	(0.138)	(0.115)
Global credit demand	-0.039	-0.038	-0.047	-0.058	-0.052	-0.060
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.043)
Interest rate spread	0.083**	0.076*	0.129**	0.149**	0.057*	0.077**
	(0.041)	(0.039)	(0.055)	(0.061)	(0.033)	(0.037)
Bank control variables						
Size	-0.016	-0.016	-0.016	-0.015	-0.015	-0.015
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capital	0.146	0.148	0.141	0.086	0.078	0.084
	(0.193)	(0.193)	(0.190)	(0.199)	(0.203)	(0.204)
Deposits	0.062	0.063	0.061	0.039	0.034	0.037
	(0.213)	(0.212)	(0.211)	(0.213)	(0.214)	(0.214)
Liquidity	0.648***	0.649***	0.649***	0.647***	0.646***	0.648***
	(0.174)	(0.174)	(0.174)	(0.173)	(0.173)	(0.173)
Observations	11593	11593	11593	11593	11593	11593
R^2	0.155	0.155	0.155	0.156	0.157	0.158
Adj R^2	0.139	0.139	0.140	0.141	0.141	0.142
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 euro area 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 7: International spillovers of unconventional monetary policy to the euro area real economy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Global factors							
Global risk	0.009**	0.011**	0.011**	0.009**	0.002	0.002	0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.002)	(0.002)
Δ Global equity	0.030**	0.028**	0.029**	0.020	-0.004	0.000	-0.009
	(0.013)	(0.014)	(0.014)	(0.015)	(0.018)	(0.018)	(0.020)
Δ Global interest rate	0.010**	0.009**	0.009**	0.010**	0.005	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Δ Major CB Balance Sheet	0.016						
	(0.016)						
Δ Major CB UMP		-0.008					
		(0.005)					
Δ UMP US			-0.005				-0.001
			(0.003)				(0.003)
Δ UMP UK				-0.023**			-0.003
				(0.009)			(0.009)
Δ UMP Japan					-0.055***		-0.034**
					(0.016)		(0.013)
Δ UMP Euro area						0.039***	0.024**
						(0.012)	(0.012)
Domestic control variables							
Domestic credit demand	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
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	0.087	0.086	0.086	0.091	0.111	0.106	0.114
	(0.117)	(0.117)	(0.117)	(0.118)	(0.120)	(0.119)	(0.120)
Deposits	0.059**	0.058**	0.058**	0.060**	0.068**	0.067**	0.070**
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)
Liquidity	0.083***	0.083***	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	0.362	0.362	0.362	0.363	0.368	0.367	0.369
Adj R^2	0.350	0.350	0.350	0.351	0.356	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 euro area 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.