Essays on international financial integration and the financial sector

Daniel Carvalho

A thesis submitted for the degree of

Doctor of Philosophy

Economics Department

Trinity College Dublin

March 2016

Declaration

I declare that this thesis, submitted to Trinity College Dublin for the degree of Doctor in Philosophy (Ph.D.), has not been submitted as an exercise for a degree at this or any other university.

I agree to deposit this thesis in the Universitys open access institutional repository or allow the library to do so on my behalf, subject to Irish Copyright Legislation and Trinity College Library conditions of use and acknowledgement.

All research contained herein is entirely my own with the exception of the second chapter, which was written and published in co-authorship, as duly acknowledged in the text wherever included.

Acknowledgements

These pages represent the end of a long journey, longer than the time I was enroled as a graduate student in Trinity College. It is a difficult task to put all that into these few words. But here we go.

First and foremost, I am very grateful to Philip Lane for having taken me under his supervison, for the invaluable advice and guidance throughout my studies. It was a priviledge to share and discuss ideas and thoughts with him.

To my colleagues at Trinity College Dublin I thank for the great spirit and working environment.

In reverse chronological order:

To Michael Fidora I thank for having dropped the initial skepticism and providing me with the impulse I needed in the early stages.

To Antonello D'Agostino for a casual office chat that completely changed the course of events.

To Ana Balcão Reis and Luís Santos-Pinto for not giving up and going out of their way in providing me with belief and conviction (as well as lots of patience in addressing the inumerous practical issues).

Finally:

To Mike Downes and his lovely family for being incredibly generous and friendly. To Dave Kennerley for putting up with me for a (very intense) semester.

To my friends for the encouragement and helping me strike a balance.

And lastly, to my family: no words can portray the importance of your constant rock-solid support through the ups and, most importantly, the inevitable downs.

Summary

This dissertation encompasses four essays, which deal with issues related to the cross-border financial integration and the financialization of economies.

The first essay analyses whether foreign bond buying of euro area securities had an impact on euro area long-term interest rates. Capital flows into the euro area were particularly large in the mid-2000s and the share of foreign holdings of euro area securities increased substantially between the introduction of the euro and the outbreak of the global financial crisis. The essay shows that the increase in foreign holdings of euro area bonds in this period is associated with a reduction of euro area long-term interest rates by about 1.55 percentage points, which is in line with previous studies that document a similar impact of foreign bond buying on US Treasury yields. These results are relevant both from a euro area and a global perspective, as they show that the phenomenon of lower long-term interest rates due to foreign bond buying is not exclusive to the United States and foreign inflows into euro area debt securities may have added to increased risk appetite and hunt-for-yield at the global level.

The second essay studies the composition of cross-border flows and their relationship with credit and money aggregates. While previous studies have focused on the relationship between international capital flows and domestic credit growth, highlighting the importance of the equity/debt mix, this chapter shows that there are also important implications of flows going to different domestic recipient sectors, especially concerning money dynamics. In particular, cross-border banking flows display a strong comovement with credit but none with broad money; in turn, flows of domestic non-banks

display comovement with both credit and money. For this reason, banking flows correlate with the decoupling of these two variables – the Great Leveraging –, a stylised fact documented for several economies in the past decades and associated to the rapid expansion of banks non-monetary liabilities. These results thus shed light on the mechanisms through which the international banking activity might have consequences for the composition of the domestic bank balance sheet.

The third essay looks at the interaction of financial flows and asset prices dynamics and how they contribute to shaping sectoral balance sheets and leverage for a set of OECD plus a few other mostly European countries. While debt instruments exhibit small holding gains and losses, equity instruments are subject to significant asset price changes. Importantly, these equity holding gains and losses display a significant positive comovement with investment in debt instruments. These patterns imply that, overall, favourable price valuations go hand in hand with the active build up of debt (and vice-versa), as well as tend to mask the increase in leverage when one considers measures based on market prices. Furthermore, this relationship is distinct across different sectors and financial corporations are the main drivers of this procyclical behaviour.

Finally, the fourth essay establishes how financial accounts data allow for the computation of interlinkages across financial sectors and document how intra-financial assets of financial corporations have been growing considerably in recent times in a set of mostly advanced economies. How is this increase in financial sectors interconnectedeness associated with credit provided to end-user non-financial sectors? While intra-financial assets growth displays no significant comovement with credit provided to non-financial corporations and the general government, it does with credit provided to households. Moreover, this relationship stems mostly from claims among non-bank and across non-bank and bank financial corporations, and not from intra-bank claims. These results suggest that the expansion of the financial corporations' interlinkages has been mostly associated with residential mortgages and consumption lending which, through activities such as securitization, contribute to the growth of links across the different financial sectors.

Finally, general conclusions from this dissertation are presented in the last chapter.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

High levels of financial assets and liabilities are a common feature of most modern economies of our times. This process of financialization, together with the spectacular increase in cross-border financial activity and the unprecedented accumulation of external assets and liabilities, has attracted substantial attention and has led to an increased awareness of the need to better understand the dynamics of aggregate balance sheets. Against this background, this dissertation focuses on different aspects of the financial links within and across different economies.

The main objective of the second chapter is to assess whether foreign purchases of euro area bonds since the introduction of the euro and in the run-up to the global financial crisis had a significant impact on euro area long-term interest rates, i.e., assessing whether the same mechanism that was found to be behind the downward impact of foreign inflows into US securities might also have been at play in the euro area.

Generalising to other developed economies the results that have been found to hold for the United States is important to further strengthen the evidence in favour of the hypothesis that there is a causal link going from foreign bond buying to long-term interest rates. It would show that the correlation that is documented for the United States is not due to characteristics which are specific to the United States and not easily controlled for in a single country framework, such as the role of US dollar reserve

accumulation by Chinese authorities in the context of China's US-dollar pegged exchange rate regime.

The euro area is arguably not affected by this potential bias stemming from large scale bond buying by authorities of large economies whose currencies are pegged to the currency of the bond-issuing economy. At the same time, the euro area is sufficiently "similar" to the United States to allow for a meaningful comparison given the size of the euro area economy and its financial market. In particular, while the euro has not caught up with the US dollar in foreign exchange reserve portfolios, the euro area is already financially more open than the United States according to conventional measures.

The results indicate that, all else equal, the increase in foreign holdings of euro area bonds from the first quarter of 2000 to mid-2006 led to a decrease in euro area long term interest rates of around 1.55 percentage points. These results are in line with other studies' findings on the impact of foreign bond buying on US long-term interest rates.

The main contribution of chapter three is to assess how financial integration and, specifically, how different types of capital flows interact with developments in the relationship between credit and money. Despite the examples of studies where the relationship between cross-border finance and private domestic credit and the incidence of crisis episodes is analysed, the literature is yet to explore how financial integration affects the interplay between the two variables in the same framework. Doing so casts light on how cross-border capital flows contribute to the funding of domestic banks, how they might affect the shape and composition of banks' liabilities, as well as the asset side and the transmission of this funding into domestic credit to non-banks.

The relevance of putting together the asset and liability sides of the banking sector balance sheet in an integrated manner is strengthened by the recent empirical evidence establishing two distinct periods concerning the dynamics of credit and money: while both were growing at roughly the same pace since the end of the Second World War until the early 1970s, from that period on credit grew faster than money. This decoupling between the two variables – the so-called Great Leveraging –, was achieved by the fast expansion of banks non-monetary liabilities, such as long-term debt securities, which enabled them to grant credit beyond their deposit base, and can be seen as a measure of leverage in the banking sector.

Turning to the results, banking sector flows display significantl co-movement with the ratio of credit to money for a group of countries encompassing OECD members plus other mostly Asian and Latin American countries: on the one hand, banking flows display a strong co-variation with credit growth dynamics and, on the other hand, the same is not valid for developments in money. Actually, it turns out that money growth is exclusively associated with non-banking sector flows, while the relation of these flows with credit is less pronounced than with the flows of the banking sector. Finally, turning to the equity/debt split, and irrespective of the sectoral breakdown of flows, these relationships work via debt flows while equity mostly plays only a negligible role.

One of the components of balance sheets is the stock-flow adjustment (SFA), i.e., the changes in financial stocks which are not caused by further transactions carried out by investors. This SFA, which is roughly made up of price and exchange rate variations (as well as other residual adjustments), constitutes the capital gain element of the total return earned by investors; the total investment return is obtained by adding to the latter the dividends and interest received/paid, recorded in the income accounts. There is an almost mechanical reason as to why SFAs have been gaining importance in recent times: as financial stocks increase, even small changes in the underlying prices of assets can lead to substantial shifts in the market value of these stocks.

Accordingly, the main objective of the fourth chapter is to analyze how financial flows and SFAs interact and affect the overall dynamics of balance sheet expansion and leverage in a cross-country setup, encompassing OECD countries and a few other mostly Eastern European countries. In doing so, I pay particular attention to the financial instrument composition and sectoral developments, given the different characteristics of types of capital and institutional sectors. On the one hand, starting with the financial instrument, the split into the two broad equity and debt categories shows significant differences: while debt instruments are mostly driven by flows and have, on average, very small SFAs, equity instruments are subject to significant valuation changes. On the other hand, the sectoral breakdown is relevant given the possibility of distinct investment behaviour of different institutions regarding asset price movements. Therefore, in broad terms, I look at the relationship between equity and debt flows and SFAs, accounting for the different financialization and leverage

levels across the countries considered, and paying particular attention to the differences across sectors as well as developments before and after the outburst of the global financial crisis.

Regression analysis shows that, for both equity and debt, the comovement *within* the same asset class is strongly dominated by flows and that SFAs play no role in this case. However, the same does not apply to comovement *across* different asset classes. Specifically, while there is no significant comovement between equity flows and either debt flows or SFAs, on the contrary, there is a significant comovement between debt flows and equity SFAs, but not with equity flows. Moreover, this comovement is stronger for equity liability than asset SFAs, and for both asset and liability debt flows; equity asset SFAs display only a weak relationship with debt asset flows. Further exploring the relationship between debt flows and equity liability SFAs at the sectoral level indicates that most of this covariation pattern observed for the total balance sheet is driven by financial corporations, on both the asset and liability sides. Importantly, in all these situations, the comovement is positive, indicating that investment in debt instruments and asset price changes are mutually reinforcing.

The noteworthy increase of the financial sector's size is a trademark of several economies of our times, which, in some cases, was faster than that of the non-financial sectors. While most studies of the financial sector balance sheet have focused on its *total* size, other more recent work has instead turned to the size of intra-financial assets, i.e., the size of financial relationships among financial corporations.

In line with the latter approach, the goal of the fifth chapter is twofold. First of all, it draws on financial accounts and sectoral balance sheet data to measure, in a harmonized fashion and at the aggregate level, intra-financial assets and interconnectedness among the domestic financial sectors for a broad set of countries mostly encompassing OECD members. This is an important contribution as, to the best of my knowledge, there is so far no cross-crountry study pinning down the size of claims within the financial sector. In doing so, the essay documents the rapid expansion of these financial sector intra-sectoral claims in recent years. Second, it seeks to look at the cross-country evidence of the relationship between intra-financial assets and domestic credit to end-user sectors, i.e., how this higher interconnectedness between financial sector institutions is associated with credit provided to the resident non-financial sectors.

Results show that while there is no statistically significant relationship between the growth in intra-financial assets and credit provided to non-financial corporations and the general government, there is however with credit provided to the household sector. Moreover, this relationship stems from claims among non-bank and across non-bank and bank financial corporations, but not from intra-bank claims. Taken together, this evidence lends support to the idea that the growth of intra-financial claims was associated to activities such as securitization – which establishes financial links across monetary and non-monetary financial corporations – and expanded mostly on the back of residential mortgage and consumption associated lending.

Chapter 2

Capital inflows and euro area long-term interest rates[1]

2.1 Introduction

There is by now a large literature that focuses on how international capital flows contributed to the unusually low levels of US long-term interest rates in the mid-2000s, which former Chairman of the Federal Reserve Board Alan Greenspan referred to as a "conundrum" (Greenspan, 2005). According to the "global savings glut" hypothesis (see Bernanke, 2005, 2007) large — and possibly excessive — net savings in some regions of the world — in particular in emerging economies in Asia but also in oil exporting countries — triggered large net capital inflows into US securities which ultimately exerted downward pressure on US long-term interest rates. Specifically, Warnock and Warnock (2009) estimate that foreign official inflows into US Treasuries lowered 10-year Treasury yields by about 80 basis points in the twelve months ending May 2005.

The coincidence of large capital inflows and low levels of long-term interest rates is however not a characteristic specific to the United States in the mid-2000s. Figure 2.1 shows a strong comovement

[1] This chapter was written in co-authorship with M. Fidora.

between euro area and US long-term interest rates with both series declining in the first half of the 2000s and up until end-2006. Over the same period, foreign purchases of both euro area and US securities were steadily increasing until end-2006 (see Figure 2.2).

This evidence points to the possibility that the same mechanism that was behind the downward impact of foreign inflows into US securities might also have been at play in the euro area. Yet, to our knowledge there is so far no study which examines the impact that foreign bond buying in the first half of the 2000s had on long-term interest rates of the euro area or, more generally, of advanced economies other than the United States. This is striking for a number of reasons.

First, the question arises whether the results that have been found to hold for the United States can be generalised to other developed economies. This would further strengthen the evidence in favour of the hypothesis that there is a causal link going from foreign bond buying to long-term interest rates as it would show that the correlation that is documented for the United States is not due to characteristics which are specific to the United States and not easily controlled for in a single country framework, such as the role of US dollar reserve accumulation by Chinese authorities in the context of China's US-dollar pegged exchange rate regime.

In the pre-crisis period foreign acquisition of US debt securities was largely accounted for by Chinese residents and in particular the Chinese official sector. This reflects the accumulation of foreign exchange reserves by Chinese authorities under the US dollar-pegged exchange rate regime. The empirical literature on the link between foreign bond buying and long-term interest rates typically emphasises the usefulness of isolating purchases of the foreign official sector, as these are likely to be non-financially motivated and hence argued to be independent from yields. This in turn would allow for establishing a direction of causality from foreign bond buying to long-term interest rates. However, foreign official sector purchases might still respond to shocks which at the same time affect yields and hence the observed correlation may not reflect a causal link between the two variables. This is in particular the case for purchases of foreign official authorities that aim at maintaining a fixed bilateral exchange rate. For example, monetary policy shocks that negatively affect both interest rates and the exchange rate of the bond-issuing country may trigger bond purchases by the authorities of the pegging country in order to stem the pressure for a appreciation of the bilateral exchange rate vis-à-vis the bond-issuing

country (and thereby also preserve the value of its foreign exchange reserves in domestic currency). This, in turn, could generate a negative correlation between foreign inflows and interest rates in the data which does not however reflect causality. ‘

The euro area is arguably not affected by this potential bias stemming from large scale bond buying by authorities of large economies whose currencies are pegged to the currency of the bond-issuing economy. At the same time, the euro area is sufficiently“similar” to the United States to allow for a meaningful comparison given the size of the euro area economy and its financial market. Importantly, the euro is an important issuer of domestic currency denominated debt to global investors and has by now gained a track record as a reserve currency successfully continuing the heritage of the Deutsche Mark also during the crisis.[2]

Moreover, while the euro has not caught up with the US dollar in foreign exchange reserve portfolios, the euro area is already financially more open than the United States according to conventional measures. In particular, between 2003 and 2006 which corresponds to the period under inspection in this analysis, euro area cross-border positions (excluding intra-euro area holdings) exceeded those of the United States by on average about 60 percent of GDP (although the statistics might be partly contaminated by the effect of round-tripping of euro area asset holdings through the United Kingdom).[3] Furthermore, the shares of foreign ownership in the total outstanding securities of all issuers are similar for both the United States and the euro area, standing at around 25 percent in mid-2006 (see Table 2.1).

These stylised facts taken together with the process of growing financial integration, where international markets play an increasingly larger role in determining long-term interest rates, also exemplify that understanding the effects of foreign bond buying on euro area long-term interest rates is relevant to understanding developments not only in the euro area itself but also globally. By contributing to an environment of low interest rates, these inflows might have led to increased risk taking in a hunt-for-yield context at the global level. Thus, understanding the funding process of the euro area is of the essence to get a more comprehensive picture of the global flow-of-funds.

[2]See ECB (2014)

[3]In the three-year periods 1999–2002, 2003–2006 and 2007–2010 the ratio of total foreign assets and liabilities to GDP amounted to 198, 254 and 336 percent, respectively, in the euro area compared to 140, 192 and 285 percent, respectively, in the United States according to IMF IFS data.

Finally, since the euro area, in contrast to the United States, recorded a roughly balanced current account throughout the period under review, the significant foreign inflows into euro area securities also highlight the importance of understanding gross financial flows and stocks and the implications of the important linkages they establish (see Lane and Milesi-Ferretti, 2007).

The main objective of this essay is therefore to assess whether foreign purchases of euro area bonds since the introduction of the euro and in the run-up to the global financial crisis had a significant impact on euro area long-term interest rates. In order to take into account endogeneity issues, we follow Bandholz et al. (2009) and Beltran et al. (2013) and use a parsimonious vector error correction model (VECM) to estimate the effect of foreign holdings on euro area long-term interest rates. The results indicate that, all else equal, the increase in foreign holdings of euro area bonds from the first quarter of 2000 to mid-2006 led to a decrease in euro area long term interest rates of around 1.55 percentage points. These results are in line with other studies' findings on the impact of foreign bond buying on US long-term interest rates.

The remainder of this chapter is organised as follows. Section 2 briefly discusses how capital flows affect long-term interest rates. Section 3 describes the data including our measure of foreign holdings. Section 4 presents the econometric evidence and Section 5 performs several robustness checks of the baseline model. Finally, Section 6 concludes.

2.2 Capital flows and long-term interest rates

Warnock and Warnock (2009) and Bertaut et al. (2012) are among the first to document an economically large and statistically significant impact of foreign purchases of US government bonds on long-term interest rates. In particular, Warnock and Warnock (2009) argue that foreign purchases of US government bonds have contributed importantly to the low levels of US interest rates prior to the global financial crisis and estimate the total impact at around 80 basis points.

It is important to note that both studies regress 10-year US Treasury bond yields on foreign official sector purchases of US Treasury bonds as well as on holdings of US Treasury and US government agency bonds by means of OLS, arguing that — while total foreign purchases and holdings of US

Treasury and Agency bonds might be endogenous to their yields — foreign official sector purchases and holdings should be exogenous. In order to explicitly address the issue of non-stationarity and endogeneity, Warnock and Warnock (2009) however also conduct robustness tests by estimating a VECM as in Bandholz et al (2009) and Beltran et al (2013), which all confirm an economically and statistically significant impact of foreign buying on US long-term interest rates.

The theoretical contributions reconciling the observed impact of asset demand on long-term interest rates with the expectations hypothesis generally emphasise the role of risk premia, i.e. the excess return over the expected future short-term interest rates that investors demand to hold an asset with a fixed long-term yield. There are two main types of models that explain how demand effects can have an impact on long-term interest rates.

On the one hand, portfolio balance theories show that by reducing the amount of a given maturity and thereby duration risk available in the market, purchases of long-term securities reduce the premium investors demand for that specific duration risk. This can be the case either because the marginal buyer of this specific duration risk who is dealing in the market is willing to pay a higher price for it, or alternatively because the average buyer decreases exposure to the specific duration risk and therefore demands a lower compensation to hold it (see Gagnon et al., 2010, Neely, 2010 and Bauer and Neely, 2012). Importantly, these effects are not necessarily confined to the asset being purchased but may also spill over to other assets.

On the other hand, preferred habitat models focus on heterogeneous investor preferences and imperfect substitutability between maturities and asset classes (see Vayanos and Vila, 2009). In these models, there are broadly two types of investors: those with preferences for specific maturities and risk-averse arbitrageurs. Faced with a demand shock in a given maturity that decreases yields, arbitrageurs will move along the yield curve looking for alternative higher yielding investment opportunities, while other investors with a preference for that specific maturity will stay put. The behaviour of arbitrageurs is the key mechanism of propagation of shocks to a specific maturity along the yield curve, the extent of which will however depend on their risk aversion. When risk aversion is high, arbitrageurs will be less willing to invest in other maturities and hence propagation will be low and demand shocks at longer maturities will produce larger impacts at the long end of the curve. Greenwood and Vayanos

(2010) study two events that led to pressures in specific parts of the yield curve — the UK Pension Reform in 2004 and the Treasury buybacks in 2000 and 2001 — and conclude that demand and supply effects were important drivers of yields. Moreover, high risk aversion of arbitrageurs also implies that monetary policy will be less effective as forward rates will under-react to changes in short-term rates.

2.3 Data

The ECB publishes a quarterly stock series and a monthly flow series of euro area inward portfolio investment by foreign investors in its balance of payments and international investment position statistics. The flow series starts in January 1999 and the stock series starts in March 1999. Importantly, the series exclude intra-euro area flows and stocks, i.e. only transactions and holdings involving non-euro area residents are included.[4]

The series are further broken down into equity and debt securities and, therein, long-term debt securities (bonds and notes) and short-term debt securities (money market instruments). Since a breakdown for bonds and notes issued by the general government sector is only available from 2006 onwards at the quarterly frequency for both flows and stocks – the share of foreign ownership is roughly 23 percent of the total outstanding in June 2006 – we use inward portfolio investment in bonds and notes issued by *all* sectors[5]. The data do not identify the residence nor the sector of the foreign investor.[6]

[4]Balance of payments statistics are however known to be subject to round-tripping issues. Given that balance of payments and international investment position statistics are compiled on a locational basis and following the residency concept, they also include transactions carried out by foreign branches of euro area investors located outside the monetary union, which should ideally be excluded from the analysis. In particular, the significant financial trade and cross-border positions between the euro area and the United Kingdom – about 50 percent of all assets and liabilities in end-2007, according to Milesi-Ferretti et. (2010) – as well as the strong presence of euro area banks' affiliates in the United Kingdom, suggest that a non-negligible amount of financial flows and holdings are likely to ultimately reflect the purchases of euro area securities by euro area investors. However, there is no way to disentangle these flows from those of UK investors or other investors who choose to use the United Kingdom as a platform to invest in the euro area.

[5]Sectoral detail is available for MFI inflows on a monthly basis but also only since 2006.

[6]The only alternative source that is able to partially shed light on the identity of the holder of euro area securities (in terms of residence and to a limited extent in terms of sector) is the Coordinated Portfolio Investment Survey (CPIS) published by the IMF. Countries report to the CPIS their holdings of foreign securities and derived liabilities are computed from the holdings data. However, the CPIS only provides annual stocks for the years 1997 and 2001–2011 and no flows are recorded. Moreover, only a limited number of countries report data and in particular some important emerging markets including China as well as many oil exporters do not participate in the survey. Therefore, the derived portfolio investment liabilities of the euro area are significantly underreported. Milesi-Ferretti et al. (2010) document that the discrepancy between euro area portfolio investment liabilities as derived from the CPIS and total portfolio investment liabilities of the euro area recorded in its international investment position as published by the ECB amounted to USD

We proceed to construct a series of *monthly* stocks of euro area bonds and notes issued by all domestic sectors and held by foreign residents, including both the foreign private sector and the foreign official sector. We start with the first available stock observation which is for March 1999 and end the sample in December 2006 to avoid any effects stemming from the emergence of the first financial market tensions before the outburst of the global financial crisis. The series is constructed by accumulating monthly flows, interpolating to monthly frequency the remaining non-flow stock variation (price and exchange rate variations and other adjustments) and adding it to the observed quarterly stocks. Taking S_t as an observed quarterly stock (i.e., either March, June, September or December), our monthly stock for the two months per each quarter for which no data is available is given by:

$$S_{t+1} = S_t + fl_{t+1} + \frac{1}{3} nfl_{t,t+3} \tag{2.1}$$

and

$$S_{t+2} = S_{t+1} + fl_{t+2} + \frac{1}{3} nfl_{t,t+3} \tag{2.2}$$

where $nfl_{t,t+3}$ is the non-flow component, which is given by

$$nfl_{t,t+3} = S_{t+3} - S_t - \sum_{i=1}^{3} fl_{t+i}. \tag{2.3}$$

This measure of monthly stocks is an observed value for the months that coincide with the end of each quarter. For the remaining months, it combines observed flows and evenly spreads out the non-flow component. Accumulating flows to observed stocks is also a standard technique employed by statisticians whenever observed (or better) data are not available.

As a measure of long-term interest rates we use 10-year government benchmark bond yields as

3,500 billion in 2007. Specific data on foreign exchange reserves is unfortunately rather scant. The IMF publishes the aggregated claims held as foreign exchange of countries participating in the Currency Composition of Official Foreign Exchange Reserves (COFER) but not individual country information. The data is quarterly since 1999 for some seven major currencies. The list of participating countries was published in September 30 2015 together with the 2015Q3 data release. Although 146 countries are included, China is still only providing partial information (expected to phase in in 2 to 3 years time) and, of the 13 OPEC members, only 3 (Kuwait, Nigeria and the United Arab Emirates) participate in this survey. Furthermore, in 2015Q3, around 41 percent of the total foreign exchange reserve holdings were unallocated reserves (37 percent in 2006Q4).

published by the ECB. The series is derived by weighting the yields of euro denominated government benchmark bonds issued by the central governments of euro area countries and included in the ECB eligible asset database with the monthly outstanding amounts of these bonds.[7] We use the 3-month Euribor rate as a measure of short-term interest rates. As a measure of inflation expectations we use realised seasonally adjusted HICP inflation excluding energy and food, since core inflation is often argued to be a better predictor of future inflation than headline inflation (see Kiley, 2008). We use realised inflation as data on break-even inflation are only available from the mid-2000s and survey-based inflation measures are subject to certain limitations regarding the timing of data and the forecast horizon covered (see ECB, 2011).

Figure 2.3 plots the 12-month cumulated first differences of the term premium – i.e. the difference between the long- and the short-term interest rates – and the foreign holdings variable between March 2000 and December 2006. The figure shows that, in general, periods of rapid growth in foreign holdings are associated with a fall in the term premium. The most prominent examples of the latter are the period starting in the first quarter of 2000 and ending in the third quarter of 2001 and the period starting in the third quarter of 2004 and ending in the first quarter of 2006. To the contrary, the term premium rebounded in end-2001 and beginning 2002, as well as in end-2003 and beginning 2004, when foreign holdings were growing at a more modest pace.

2.4 Econometric evidence

2.4.1 Vector error correction model

Since a series that identifies foreign official sector transactions and holdings of euro area securities is not available and therefore our measure of flows and stocks of euro area portfolio investment inflows into long-term debt securities also includes private investors, exogeneity of holdings to yields cannot be assumed. Thus we estimate a parsimonious VECM along the lines of Bandholz et al. (2009), Beltran et al. (2013) and Warnock and Warnock (2009), which is appropriate to deal with non-stationary but

[7] We use end-of-period yields as they contain all the relevant information of the given month and using monthly averages could introduce smoothness in the data that may lead to residual autocorrelation (see Gujarati, 1995)

cointegrated variables. Given that we are chiefly interested in the level relationship, using financial stocks is more appropriate than flows. Note however that in the short-run dynamics foreign holdings are differentiated and therefore largely reflect the variation of financial flows, in addition to a valuation component. The system can be written as follows:

$$\Delta \mathbf{Y}_t = \underbrace{\sum_{k=1}^{n} \mathbf{\Gamma}_k \Delta \mathbf{Y}_{t-k}}_{\text{short-run}} + \underbrace{\mathbf{\Pi} \mathbf{Y}_{t-1}}_{\text{long-run}} + \epsilon_t \tag{2.4}$$

where $\mathbf{Y}_t$ is a vector containing the endogenous variables, $\mathbf{\Gamma}_k$ is the matrix of the short-run coefficients and $\mathbf{\Pi}$ the matrix of the long-run coefficients.

Initial tests show that the null hypothesis of a unit root cannot be rejected for the four variables in the March 1999 to December 2006 period. Moving to the model estimation, we first estimate an unrestricted VAR with the four variables. We then look at the usual lag length criteria to choose the appropriate number of lags. Both the Schwarz and Hannan-Quinn criteria indicate that one lag is sufficient while other criteria point to twelve lags. We focus on the most restrictive criteria given the small sample size of 94 observations from March 1999 to December 2006. We run cointegration rank tests using one lag and find that both the trace and maximum eigenvalue statistics indicate that one relationship between the four variables exists (see Table 2.2, panel A). We estimate a VAR with the same variables in differences and look again at the lag length criteria, which point to one lag as being enough. Accordingly, we specify a VECM with one cointegration equation and allowing for one lag in the short-run dynamics. Finally, we test for residual autocorrelation of the VECM of which we find no evidence.

With these results, the VECM simplifies to the following equation:

$$\begin{pmatrix} \Delta i_t^l \\ \Delta i_t^s \\ \Delta \pi_t^e \\ \Delta FH_t \end{pmatrix} = \mathbf{\Gamma} \begin{pmatrix} 1 \\ \Delta i_{t-1}^l \\ \Delta i_{t-1}^s \\ \Delta \pi_{t-1}^e \\ \Delta FH_{t-1} \end{pmatrix} + \begin{pmatrix} \alpha^l \\ \alpha^s \\ \alpha^\pi \\ \alpha^{FH} \end{pmatrix} (1 \beta^s \beta^\pi \beta^{FH} \kappa) \begin{pmatrix} i_{t-1}^l \\ i_{t-1}^s \\ \pi_{t-1}^e \\ FH_{t-1} \\ 1 \end{pmatrix} + \epsilon_t \tag{2.5}$$

where i^l is the long-term interest rate, i^s is the short-term interest rate, π^e is expected inflation and FH is our measure of foreign holdings of euro area debt securities normalised by nominal GDP.

2.4.2 Results

The VECM estimates are displayed in Table 2.3. The level coefficients are all significant and have the expected signs. Long-term interest rates increase in the short-term interest rate as well as inflation expectations and decrease with foreign holdings. The coefficients on the short-term interest rate and inflation expectations suggest that a one percentage point increase in these variables is associated with a 0.25 and 0.43 percentage point increase in the long-term interest rate, which is close to the estimates obtained by Bandholz et al. (2009) and Warnock and Warnock (2009).[8] The coefficient on foreign holdings indicates that a one percentage point increase in foreign holdings of euro area debt securities lowers the long-term interest rate by about 13 basis points.[9] Finally, the error correction term for the long-term interest rate is also statistically significant, as is also the error correction term of the short-term interest rate. The error correction coefficient of expected inflation turns out to be insignificant which is unsurprising given that we proxy it with realised inflation which we do not expect to respond contemporaneously to the system. The error correction coefficient for foreign holdings is also insignificant suggesting that foreign holdings are weakly exogenous in the system, in line with the results in Bandholz et al. (2009).

We look again at our coefficient on foreign holdings and the coefficients of other studies to see how our results for the euro area compare with those of similar studies based on US data. In order to get a meaningful comparison across the available studies we take into account the different scales used in the normalisation of foreign holdings as well as the different time samples and compute the total impact of the change in foreign holdings for a common time period. We choose the period ranging from March 2000 to June 2006. The reason is that in this study as well as the studies based on US data, the holdings series are constructed by augmenting stock data which are not available on a monthly basis

[8] The coefficient estimates for the short-term interest rate in Bandholz et al. (2009) and Warnock and Warnock (2009) are -0.21 and -0.34, and the coefficient estimates for inflation expectations are -0.55 and -0.54.

[9] This long-term coefficient should however be contrasted with the short-run coefficient, which indicates that the contemporaneous change in the long-term interest rate responds positively to the lagged change in the foreign holdings variable.

with monthly flow data. In order to base the comparison on the data with the best quality we prefer to identify dates when for both economies the stock data are available. While for the euro area stock data are available for each quarter, for the United States stock data are compiled less frequently in the Treasury International Capital System survey. The two survey dates that are closest to the beginning and the end of our sample are March 2000 and June 2006.

Column 2 of Table 2.4 indicates the foreign holdings variable used, column 3 reports the scale measure, columns 5 and 6 the initial and final foreign holdings values and finally column 7 the total impact which results from the coefficient multiplied by the change from the initial to the final stock. Our results indicate that, all else equal, the increase in foreign holdings of euro area long-term debt securities decreased euro area long-term interest rates by 1.55 percentage points in the period. Our estimate for the total impact falls within the same ballpark as those of other studies, albeit somewhat higher.

There are a few candidate explanations for the higher estimated impact in the case of the euro area. First of all, our measure of foreign holdings is more encompassing than that of other studies since it includes *all* domestic issuer sectors vis-à-vis *all* foreign holding sectors. To the contrary, other US studies only include official foreign holdings of the domestic government sector — except for Bandholz et al. (2009) who include all foreign holding sectors and also estimate a somewhat higher impact than the other US studies. Second, Beltran et al. (2013) argue that the long-term impact in Bertaut et al. (2012) may be downward biased because of the exogeneity assumption of foreign official holdings. The intuition is that in periods of heightened uncertainty, safe haven flows into US Treasuries by global investors will put downward pressure on US long-term interest rates and upward pressure on the dollar exchange rate. This, in turn, reduces the need for reserve accumulation in the form of US Treasuries for some monetary authorities which otherwise regularly intervene to counter domestic appreciation pressures. Finally, cross-border flows due to round-tripping which ultimately reflect the buying of euro area securities by euro area residents might lead to an upward bias of the estimated impact.

2.4.3 Foreign vs domestic holdings

Given the data limitations discussed and our foreign holdings measure, it is not clear to which extent the results obtained in the previous subsections might be driven by (i) foreign official inflows into euro area safe assets and/or (ii) round-tripping, whereby purchases recorded in extra-euro area financial centres such as London ultimately represent purchases of domestic residents. One way to address this issue is to investigate if the relationship we found is specific to foreign holdings only or whether foreign and domestic holdings are driven by similar forces. If, in fact, significant differences can be found, then these should alleviate the concerns that the relationship found regarding foreign holdings stems from such round-tripping practices.

For this purpose, as an initial step, we compute domestic holdings as a residual of the monthly total outstanding amount of euro area long-term debt securities issued by all resident sectors, and our measure of foreign holdings of euro area long-term debt securities. With the latter measure, we firstly run a model with the same variables as in our benchmark specification but using *domestic* instead of foreign holdings. We proceed following the same steps as previously. Lag length criteria point to one lag as being sufficient for the VAR. Cointegration tests indicate that one relationship between the four variables exists (see Table 2.5, panel A). Finally, lag length criteria regarding the VAR in differences also indicate that one lag is sufficient. The results for the VECM with these characteristics are displayed in Table 2.6. In broad terms, although the coefficients in the cointegration equation – and in particular that on the domestic holdings variable – have the expected signs and are all significant, the error correction term is not, thus indicating that the long-term relationship between these variables does not hold.

In a second specification, we extended the previous model to include both foreign and domestic holdings of euro area long-term debt securities. Cointegration tests now point to the existence of two cointegration equations (see Table 2.5, panel B) – the remaining lag length criteria give the same indications as before. Since now two long-term relationships exist, restrictions are needed to estimate the VECM. We associate the first cointegration equation with foreign holdings and the second with domestic holdings. Accordingly, we impose the coefficient on domestic holdings to be zero in the first equation and the coefficient on foreign holdings to be zero in the second equation; in both cases, we

normalize all coefficients by the coefficient on the long-term interest rate.

The resulting VECM is displayed in Table 2.7. Again, in both cases the coefficients in the cointegration equations have the expected signs and are significant. However, while the error correction term for the first cointegration equation has the expected negative sign, the coefficient on the second equation has a positive sign. Thus, not only does the long-term relationship between the interest rates and inflation variables with domestic holdings not hold, but also the benchmark relationship with foreign holdings holds despite the inclusion of the additional variable.

In a final estimation, we check whether the euro area issuer sector is relevant for our analysis. We run the specification with both foreign and domestic holdings on corporate yields of different ratings. Specifically, the yields are taken from Datastream and pertain to 7 to 10 year securities issued by the euro area corporate sector, encompassing AAA, AA, A and BBB ratings.[10] Cointegration tests (not provided) rule out a long-term relationship for A and BBB ratings; in turn, tests are inconclusive for AAA and AA ratings – see Table 2.5 (panels C and D). The respective VECM results, displayed in Table 2.8 (panels A and B) confirm that the long-term relationship does not exist as, once more, and in both cases, the error correction term is not significant.

To sum up, these estimations point to a differentiated relationship between euro area long-term interest rates and domestic/foreign holdings. Furthermore, they also show that the issuer sector is relevant, as the long-term relationship is limited to general government yields. On the one hand, foreign inflows are different from domestic inflows to the extent that they encompass official inflows – and that the latter have a significant role in total inflows –, typically associated to reserve accumulation purposes, not motivated solely by return maximing considerations and, therefore, less price sensitive than flows of other investor sectors. On the other hand, most of the holdings of these official investors are likely to be of high-rated and liquid government bonds, implying that the significant relationship should only be verified for the yields of these securities and not for the corporate sector. In this sense, these results again reinforce the consistency with those of other US studies, namely Beltran et al. (2013), who find that, within foreign holdings of US Treasury bonds, only those of official entities are associated with lower yields.

[10] These series initial data point is January 2000.

2.5 Robustness checks

2.5.1 Trend in data

Given that our foreign holdings variable is trending upwards throughout the whole sample and long-term interest rates are trending downwards, the results could partly reflect a combination of these two trends. To test whether this is the case, we re-run the model including a linear trend t in the cointegration relation of the benchmark model in equation 2.5. We get qualitatively the same results regarding the cointegration tests (see Table 2.2, panel B). The VECM results which are displayed in Table 2.9 (panel A) suggest that our findings are not driven by a combination of trends. First, the trend coefficient β^t is not statistically significant. Second, despite the inclusion of the trend, the coefficient on the level of foreign holdings is still statistically significant, indicating that there is an effect of foreign holdings on long-term interest rates over and above that of the trend in the data. Furthermore, all other level coefficients in the model remain broadly in line with the results obtained in the benchmark model.

2.5.2 Sample size

Given that our sample is smaller than that typically used in studies based on US data we repeat the exercise using the autoregressive distributed lag (ARDL) approach of Pesaran and Shin (1999) taking advantage of the small sample properties of this method. Despite being asymptotically equivalent, there are two reasons why the Johansen procedure and ARDL might yield different results. First, whereas the Johansen approach relies on maximum likelihood to estimate the model, ARDL uses OLS. Second, ARDL is a uni-equation model, in contrast to the VECM system of Johansen. Our ARDL specification can be written as:

$$\Delta i_t^l = \gamma_1 + \gamma^l \Delta i_{t-1}^l + \gamma^s \Delta i_{t-1}^s + \gamma^\pi \Delta \pi_{t-1}^e + \gamma^{FH} \Delta FH_{t-1} + \delta^l i_{t-1}^l + \delta^s i_{t-1}^s + \delta^\pi \pi_{t-1}^e + \delta^{FH} FH_{t-1} + \epsilon_t \quad (2.6)$$

where the coefficients have the same interpretation as before.

In order to determine whether a cointegration relationship in the period under consideration exists we rely on the bounds approach as described in Pesaran et al. (2001). Specifically, this approach is valid regardless of whether the regressors are $I(0)$, $I(1)$ or mutually cointegrated. For this reason, the authors provide two sets of asymptotic critical values for the two extreme cases, i.e., when (i) the regressors are all purely $I(1)$ and (ii) the regressors are all purely $I(0)$. Therefore, a conclusive test inference can only be drawn whenever the test statistic falls outside of the critical value bounds. If, to the contrary, the test statistic falls within the mid-range defined by the critical value bounds, no conclusion can be drawn and prior knowledge of the integration order of the underlying regressors is needed.

We test the joint significance of the coefficients in the cointegration equation based on the critical values provided in Pesaran et al. (2001). Specifically, we use Table CI(iii) in the paper since the specification includes an unrestricted intercept and no trend and $k = 3$ given that we are regressing long-term interest rates on three explanatory variables. The F-statistic testing for the null hypothesis $\delta^l = \delta^s = \delta^\pi = \delta^{FH} = 0$ yields 4.38, which is higher than the critical value for $I(1)$ regressors at the 5 percent level and therefore we can conclusively reject the null hypothesis that a level relationship does not exist.

To compare the ARDL results with those obtained in our benchmark model, we normalise the lagged level coefficients by the yield coefficient and include an error correction term, which amounts to rewriting the model as follows:

$$\Delta i_t^l = \gamma_1 + \gamma^l \Delta i_{t-1}^l + \gamma^s \Delta i_{t-1}^s + \gamma^\pi \Delta \pi_{t-1}^e + \gamma^{FH} \Delta FH_{t-1} + \alpha(i_{t-1}^l + \beta^s i_{t-1}^s + \beta^\pi \pi_{t-1}^e + \beta^{FH} FH_{t-1}) + \epsilon_t. \tag{2.7}$$

As shown in Table 2.9 (panel B), the coefficient on foreign holdings is almost the same as that obtained using the Johansen method in our benchmark model. Moreover, the remaining coefficients are broadly in line with our previous results.

2.5.3 Global factors and US long-term interest rates

Boivin and Giannoni (2008) show that the correlation between US long-term interest rates and global factors (including measures of economic activity, prices, short- and long-term interest rates of the United States' 15 largest trading partners) increases significantly in the period between 1984 and 2005. Similarly Diebold et al. (2008) and Kaminska et al. (2011) show that global inflation and the global business cycle affect long-term interest rates of advanced economies in addition to domestic factors. Against this background the question arises whether the downward impact we are assigning to foreign holdings of euro area securities on long-term interest rates is in fact driven by other factors, such as the environment of lower global inflation and lower business cycle volatility in the period under consideration.

Since the global variables should be reflected in US long-term interest rates, we use the latter as a proxy for global factors and check how their inclusion affects the results of our benchmark model. Moreover, Favero and Giavazzi (2008) and Chinn and Frankel (2005, 2007) argue that euro area long-term interest rates follow US long-term interest rates. Van Landschoot (2008) also finds empirical evidence supporting the claim that US interest rates have a significant impact on European interest rates. It is however out of the scope of this essay to address the question of causality between euro area and US long-term interest rates. For this reason, we check whether our results are robust to the inclusion of US long-term rates both taken as exogenous and endogenous.

First, we add end-of-period 10-year US Treasury bond yields taken from Bloomberg as an exogenous variable to our benchmark model. Results are displayed in Table 2.10 (panel A). The coefficients are robust to the inclusion of the US long-term interest rate. In particular, the long-term coefficient on our foreign holdings variable – while slightly lower – remains significant. In turn, the coefficient on US long-term interest rates has the expected positive sign, indicating that an increase (decrease) in the US interest rate leads to an increase (decrease) in that of the euro area.

Turning to the second case, we expand the original set of euro area variables in the baseline model by including the same variables for the United States as endogenous. In addition to the 10-year US Treasury bond yields as a measure of long-term interest rates, we use the 3-month Libor rate as a measure of short-term interest rates and seasonally adjusted inflation excluding energy and food from

the US Bureau of Labour Statistics, taken from the Federal Reserve Economic Data of the Federal Reserve Bank of St. Louis.

There is no measure of foreign holdings of US debt securities that would be directly comparable to the series constructed for the euro area. First, balance of payments data for the US are not available at the monthly frequency. Second, balance of payments statistics and international investment position data published by the Bureau of Economic Analysis do not provide flow or stock measures of total liabilities of long-term debt securities that would be consistent with our measures for the euro area. At the same time, stocks published by the IMF – which are consistent with our measure – are published only at the annual frequency. We therefore resort to the monthly stocks of foreign holdings of US securities constructed by Bertaut and Tryon (2007) based on a combination of annual survey data and monthly flow data from the Treasury International Capital System (TICS) database. Specifically, we use holdings of Treasuries, Agencies and corporate bonds scaled by GDP (in order to be consistent with the scaling applied to the euro area foreign holdings measure).

Before adding the US data to our bechnmark model, we test whether our US data are appropriate by running our benchmark model with US data only. The VECM results are presented in Table 2.11. Our foreign holdings coefficient turns out to be almost identical to that in Bandholz et al (2009) – 0.088 and 0.081 respectively – which provides the only study that does not use a split between official and private holdings of US securities.

We then proceed with the model including both euro area and US long-term interest rates as endogenous. Lag length criteria point to either one or three lags. Cointegration tests indicate that three cointegration relations exist, except for the trace test when using one lag which favours five relations (see Table 2.12, panels A and B). Lag length criteria on the same VAR in differences indicate no lags or one lag. We therefore proceed with three cointegration relations for parsimony and estimate two VECMs: one with no short-run dynamics and a second with one lag. To estimate the VECMs we impose the following restrictions: (i) we define the first cointegration equation to be the euro area model – i.e., forcing the coefficients on the US variables to be zero and normalising the remaining by the coefficient on the euro area long-term interest rate – (ii) the second cointegration equation is the US model – i.e., forcing the coefficients on the euro area variables to be zero and normalising those

remaining by the coefficient on the US long-term interest rate – and (iii) the last cointegration equation establishes a relationship between both long-term interest rates – i.e., forcing all variables to be zero except both euro area and US long-term interest rates (normalized by the euro area rate). The global model results are displayed in Table 2.13 (panels A and B). The long-term coefficients continue to have the expected signs and are close to those of our benchmark model, confirming robustness of our results to the inclusion of these additional US variables.

2.5.4 Financial crisis period

Following Beltran et al. (2013) we extend the sample to also cover the period since the outburst of the global financial crisis. As they point out, the high levels of volatility during the financial crisis including the Lehman collapse, the drying out of interbank markets, unconventional monetary policies such as the Fed's Large Scale Asset Programmes or the ECB's Securities Market Programme and the announcements with regard to Outright Monetary Transactions, may have had an impact on the relations we are exploring in this essay. Moreover, in the particular case of the euro area, the sovereign debt crisis is an additional factor, as our analysis is based on measures of long-term interest rates and foreign holdings which are effectively composed of information pertaining to the different euro area countries.

We run cointegration tests for our model extending the euro area sample beyond December 2006 in six-month blocks. As our analysis is based on foreign buying by all sectors, whereas Beltran et al. (2013) differentiate between foreign official and private buying, our results would not be directly comparable. We therefore also run rolling cointegration tests for the US model, however, using the measure of monthly stocks of foreign holdings of US securities constructed by Bertaut and Tryon (2007). It turns out that in both cases the cointegration relationship breaks when the sample is extended to include data up to December 2008.

This break in the relationship between foreign purchases and long-term interest rates could reflect the choice of our measure of foreign holdings. Figure 2.4 plots the measure used in the econometric analysis, i.e. foreign purchases of debt issued by *all* sectors, against the foreign purchases of debt issued by the general government which is only available from 2006 onwards at the quarterly frequency. It

turns out that the two measures start to diverge around the last quarter of 2008, suggesting that the decoupling of private from public liability flows led to a weakening of the relationship between foreign purchases issued by all sectors and the level of benchmark long-term interest rates.

2.5.5 Other exogenous factors

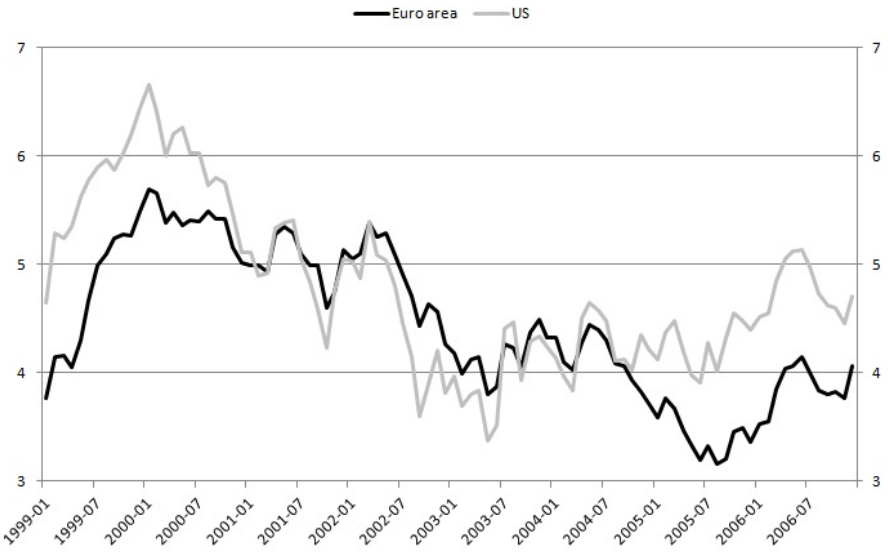
In a last robustness check, we also add the euro area industrial production index to proxy for GDP growth and the VIX to proxy for risk aversion as exogenous variables. Results are displayed in Table 2.10 (panel B). There is no qualitative change to the overall results and the coefficient estimate on the measure of risk aversion is statistically significant and economically plausible suggesting that yields on government bonds decrease when risk aversion is high.

2.6 Conclusion

Foreign ownership of securities issued by euro area residents has increased considerably since the introduction of the euro and in the run up to the global financial crisis. We set out to see whether the increase in cross-border holdings had an impact on long-term interest rates, as is already documented for the United States in several studies. We show that there is in fact a statistically significant impact: all else equal, the increase in foreign holdings in the period led to a decrease in euro area long-term interest rates of 1.55 percentage points.

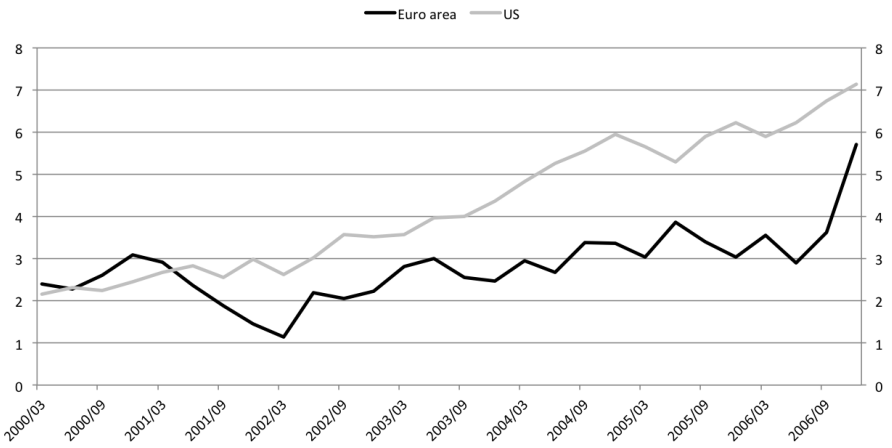
These results are relevant both from a euro area and a global perspective, as they show that the phenomenon of lower long-term interest rates due to foreign bond buying is not exclusive to the United States and foreign inflows into euro area debt securities may have added to increased risk appetite and hunt-for-yield at the global level. In particular, in addition to the implications for monetary policy which needs to take into account the role of international capital flows and global liquidity, the results are also relevant for macroprudential policy and financial stability. Further research avenues could therefore focus on developing macro models that explore the role of capital flows and link the developments in long-term interest rates across different countries, including both advanced and emerging economies.

Figure 2.1: Long-term interest rates
(percent, January 1999 – December 2006)



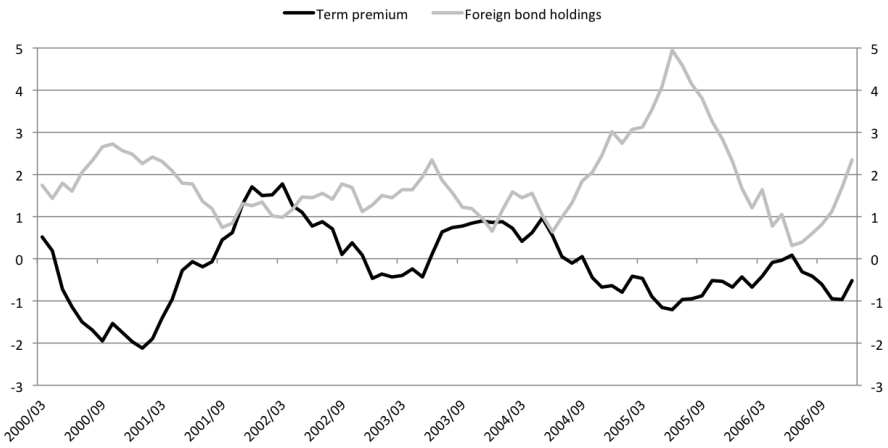
Source: ECB and Datastream.

Figure 2.2: Foreign bond inflows
(percentage of GDP, 4-quarter cumulated, 2000Q1 – 2006Q4)



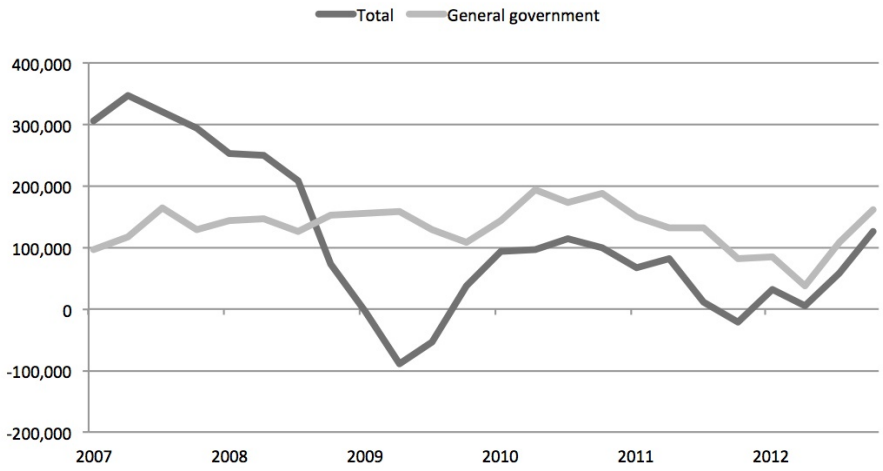
Source: ECB and IMF BOPS.

Figure 2.3: Term premium and foreign holdings
(percent and percentage of GDP, annual change, March 2000 – December 2006)



Source: ECB and authors' calculations.

Figure 2.4: Euro area debt securities liability flows
(million euro, 4-quarter moving sums, 2007Q1–2012Q4)



Source: ECB.

Table 2.1: Foreign ownership of US and euro area debt securities

		Euro area	United States
All issuers	Outstanding	9,690	20,341
	of which foreign owned	2,571	4,732
	(in percent of outstanding)	(26.5)	(23.3)
	(in percent of GDP)	(31.1)	(35.5)
Total Government	Outstanding	4,353	9,044
	of which foreign owned	995	2,711
	(in percent of outstanding)	(22.9)	(30.0)
	(in percent of GDP)	(12.0)	(20.4)
Treasury	Outstanding		3,321
	of which foreign owned		1,727
	(in percent of outstanding)		(52.0)
	(in percent of GDP)		(13.0)
Agencies	Outstanding		5,723
	of which foreign owned		984
	(in percent of outstanding)		(17.2)
	(in percent of GDP)		(7.4)
Corporates	Outstanding	5,337	11,297
	of which foreign owned	1,576	2,021
	(in percent of outstanding)	(29.5)	(17.9)
	(in percent of GDP)	(19.1)	(15.2)

Source: Treasury Department et al. (2008, 2012) and ECB.
Note: Amounts in domestic currency unless otherwise indicated at end-June 2006.

Table 2.2: Cointegration tests

Panel A: benchmark model				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.295	54.319	47.856	0.010
At most 1	0.139	22.216	29.797	0.287
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.295	32.103	27.584	0.012
At most 1	0.139	13.761	21.131	0.385
Panel B: with trend				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.374	80.981	63.876	0.001
At most 1	0.176	38.349	42.915	0.133
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.374	42.631	32.118	0.002
At most 1	0.176	17.603	25.823	0.408

Note: * denotes rejection of the hypothesis at the 0.05 level.

Table 2.3: VECM results - benchmark model

Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}
	1	−0.247	−0.434	0.128
		[−4.840]	[−4.564]	[11.524]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH
α	−0.230	0.161	0.074	−0.063
	[−2.932]	[3.232]	[1.245]	[−0.422]
Δi^l_{t-1}	0.316	0.101	0.014	−0.491
	[2.921]	[1.483]	[0.170]	[−2.393]
Δi^s_{t-1}	0.194	0.297	−0.034	0.383
	[1.187]	[2.861]	[−0.273]	[1.236]
$\Delta \pi^e_{t-1}$	−0.036	−0.087	−0.129	0.090
	[−0.256]	[−0.971]	[−1.202]	[0.337]
ΔFH_{t-1}	0.146	0.018	0.028	−0.035
	[2.595]	[0.505]	[0.659]	[−0.330]

Note: t-statistics in brackets.

Table 2.4: Impact of foreign holdings on long-term interest rates – March 2000 to June 2006

	FH variable	Scale	Coefficient	Initial	Final	Total Impact
This study	FH bonds	GDP	0.128	17.99	30.08	-1.548
Bandholz et al. (2009)	FH Treas	Outst	0.070	35.25	52.00	-1.173
Beltran et al. (2013), lower bound	FOH Treas	Outst	0.046	18.54	36.53	-0.828
Beltran et al. (2013), upper bound	FOH Treas	Outst	0.063	18.54	36.53	-1.133
Bertaut et al. (2012)	FOH Treas + Agenc	Outst	0.062	9.09	18.67	-0.875

Source: Authors' calculations. Initial is the stock in March 2000, final is the stock in June 2006, total impact is the coefficient times the change in the stock from March 2000 to June 2006.

Table 2.5: Cointegration tests

Panel A: domestic holdings model				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.302	55.110	47.856	0.009
At most 1	0.138	22.009	29.797	0.298
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.302	33.101	27.584	0.009
At most 1	0.138	13.654	21.131	0.394
Panel B: foreign and domestic holdings model				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.316	84.111	69.819	0.002
At most 1*	0.271	49.105	47.856	0.038
At most 2	0.127	20.072	29.797	0.418
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.316	35.006	33.877	0.037
At most 1*	0.271	29.003	27.584	0.032
At most 2	0.127	12.451	21.132	0.504
Panel C: foreign and domestic holdings model - Corporate AAA				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.313	72.181	69.819	0.032
At most 1	0.275	41.368	47.856	0.177
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None	0.313	30.813	33.877	0.111
At most 1	0.275	26.393	27.584	0.070
Panel D: foreign and domestic holdings model - Corporate AA				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.324	72.697	69.819	0.029
At most 1	0.268	40.570	47.856	0.203
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None	0.324	32.127	33.877	0.080
At most 1	0.268	25.620	27.584	0.087

Note: * denotes rejection of the hypothesis at the 0.05 level.

Table 2.6: VECM results - domestic holdings

Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	DH_{t-1}
	1	−0.149	−0.725	0.177
		[−2.133]	[−5.892]	[9.241]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔDH
α	−0.083	0.124	0.087	−0.456
	[−1.297]	[3.180]	[1.900]	[−2.614]
Δi^l_{t-1}	0.213	0.102	−0.008	0.784
	[1.917]	[1.518]	[−0.097]	[2.594]
Δi^s_{t-1}	0.023	0.275	−0.104	0.524
	[0.128]	[2.541]	[−0.814]	[1.078]
$\Delta \pi^e_{t-1}$	−0.108	−0.087	−0.142	0.098
	[−0.737]	[−0.981]	[−1.349]	[0.247]
ΔDH_{t-1}	0.050	0.002	0.009	−0.188
	[1.388]	[0.084]	[0.341]	[−1.911]

Note: t-statistics in brackets.

Table 2.7: VECM results - foreign and domestic holdings

	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	DH_{t-1}
Cointegration equation 1	1	−0.259	−0.430	0.126	-
		[−5.527]	[−4.767]	[13.493]	-
Cointegration equation 2	1	−0.163	−0.730	-	0.175
		[−2.480]	[−6.020]	-	[10.481]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH	ΔDH
α^1	−0.776	0.113	−0.168	−0.389	1.029
	[−3.985]	[0.869]	[−1.090]	[−1.014]	[1.815]
α^2	0.460	0.045	0.201	0.260	−1.163
	[3.054]	[0.449]	[1.691]	[0.878]	[−2.656]
Δi^l_{t-1}	0.322	0.096	0.016	−0.458	0.597
	[3.082]	[1.381]	[0.192]	[−2.226]	[1.960]
Δi^s_{t-1}	0.044	0.277	−0.092	0.343	0.448
	[0.267]	[2.539]	[−0.713]	[1.064]	[0.941]
$\Delta \pi^e_{t-1}$	−0.025	−0.084	−0.121	0.104	−0.075
	[−0.188]	[−0.932]	[−1.130]	[0.389]	[−0.190]
ΔFH_{t-1}	0.157	0.016	0.033	0.022	−0.353
	[2.779]	[0.422]	[0.734]	[1.196]	[−2.144]
ΔDH_{t-1}	−0.016	0.005	−0.005	−0.118	−0.076
	[−0.455]	[0.210]	[−0.182]	[−1.663]	[−0.724]

Note: t-statistics in brackets.

Table 2.8: VECM results - foreign and domestic holdings, corporate yields

Panel A: corporate AAA yields					
Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	DH_{t-1}
	1	−0.399	−0.530	0.147	−0.007
		[−9.362]	[−6.996]	[4.656]	[−0.181]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH	ΔDH
α	−0.015	0.264	0.045	−0.016	−0.033
	[−0.266]	[9.947]	[1.071]	[−0.146]	[−0.209]
Panel B: corporate AA yields					
Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	DH_{t-1}
	1	−0.417	−0.608	0.116	0.029
		[−9.892]	[−8.097]	[3.768]	[0.750]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH	ΔDH
α	−0.001	0.266	0.049	−0.019	−0.074
	[−0.019]	[9.789]	[1.154]	[−0.180]	[−0.464]

Note: t-statistics in brackets.

Table 2.9: VECM results - alternative models

Panel A: model with trend					
Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	β^t
	1	−0.298	−0.336	0.235	−0.018
		[−5.628]	[−3.356]	[3.563]	[−1.646]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH	
α	−0.249	0.178	0.056	−0.171	
	[−3.015]	[3.403]	[0.888]	[−1.098]	
Δi^l_{t-1}	0.336	0.086	0.019	−0.433	
	[3.060]	[1.230]	[0.231]	[−2.084]	
Δi^s_{t-1}	0.183	0.300	−0.002	0.503	
	[1.152]	[2.979]	[−0.013]	[1.673]	
$\Delta \pi^e_{t-1}$	−0.035	−0.089	−0.124	0.114	
	[−0.247]	[−0.996]	[−1.151]	[0.427]	
ΔFH_{t-1}	0.159	0.008	0.027	−0.018	
	[2.811]	[0.221]	[0.621]	[−0.164]	
Panel B: ARDL					
Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	
	1	−0.202	−0.047	0.131	
		[−2.115]	[−0.232]	[6.530]	
Error correction	Δi^l				
α	−0.260				
	[−3.287]				
Δi^l_{t-1}	0.272				
	[2.469]				
Δi^s_{t-1}	0.071				
	[0.434]				
$\Delta \pi^e_{t-1}$	0.035				
	[0.243]				
ΔFH_{t-1}	0.133				
	[2.429]				

Note: t-statistics in brackets.

Table 2.10: VECM results with control variables

Panel A: US long-term interest rates				
Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}
	1	−0.111	−0.560	0.078
		[−2.991]	[−7.051]	[8.169]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH
α	−0.439	−0.018	0.112	0.001
	[−8.419]	[−0.380]	[2.089]	[0.011]
Δi^l_{t-1}	0.054	0.116	0.029	−0.488
	[0.681]	[1.635]	[0.356]	[−2.361]
Δi^s_{t-1}	−0.008	0.443	−0.043	0.341
	[−0.081]	[4.763]	[−0.404]	[1.257]
$\Delta \pi^e_{t-1}$	−0.083	−0.077	−0.145	0.092
	[−0.804]	[−0.827]	[−1.363]	[0.339]
ΔFH_{t-1}	0.090	0.022	0.034	−0.035
	[2.195]	[0.591]	[0.810]	[−0.331]
Δi^{US}_t	0.285	0.050	−0.030	−0.023
	[9.499]	[1.851]	[−0.973]	[−0.295]
Panel B: industrial production and VIX				
Cointegration equation	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}
	1	−0.270	−0.453	0.151
		[−4.977]	[−4.443]	[9.725]
Error correction	Δi^l	Δi^s	$\Delta \pi^e$	ΔFH
α	−0.276	0.135	0.075	−0.143
	[−3.632]	[2.695]	[1.274]	[−0.975]
Δi^l_{t-1}	0.295	0.114	0.037	−0.475
	[2.812]	[1.657]	[0.453]	[−2.350]
Δi^s_{t-1}	0.155	0.312	0.011	0.350
	[0.990]	[3.022]	[0.094]	[1.160]
$\Delta \pi^e_{t-1}$	−0.042	−0.070	−0.131	0.081
	[−0.304]	[−0.776]	[−1.214]	[0.305]
ΔFH_{t-1}	0.134	0.017	0.028	−0.081
	[2.299]	[0.442]	[0.610]	[−0.723]
ΔVIX_t	−0.008	−0.001	0.004	−0.007
	[−2.476]	[−0.397]	[1.673]	[−1.160]
ΔIP_t	0.001	−0.000	0.001	0.005
	[0.407]	[−0.016]	[0.314]	[1.126]

Note: t-statistics in brackets.

Table 2.11: VECM results - US model

Cointegration equation	$i_{t-1}^{l,US}$	$i_{t-1}^{s,US}$	$\pi_{t-1}^{e,US}$	FH_{t-1}^{US}
	1	−0.126	−0.469	0.088
		[−3.227]	[−2.936]	[8.318]
Error correction	$\Delta i^{l,US}$	$\Delta i^{s,US}$	$\Delta \pi^{e,US}$	ΔFH^{US}
α	−0.169	0.158	0.148	0.254
	[−2.098]	[3.499]	[4.002]	[1.476]
$\Delta i_{t-1}^{l,US}$	0.228	−0.000	−0.100	−0.185
	[1.723]	[−0.003]	[−1.651]	[−0.653]
$\Delta i_{t-1}^{s,US}$	0.228	0.460	−0.155	−0.787
	[1.354]	[4.880]	[−2.009]	[−2.189]
$\Delta \pi_{t-1}^{e,US}$	0.133	−0.021	−0.084	0.185
	[0.623]	[−0.174]	[−0.860]	[0.407]
ΔFH_{t-1}^{US}	0.095	−0.010	0.021	−0.002
	[1.643]	[−0.302]	[0.789]	[−0.020]

Note: t-statistics in brackets.

Table 2.12: Cointegration tests - model with US rates

Panel A: one lag				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.480	237.419	159.530	0.000
At most 1*	0.427	177.280	125.615	0.000
At most 2*	0.356	126.032	95.754	0.000
At most 3*	0.293	85.544	69.819	0.002
At most 4*	0.247	53.593	47.856	0.013
At most 5	0.195	27.506	29.797	0.090
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.480	60.139	52.363	0.007
At most 1*	0.427	51.247	46.231	0.013
At most 2*	0.356	40.488	40.078	0.045
At most 3	0.293	31.951	33.877	0.083
Panel B: three lags				
Unrestricted cointegration rank test (Trace)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.555	237.180	159.530	0.000
At most 1*	0.433	164.266	125.615	0.000
At most 2*	0.387	113.220	95.754	0.002
At most 3	0.230	69.222	69.819	0.056
Unrestricted cointegration rank test (Maximum Eigenvalue)				
No. cointegration relations	Eigenvalue	Trace statistic	0.05 critical value	p-value
None*	0.555	72.915	52.363	0.000
At most 1*	0.433	51.045	46.231	0.014
At most 2*	0.387	43.998	40.078	0.017
At most 3	0.230	23.498	33.877	0.493

Note: * denotes rejection of the hypothesis at the 0.05 level.

Table 2.13: VECM results - global model

Panel A: no lag								
	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	$i^{l,US}_{t-1}$	$i^{s,US}_{t-1}$	$\pi^{e,US}_{t-1}$	FH^{US}_{t-1}
Cointegration equation 1	1	−0.543	−0.680	0.179	-	-	-	-
		[−10.071]	[−6.918]	[14.208]	-	-	-	-
Cointegration equation 2	-	-	-	-	1	−0.060	−0.079	0.004
	-	-	-	-		[−7.327]	[−3.269]	[1.832]
Cointegration equation 3	1	-	-	-	2.933	-	-	-
		-	-	-	[34.712]	-	-	-
Error correction	Δi^l	Δi^s	$\Delta\pi^e$	ΔFH	$\Delta i^{l,US}$	$\Delta i^{s,US}$	$\Delta\pi^{e,US}$	ΔFH^{US}
α^1	−0.084	0.055	0.182	−0.017	−0.053	0.103	0.041	0.243
	[−1.801]	[1.657]	[6.768]	[−0.196]	[−0.758]	[2.628]	[1.189]	[2.580]
α^2	0.481	−0.321	−0.128	−0.016	0.176	0.898	0.060	−0.578
	[2.302]	[−2.165]	[−1.055]	[−0.041]	[0.558]	[5.072]	[0.391]	[−1.363]
α^3	−0.114	0.082	0.053	−0.001	−0.061	−0.209	−0.008	0.134
	[−2.283]	[2.320]	[1.838]	[−0.012]	[−0.815]	[−4.956]	[−0.206]	[1.321]
Panel B: one lag								
	i^l_{t-1}	i^s_{t-1}	π^e_{t-1}	FH_{t-1}	$i^{l,US}_{t-1}$	$i^{s,US}_{t-1}$	$\pi^{e,US}_{t-1}$	FH^{US}_{t-1}
Cointegration equation 1	1	−0.476	−0.211	0.129	-	-	-	-
		[−7.139]	[−4.700]	[14.553]	-	-	-	-
Cointegration equation 2	-	-	-	-	1	−0.098	−0.595	0.116
	-	-	-	-		[−3.179]	[−5.062]	[11.030]
Cointegration equation 3	1	-	-	-	4.267	-	-	-
		-	-	-	[6.096]	-	-	-
Error correction	Δi^l	Δi^s	$\Delta\pi^e$	ΔFH	$\Delta i^{l,US}$	$\Delta i^{s,US}$	$\Delta\pi^{e,US}$	ΔFH^{US}
α^1	−0.498	0.074	0.062	−0.396	−0.347	−0.098	0.049	0.345
	[−4.230]	[0.823]	[0.820]	[−1.724]	[−1.860]	[−0.943]	[0.544]	[1.490]
α^2	0.157	−0.013	0.063	0.266	0.015	0.215	0.121	0.214
	[2.287]	[−0.253]	[1.429]	[1.991]	[0.140]	[3.543]	[2.307]	[1.587]
α^3	0.017	−0.004	0.005	−0.000	−0.004	0.000	0.003	−0.034
	[2.536]	[−0.762]	[1.246]	[−0.009]	[−0.402]	[0.070]	[0.628]	[−2.572]

Note: t-statistics in brackets. Short-run coefficients not reported.

Chapter 3

Financial integration and the Great Leveraging

3.1 Introduction

A number of studies have shown that episodes of rapid credit expansions are important in understanding the emergence of crises as well as their magnitude. In both advanced and emerging economies, the build-up of credit booms contributes to expansions, raising asset prices, appreciation and external deficits; in turn, the bust phase is associated with the opposite dynamics (Mendoza and Terrones, 2008). This feature is not restricted to our recent and modern times – Jordà et al. (2012) argue that it is common to different eras. However, it is a feature specific to credit provided to the private sector: whereas private debt contributes to elevated financial crisis risks, a country's fiscal position becomes important only once a crisis has already erupted (see Jordà et al. 2013).

To the extent that international capital flows and, more generally, financial integration have commonly been associated with periods of rapid credit growth, they too have been linked to the likelihood of crises. For instance, Reinhart and Reinhart (2008) examine the links between capital flows and financial crises and draw unconditional probabilities of a crisis given episodes of capital flow bonanzas.

Against the backdrop of the global financial crisis, Lane and Milesi-Ferretti (2012) study the process of external adjustment and conclude that countries with higher current account deficits in the pre-crisis period than would be explained by underlying economic fundamentals experienced sharper corrections once the crisis erupted. In a more recent study, Lane and McQuade (2014) dig deeper within the external accounts and explore directly the relation between private credit growth and different types of international capital flows. They show that the instrument composition is relevant: while debt flows exhibit a strong co-variation pattern with private domestic credit growth, equity flows do not play a significant role – hence, looking only at aggregate measures of capital flows, such as the current account, might be misleading.

The main contribution of this essay is to extend the previous literature by assessing how financial integration and, specifically, how different types of capital flows interact with developments in the relationship between credit and money. Despite the examples of studies where the relationship between cross-border finance and private domestic credit is analysed, the literature is yet to explore how financial integration affects the interplay between the two variables in the same framework. Doing so casts light on how cross-border capital flows contribute to the funding of domestic banks, how they might affect the shape and composition of banks' liabilities, and finally links them to the asset side and the transmission of this funding into domestic credit to non-banks.

The relevance of putting together the asset and liability sides of the banking sector balance sheet in an integrated manner is strengthened by the recent evidence by Schularick and Taylor (2012) of two distinct periods concerning the dynamics of credit and money. Using a groundbreaking historical dataset, they describe that money and credit were growing at roughly the same pace since the end of the Second World War until the early 1970s, but from that period on credit grew faster than money. This decoupling between the two variables – labeled the Great Leveraging by Taylor (2012) –, was achieved by the fast expansion of banks non-monetary liabilities, such as long-term debt securities, which enabled them to grant credit beyond their deposit base, and can be seen as a measure of leverage in the banking sector.

Furthermore, based on the crisis classifications in Bordo et al. (2001), they provide the link between faster credit growth and crises, by noting that the decoupling between credit and money went hand

in hand with a resurgence of these episodes since the 70s; in contrast, there were barely any crisis episodes before that. Moreover, they show that credit is a predictor of crises while money is not. Their intuition for this result is that credit is a more encompassing measure of bank balance sheets as it captures features such as leverage and non-monetary liabilities which money doesn't.[1]

To better track how cross-border flows affect domestic monetary holdings, I rely on the monetary presentation of the balance of payments which, in a nutshell, establishes a statistical link between balance of payments flows of the different resident sectors – specifically, banking or money-issuing and non-banking or money-holding sectors – and monetary aggregates.

Turning to the results, banking sector flows significantly co-move with the decoupling of credit and money for a group of countries encompassing OECD members plus other mostly Asian and Latin American countries: on the one hand, banking flows display a strong co-variation with credit growth dynamics and, on the other hand, the same is not valid for developments in money. Actually, it turns out that money growth is exclusively associated with non-banking sector flows, while the relation of these flows with credit is less pronounced than with those of banks. Finally, turning to the equity/debt split, and irrespective of the sectoral breakdown of flows, these relationships work via debt flows while equity mostly plays only a negligible role.

The rest of the chapter is organized as follows: Section 2 discusses the link between money and international capital flows, with an emphasis on the monetary presentation of the balance of payments; Section 3 goes through the data and stylised facts; Section 4 introduces the empirical approach and the results obtained; concluding remarks are provided in Section 5.

[1] Baeriswyl and Ganarin (2011) see the decoupling between credit and money as an opportunity to empirically test which of the two variables drives aggregate demand and inflation and thus solve the decade long dispute between the "credit view" and the "money view". With a focus on the United States and Switzerland, they conclude that money is the relevant variable to explain inflation, corroborating Friedman's (1970) assessment that "inflation is always and everywhere a monetary phenomenon". Putting the pieces together, while the asset side of bank balance sheet is the relevant one for financial stability purposes, the liability side is the relevant for monetary policy and price developments. A direct consequence of the latter is that the decoupling between credit and money has important implications for the role of central banking: when both variables were growing in tandem, by setting interest rates and controlling money growth, central banks were also determining developments in credit. Hence, with only a weak relationship between both variables, targeting inflation might be insufficient to address undesirable credit expansions.

3.2 Credit, money and international capital flows

A natural way to approach the relationship between money and international capital flows is to recall the concept of the monetary presentation of the balance of payments. This particular idea hasn't received much attention in the literature in recent times, most theoretical contributions go back a few decades. For instance, Johnson (1972) surveys monetary balance of payments models which, in contrast to Keynesian models that focus on relative price changes, look at the direct impact of the demand and supply for money on the balance between income and expenditure. He concludes that monetary balance of payments models are better suited for policy guidance in the long-run since they assume full employment of resources and that domestic price levels are in line with international price levels (Polak (2001) discusses in detail the Keynesian and the Johnsonian monetary approaches to the balance of payments). Along the same lines, Kemp (1975) argues that the balance of payments embodies an automatic adjustment mechanism, whereby divergences between actual and desired money balances are corrected. Importantly, no distinction is made between the different items of the balance of payments; the only thing that this class of models states is that excess supply or demand for money will be cleared in the goods, services or securities markets.

Both papers focus on how money demand and supply affect the current account balance and/or cross-border capital flows. More recent contributions instead look at how cross-border flows affect money aggregates, which is the adequate approach for the purpose of this essay. The ECB regularly publishes the monetary presentation of the euro area balance of payments together with its monthly releases and uses it in its regular analysis of monetary aggregates' developments[2]. One useful way to think about how cross-border flows may have a direct influence on the domestic money stock is to split them into transactions between non-residents and domestic (i) MFIs or money-issuing sectors and (ii) non-MFIs or the money-holding sectors. The monetary presentation of the balance of payments concentrates on the latter.

To see how transactions of the money-holding sectors might influence money dynamics, it is best to first look at the components of money. While in practice, it is up to each country to define its

[2]See for instance ECB (2008) as well the regular box on financial flows in the quarterly editions of the ECB's Monthly Bulletin

own money aggregates[3] it is nevertheless possible to define a general broad money concept using the consolidated aggregate balance sheet of the resident MFIs, i.e., the sum of all individual MFI (including the central bank) balance sheets after netting out intra-MFI positions, as depicted in Table 3.1.

Money aggregates are typically expressed on the basis of the liability side of the balance sheet. Accordingly, broad money can be defined as generally consisting of currency in circulation, liquid deposits (including foreign-currency-denominated) and other instruments with a given level of liquidity, such as repurchase agreements, debt securities (normally with a maturity below two years) and money market fund shares. Not included in money aggregates are other longer-term liabilities such as deposits with an agreed maturity and those redeemable at a period of over three months, as well as capital, reserves and provisions and other liabilities, such as central government deposits.

But, given that, by construction, the asset and liability sides of the aggregate consolidated balance sheet of the MFI sector must add up to the same amount, one can also define money aggregates using the asset side components or counterparts of money, which are more illustrative of the money creation mechanism. With this second approach, broad money (M) can be defined as the sum of loans to domestic non-banks (DC), net external assets (NEA) obtained as the difference between claims on (external assets) and liabilities (external liabilities) to non-residents – loans and deposits held abroad as well as foreign currency loans and deposits –, and other domestic assets (ODA) – such as, for instance, securities issued by domestic residents or fixed assets – minus longer-term financial liabilities (LTFL) as defined before:

$$M = DC + NEA + ODA - LTFL \tag{3.1}$$

This approach is closely related to the stylized consolidated banking sector balance sheet in Cloyne et al. (2015a and 2015b). On the asset side, loans to domestic non-banks are further broken down into lending to households, private non-financial corporations (PNFCs) and non-bank non-intermediate financial corporations (NIOFCs), given the need for additional sectoral split to fulfil the purpose of these studies – in Cloyne et al (2015b) intermediate financial institutions (IOFCs) are also considered.

[3] §283 of the IMF's Monetary and Financial Statistics Manual states that "this manual does not contain prescriptions for national definitions of money, credit and debt, which are left to the discretion of national authorities"

The same split is also present on the liability side, with household, PNFC and NIOFC money depicting these sectors' money holdings. Regarding external assets and liabilities, these are the equivalent of overseas pound lending/deposits and foreign currency lending/deposits. Finally, gilt holdings are the (simplified) equivalent other domestic assets and non deposit liabilities that of longer-term financial liabilities.

With the previous expression in mind, one can alter it to get flows instead of stocks. Leaving aside the longer-term financial liabilities for simplification, changes to the broad money stock can then be traced to changes to domestic credit to the non-bank sectors, the net external transactions of the money issuing sector (NETMI), which are the flows that affect the claims and liabilities of banks with respect to non-residents, and net other domestic transactions (NODT) which are the transactions in other domestic assets:

$$\Delta M = \Delta DC + NETMI + NODT \tag{3.2}$$

The next step is to establish a relation between net external transactions of banks and balance of payments flows. Since MFI balance sheet and balance of payments statistics follow similar concepts, transactions in both sets of statistics are equivalent[4]. This means that using balance of payments cross-border banking flows instead of the ones derived in MFI balance sheet data is appropriate in this context. But then, given that, by construction, balance of payments flows must sum to zero, it is trivial to realise that the net external transactions of the money-issuing sectors must be symmetrical to those of the money-holding sectors (NETMH), i.e., $NETMI + NETMH = 0$ or $NETMI = -NETMH$. Combining both expressions, we get

$$\Delta M = \Delta DC - NETMH + NODT \tag{3.3}$$

which finally establishes a direct relationship between broad money and non-bank balance of payments flows. Thus, in a nutshell, constructing the monetary presentation of the balance of payments involves isolating the balance of payments items that mirror the net external transactions of non-MFIs,

[4]There might be some differences in practice because of different compilation methods but those are deemed to be relatively small

which have an effect on the net external assets of banks and finally money holdings.

To better understand, consider the following example: if a domestic household sells an asset to another domestic household, there is no change in money holdings in the economy. In contrast, consider the case of a domestic household who sells an asset to a foreign resident: if the buyer uses a foreign account to pay for the asset and the domestic household deposits the proceeds in a domestic bank account, then money holdings will increase.

In a monetary union, this increase would be straightfoward. When different currencies are involved, the foreign investor might exchange foreign with domestic currency and use the latter to pay the domestic resident, in which case domestic currency deposits would increase. But it could be that the domestic resident accepts foreign currency as means of payment for the asset, in which case he could have a foreign currency deposit with the domestic banking sector. Ultimately, the FX regime will be relevant to determine the impact that cross-border flows have on monetary holdings. For instance, in the presence of significant inflows, a country with a fixed exchange rate regime may be forced to carry out a foreign exchange intervention to uphold the currency's value; this intervention can be sterilized – in which case the impact on the monetary base will be offset – or unsterilized – in which case the monetary base will be affected.

Importantly, this refers only to the *direct* effect of the capital flow on the MFI balance sheet. Other second round effects may follow suit. Using the same example as before, if the domestic MFI where the deposit is held then decides to use the extra money to increase loans to the domestic sector, this will lead to a further expansion of the aggregate balance sheet, if the funds are subsequently deposited and lent domestically. The size of the balance sheet expansion (or, in other words, money creation) will ultimately depend on the money multiplier.

However, in some situations the size of the aggregate balance sheet may remain unchanged. This would be the case if, considering the converse of the previous example, a resident household finances the purchase of foreign securities with a loan instead of drawing down its deposit, this will not reduce the money holdings in the domestic economy.

Furthermore, although both sets of statistics have similar concepts, in practice, however, there may be divergences. The most important is the underlying assumption in the above reasoning, that the

resident banking sector is involved in these money-holding sectors transactions. Going back to the previous example, if the resident household uses a non-resident bank account to purchase a foreign asset, this does not have an impact on the country's money stock; nevertheless, it should still be recorded in the balance of payments as it represents a financial transaction between a resident and a non-resident counterpart[5].

Finally, the last remaining link that needs to be established is between the standard detail provided in balance of payments statistics and the money-issuing and -holding sectors flows. In broad terms, it (almost exclusively) involves using the sectoral breakdown available in the financial account; a more detailed description is provided in the data appendix.

In itself, the monetary presentation of the balance of payments provides information on patterns and dynamics of financial account flows which allow for two main interesting analyses. On the one hand, they allow an understanding of which specific types of capital and/or instruments are being purchased or sold and, to the extent that they have different characteristics, the respective impacts and implications of these operations in money developments. In broad terms, the details available in the financial account are on (i) functional categories – foreign direct investment, portfolio investment, other investment –, (ii) the financial instrument – securities, loans, deposits, etc. – and (iii) the type of capital – equity or debt. On the other hand, the monetary presentation of the balance of payments provides not only measures of *net* but also *gross* flows, i.e., asset and liability flows. Specifically, domestic money holdings might change because of the behaviour of both resident and non-resident investors. For instance, money holdings might increase (decrease) because domestic residents sell (buy) foreign assets or because foreign investors buy (sell) domestic assets (or both, of course). Understanding the origin of flows that affect money holdings could also be analytically relevant[6]. In short, the monetary presentation of the balance of payments enables (i) linking developments in money aggregates to cross-border transactions in specific asset classes and (ii) disentangling domestic versus foreign residents behaviour by looking separately at the dynamics of assets and liabilities.

[5] In practice, this situation should be mitigated by the fact that these are typically the transactions which statisticians have the greater difficulties to record. This is because normally the resident banking sector is the basis of reporting.

[6] For instance, Forbes and Warnock (2012) show the importance of using gross flows and clearly disentangling the behaviour of domestic and foreign investors when assessing episodes of capital surges and stops

3.3 Data and stylised facts

In this section I briefly describe the data I use. More detailed information is provided in the data appendix. The list of countries covered and the time periods are in Table 3.3. Although data for Luxembourg are available, I make the standard assumption and remove it from the analysis due to the significant mutual fund industry operating from the country[7].

3.3.1 Data

Starting with credit, I use the private credit to the private non-bank sectors by banks published by the IMF in the International Financial Statistics (IFS) dataset. The BIS staff has recently put together a new credit dataset for some forty countries (details are provided in Dembiermont et al. 2013). In broad terms, this new dataset differs from the IFS credit series (or any other typical credit measure) in two main aspects: it includes (i) cross-border credit directly to domestic non-banks and (ii) credit provided by domestic non-banks. There are two reasons for not considering these credit series and sticking to those of the IFS. The first is a conceptual reason: the focus of this essay is on the aggregate balance sheet of MFIs, i.e., how international capital flows *directly* affect both the asset side (credit) and the liability side (money holdings). The two additional sources of credit contemplated in the new BIS series bypass the domestic banking sector and are therefore not consistent with the essay's goal. The second reason is of a practical nature: the country coverage in these new BIS series is smaller and, intersected with the capital flows data availability, would significantly reduce the number of countries considered.

Turning to money series, these are also from the IFS dataset and are broad money aggregates (mostly M3 but also M2 and other broad measures whenever M3 is not available). Additionally, one particular case is that of euro area countries, for which individual national money aggregates are not available. National contributions to the euro area money aggregates are available from the ECB but these are based on an euro area wide residency concept, i.e., they exclude intra-euro area banking

[7]The cross-border capital flows associated with the mutual funds industry are typically (i) very large and have a very limited impact in the domestic economy and (ii) imbalanced in the sense that equity flows associated to purchases of mutual fund shares are recorded on the liability side while debt flows are recorded on the asset side on account of the large bond portfolios these funds hold.

positions. Using these as measures of national money aggregates would therefore likely hamper the analysis since the share of intra-euro area positions among total banking positions is significant for most EMU countries – Spiegel (2009a,b) for instance discusses the increase and the drivers of euro area countries' share in the total borrowing of Portuguese and Greek banks. Moreover, using a euro area wide residency concept would also be inconsistent with the residency concept underlying the national balance of payments flow data of individual euro area countries. For these reasons, I computed proxies for these aggregates using IFS data, which are based on the relevant national residency concept. More details can be found in a dedicated subsection in the data appendix. Table 3.4 displays the complete list of the aggregates I used for each country.

Finally, concerning capital flows data, the source is the IMF balance of payments database. I focus on net measures of debt and equity flows, both for the money-issuing and money-holding sectors. A positive figure represents net capital inflows whereas a negative figure represents net outflows. Details on the construction of these measures are provided in the respective section of the data appendix. I also consider the current account balance for completeness. To get a better feel for these capital flows measures, Table 3.5 displays correlations between net equity and debt flows of money-issuing and -holding sectors with the change in the BIS net external bank claims for the available countries (all scaled by GDP and in the 1999-2007 period). The latter measure is a proxy for cross-border bank flows as changes in net claims, although also reflecting price and exchange rate variations, are mostly related to flows. As can be seen and despite these limitations, the correlation of the net debt flows of the money-issuing sectors with the BIS measure is particularly strong and positive, as expected.

3.3.2 Some stylised facts

I start by focusing on annual data for the 1999-2007 period. There are two reasons for choosing this period. First, given that 1999 is the initial data point for the euro area countries' money aggregates proxies, I use this year as starting point so as not mix the previous national monetary aggregates with these proxies[8]. Moreover, going further back than 1999 would also reduce the country coverage due to

[8]Of course, the problem remains for Greece and Slovenia, that joined the euro area in 2001 and 2007, respectively. All remaining countries that didn't join the euro area at its inception, joined later than 2007: Cyprus and Malta in 2008, Slovakia in 2009 and Estonia in 2011.

data availability. Second, I intentionally exclude the crisis period.

Table 3.6 displays some basic descriptive statistics for the countries in the dataset. Starting with the total, we see that credit and money scaled by GDP are almost identical, thus leading to a ratio of these variables of almost one. Moreover, this ratio was increasing in the period under consideration as credit grew faster than money. However, the statistics for the total dataset hide important differences across OECD and non-OECD countries: credit scaled by GDP is much higher in OECD than in non-OECD countries, whereas money is broadly the same in both country groups. As a consequence, the ratio of credit to money is higher in OECD countries. Moreover, this ratio has been growing for OECD countries as credit growth has been faster than money growth. Again, we get the opposite picture when looking at non-OECD countries, with money growing faster than credit and, therefore, a falling ratio.

Table 3.7 displays the same descriptive statistics according to two variables (details provided in the appendix): (i) the FX regime classification since, as opposed to a floating regime, the management of a fixed regime might lead the central bank to react and intervene in the presence of cross-border capital flows to stem their impact on the exchange rate and thereby influence the dynamics of credit and money; and (ii) the share of foreign banks in the domestic banking system as a significant presence of foreign banks is likely associated with higher cross-border financial activity. The statistics show that countries with fixed regimes have, on average, both higher levels and growth rates of credit and money scaled by GDP and of the ratio of both variables. The picture is less clear concerning the share of foreign banks. Countries with high shares have lower levels of credit scaled by both GDP and money. They also have lower credit and money growth rates but a higher average growth of the credit to money ratio.

To better assess the interplay of developments in money and credit and cross-border capital flows, I split the countries in the dabatase into quartiles according to their credit to money ratios growth in the entire period between 1999 and 2007. For each quartile, Table 3.9 displays the median values of credit, money, the ratio between both variables, the five cross-border flow measures, FX regime classification and the share of foreign banks in the domestic banking sector. The growth rate of the ratio of credit to money is negative in the first and second quartiles and positive in the third and fourth.

These descriptive statistics provide a few interesting insights. First, countries in the fourth quartile, which experience higher growth in the ratio of credit to money, do so on account of faster credit growth than money: both variables are growing, one faster than the other, while in the first quartile credit is decreasing and money increasing quite substantially. Second, the growth of the credit to money ratio and net debt flows of the money-issuing sectors seem to be related: net outflows are recorded in the first and second quartiles together with a decrease in the ratio, while inflows are recorded in the third and fourth alongside an increase in the ratio. Furthermore, the decrease in the ratio is bigger in the first quartile than in the second, at the same time that larger outflows are recorded; similarly, the increase is higher in the fourth quartile than in the third and the inflows are also larger. The same type of association is not visible for the remaining types of flows – debt flows of the money-holding sectors and equity flows – which are relatively constant throughout all quartiles. However, the same is not the case for the current account, which displays an inverse relationship with the growth of the ratio of credit to money: it is positive (i.e., outflows are recorded) in the first quartile and increasingly negative in the remaining quartiles. In other words, the larger the inflows, the faster the growth of the ratio of credit to money. Finally, faster credit to money ratio growth is associated with fixed FX regimes (fourth quartile) while a clearer picture is not visible in the share of foreign banks in the domestic banking sector.

As I am chiefly interested in capturing the medium- and long-term relationship between credit and money dynamics and cross-border capital flows, I use multi-year periods. Specifically, I use two four-year periods from 1999 to 2003 and 2003 to 2007. I apply the same procedure as before but use instead terciles. The results, displayed in Table 3.10, are qualitatively identical.

To illustrate these patterns, Figures 3.1 and 3.2 display quarterly credit and money scaled by GDP and 4-quarter moving sums scaled by GDP of money-issuing and money-holding sectors net debt flows for Estonia and Japan. These two countries provide examples for, respectively, a net importer of capital with a high presence of foreign banks in the domestic banking system and a fixed FX regime and a net exporter of capital with a low presence of foreign banks in the domestic banking system and a floating FX regime. Starting with Estonia, credit and money were growing pretty much in line in the beggining of the period: from end-1996 until roughly 1998 there was an initial rise in both variables at the same

time that inflows into both the money-issuing and holding sectors were recorded; from 1998 until roughly 2000 both credit and money fell while net outflows were recorded. However, since the early 2000s, credit started to grow faster than money, leading to the decoupling of the two variables. This development took place at the same time that consistent and sizeable inflows into the money-issuing sectors were recorded while money-holding sectors flows remained subdued and alternating between inflows and outflows. Turning to Japan, the decline in credit for most of the period goes together with consistent outflows from the money-issuing sectors as well as from the money-holding sectors, albeit smaller. In turn, money barely increases in the period.

In summary, there seems to be a strong comovement between credit and net debt flows, especially in the case of the money-issuing sectors, while broad money seems to move in line with money-holding sectors debt flows. Finally, these relationships are independent of whether the country in question is an overall net exporter or importer of capital, i.e., has a positive or negative current account.

Euro area

The euro area aggregate monetary presentation of the balance of payments is published by the ECB but country level data is not available. This essay's database however allows for an in-depth analysis of euro area country level dynamics. One natural and obvious way to organize euro area countries is to split them between core and periphery. In the database there are four core countries - Austria, Finland, France and Germany, - and four periphery countries - Greece, Italy, Portugal and Spain.

Table 3.8 displays descriptive statistics for the euro area countries. Importantly, for consistency purposes, the euro area figures presented in this table are the sum of the eight available countries and not aggregate credit or money variables based on euro area residency concepts (see the data appendix for more details).

Developments in credit and money in core and periphery countries are quite disparate. Credit and money scaled by GDP are both higher in periphery countries. The difference is however larger in the case of credit (around ten percentage points) than in the case of money (around five percentage points). As a consequence, the ratio of the two variables is also higher in periphery countries. Perhaps more striking than the differences in the levels of these variables are the respective growth rates, especially

that of credit: whereas credit grew only modestly in core countries, its expansion was much more pronounced in periphery countries. Moreover, credit growth was slower than money growth in core countries, therefore leading to a fall in the credit to money ratio. In contrast, credit grew almost twice as fast as money holdings in periphery countries, thus leading to a widening of the ratio between the two variables.

Charts 3.3 and 3.4 display credit and money as well as net debt flows of the money-issuing and -holding sectors for Portugal and Germany in the same way as those for Estonia and Japan and illustrate broadly the same ideas. Starting with Portugal, a significant increase in credit took place together with a spike in inflows into the money-issuing sectors from 1999 to 2003. A period of subdued inflows and credit growth then took place. Strong credit growth resumed from roughly 2005, coupled with a new wave of sizeable money-issuing sectors inflows. Money decreased slightly from 1999 to 2004, at the same time that outflows were recorded for the money-holding sectors. From then on, money increased alongside inflows into the money-holding sectors. Turning to Germany, after an initial period up until roughly 2000 of credit growth and inflows into the money-issuing sectors, credit was constantly decreasing at the same time that outflows were recorded for the money-issuing sectors. In turn, money was almost always increasing.

3.4 Econometrics

3.4.1 Empirical approach

I use a cross-sectional empirical approach using the previous two four-year periods – from 1999 to 2003 and 2003 to 2007. There are a few reasons for using a multi-year approach. First of all, and as mentioned, I am interested in the medium- and long-term joint-dynamics of, on the one hand, credit and money and, on the other hand, international capital flows. For this purpose, lower frequency data is more appropriate. Second, capital flow data are known for sizeable fluctuations and volatility at higher frequency, whose undesired effects would be mitigated by this multi-year period approach. Finally, this approach closely follows Lane and McQuade (2014), the only referrence that also resorts to this level of breakdown of capital flows data, in turn allowing for better comparability and tractability.

Regarding the actual choice of periods, it was constrained by the data availability. Ideally, five-year periods would be optimal to, again, ensure comparability with Lane and McQuade (2014). However, I chose 1999 as a starting point to avoid mixing the proxies for euro area countries' money aggregates with the previous national aggregates; I chose 2007 as the ending point to exclude the crisis from the analysis. With these starting and ending points, one is left with two non-overlapping four-year periods.

The specification is given by

$$\begin{aligned}(X_{it} - X_{it-s}) &= \beta_p^1 + \beta_p^2 X_{it-s} + \beta_p^3 log(GDP_{it-s}^{pc}) + \beta_p^4 FX_{it-s} + \beta_p^5 SFOREIGN_{it-s} + \beta_p^6 NOECD + \\ &+ \beta_p^7 \sum_{k=t-(s+1)}^{t} FL_{ik} + \varepsilon_{ip}\end{aligned}$$

The left hand side variables X are either credit or money - both scaled by GDP - or the ratio of credit to money. Moving on to the right hand side variables, X is the initial level of the three variables and GDP^{pc} is the initial level of GDP per capita. Both co-variates are intended to capture potential convergence effects, whereby countries with smaller initial levels of credit/money and output per capita might be undergoing a catch up effect and, for this reason, experiencing faster growth. Turning to FX, this is a dummy variable for the FX regime classification, assuming value 1 in the case of fixed regimes and 0 otherwise. $SFOREIGN$ is the share of foreign banks in total bank assets proxied by the local claims of foreign affiliates in a given country, taken from the BIS banking statistics, and scaled by private credit. In turn, $NOECD$ is a dummy variable taking value 1 for countries that do not belong to the OECD and 0 otherwise. Finally, FL are the cross-border capital flow measures. I use net equity and debt flows of the money-issuing and -holding sectors as well as the current account balance (4-year averages, scaled by GDP). The index p in the regression coefficients stands for the two time periods considered.

Cross-border capital flows and, more generally, financial integration, interact with credit growth via different channels. On the one hand, capital inflows provide the resident banking sector with more resources which can be channeled to domestic credit provision. On the other hand, capital flows exert an upward pressure on asset prices, generating wealth effects, which can be translated

into higher consumption and demand for credit – see, for instance, Aizenman and Jinjarak (2009), Sá and Wieladek (2010) and Vasquez-Ruiz (2012). Furthermore, higher asset values improve household and corporate balance sheets, boosting colateral values and, in that fashion, facilitate the access to credit. Regarding money, and as extensively discussed in the section on the monetary presentation of the balance of payments, capital flows also affect money holdings via the net external assets of the domestic banking sector.

Regarding the co-variates, countries with higher GDP per capita also tend to have more developed and deeper financial systems, as well as a better institutional environment, all of which facilitate credit provision and render it more accessible. The FX regime interacts with money aggregates to the extent that countries with fixed regimes, as opposed to flexible, may influence the monetary base (and hence the monetary aggregates) depending on whether they carry out sterilized or unsterilized foreign exchange operations. The FX regime may also be important for credit growth since countries with fixed regimes minimize the exchange rate risk, thus providing a more stable environment for foreign investment and capital flows.

3.4.2 Results

Tables 3.11, 3.12 and 3.13 display, respectively, results for credit, money and the ratio between both variables. The first can be thought of as an asset side regression, the second as a liability side regression and the third combines both the asset and liability sides.

Starting with the credit regressions in Table 3.11, credit growth displays overall a statistically significant comovement with net debt flows, especially in the 2003-2007 period and in the pooled regression. Moreover, the signs are those expected: a positive coefficient means that net inflows are associated with credit growth. The only exception is in the 1999-2003, where the coefficient on net equity flows of the money-holding sectors is significant. However, in this instance, net flows are associated to a lower credit, as the coefficient is negative. These results are therefore consistent with the findings in Lane and McQuade (2014) in the sense that debt is the significant component in explaining credit growth. Furthermore, within net debt flows, those of the money-issuing sectors seem to have a stronger comovement with credit than those of the money-holding sectors, which are mostly relevant in

the pooled regression only. The coefficient on the share of foreign banks is statistically significant in the regressions with the current account and ceases to be in the regressions with the detailed flows (except in the pooled regression). This likely is the case because the variation is picked up by coefficients on the detailed flows – a more complete speficication than the current account only – and the statistical significance drained from the coefficient on the share of foreign banks.

The picture is completely different in the money regressions in Table 3.12. First of all, only money-holding sectors flows are relevant in explaining money dynamics; in no instance are money-issuing sectors flows significant. Again, net debt flows seem to be more powerful than net equity flows as the latter are only barely significant in the pooled regression. Moreover, in that particular case, the coefficient is negative, indicating that equity flows are associated with negative money growth.

Finally, turning to the credit to money ratio in Table 3.13, there is an evident and strong relation between money-issuing sectors debt flows in both periods and in the pooled regression. At the same time, interestingly, money-holding sectors debt flows are not statistically significant. Finally, money-holding sectors equity flows are only tenuously significant in the 2003-2007 period and with a positive coefficient: putting this result together with those of both previous sets of regressions, while money-issuing debt flows are likely associated with a higher credit to money ratio via a numerator effect, money-holding sectors equity flows have the same effect working via a denominator effect, i.e., by reducing money holdings.

Throughout the whole analysis, the current account exhibits a statistically significant comovement with the three variables and the periods under consideration, with only few exceptions. This clearly shows that focusing on broad measures such as the current account is unsufficient to grasp the relevant relationships at play. This is because one could assume that all types of flows regarding instrument and sectoral composition would have a significant relationship whenever the current account does (which is generally the case) with credit, money or the ratio between both. However, as the results in this chapter show, this would be misleading given the differentiated roles flows display once they are broken down by equity and debt instruments and by the recipient domestic sector.

In some countries, intra-company loans may represent a significant cross-border source of funding to non-financial corporations. Although they are formally recorded within FDI, and therefore considered

equity, they are in essence loans like others recorded elsewhere in the financial account – in other investment or in portfolio investment, since they can also take the form of debt securities – whereby companies in the same group provide funds to one another. Furthermore, these loans might also represents a source of inconsistencies, since as explained in detail in the appendix, intra-company loans in the case of financial corporations are recorded under other investment. For this reason, and to assess whether taking these loans as equity could be biasing the results, I reran the regressions considering the debt component of FDI within debt and only the remaining components of capital and reinvested earnings as equity (again more details on this alternative specification are provided in the data appendix). Results are displayed in Table 3.14 and they are qualitatively the same (I report only the results for the credit to money ratio). Net equity flows of the money-holding sectors are now larger, especially in the 2003-2007 period but still positive and fully consistent with the picture provided by the previous regressions.

3.5 Concluding remarks

This essay has looked at the relationship between credit, money and international capital flows. It has shown that the sectoral composition of flows is an important component with different implications for domestic credit and money holdings. In particular, while net debt flows of non-banks display comovement with broad money, net debt flows of banks seem to be more relevant in explaining credit dynamics and display significant co-movement with the ratio of credit to money.

In other words, according to this evidence, in addition to contributing to credit growth and the expansion of the asset side of domestic banks' balance sheets, the cross-border banking activity has gone hand in hand with a change in the mix between monetary and non-monetary liabilities of banks and, in this sense, it is associated with the expansion of bank non-monetary liabilities.

These results point to the need for carefully monitoring the cross-border element when assessing developments in credit and money. Shin (2013) argues that the non-core liabilities of banks – and therein especially external ones – are strongly associated with the vulnerability to a crisis. Hoggarth et al. (2010) discuss how foreign sources of funding are typically more volatile and procyclical than

domestic sources and Hoggarth et al. (2013) discuss how foreign affiliates in the UK, which operate mostly using non-resident funding, were more volatile than UK-owned banks once the crisis erupted. Finally, one key element stressed by these results is the need to better understand the role of global banks, how they operate and provide liquidity worldwide – examples of work in that area are Cetorelli and Goldberg (2011, 2012), Bruno and Shin (2013), McCauley (2012) and Niepmann (2013).

3.6 Data Appendix

The starting point for the country coverage was the OECD countries. To these I also added a significant number of other countries, mostly Asian and Latin American. Unfortunatelly, for data availibility reasons, the country coverage is smaller than that. The complete list of countries and with the time period for which data is available is in Table 3.3. This list is the intersection of the data availability across the three variables: credit, money and capital flows. More details for the different variables are provided in the next subsections.

3.6.1 Credit and money aggregates

The data for credit and money aggregates from the IFS CD-ROM version of August 2012.

Starting with credit, I use the claims of depositary corporations on other private sectors available at the IMF IFS dataset (line 22d). For some countries there are breaks in these series, mostly from 2000 to 2001. In these cases, I remove the initial data points and start in 2001 only.

Regarding money aggregates, there are two types in IFS: the standardized report forms (SRFs) and the national definitions of money (NDMs). For consistency sake, I use the SRFs to the extent possible. I focus on a broad monetary aggregate and choose M3 as default. Whenever it's not available, I use M2. If neither is available in the SRFs, I resort to the NDMs or to other broad money definitions.

Finally, both credit and money series are provided in national currency. I convert them to US dollars using end-period exchange rates, also taken from the IFS dataset.

Euro area countries money aggregates

The ECB compiles and publishes euro area money aggregates which are built using country level data of the individual member states' contributions to both the aggregate and consolidated euro area MFI balance sheet. The contributions are compiled using the euro area wide residency concept, i.e., excluding intra-euro area positions. Therefore, these data are not suited to build individual countries' money aggregates and the ECB doesn't publish alternative public data. However, the IMF publishes depository corporations balance sheet data of euro area member states according to a national residency

concept – the same as balance of payments statistics – in the IFS statistics database.

The breakdowns are not exactly the same as the ones the ECB uses to build the euro area aggregates. Specifically, the split between different types of deposits – overnight deposits, deposits with an agreed maturity up to 2 years, deposits redeemable at a period of notice up to 3 months – as well as repurchase agreements is not available. One can nevertheless construct broad money aggregates similar to the ECB's definition for the euro area. In order to get concepts as close as possible to the ECB, I define M2 as the sum of currency in circulation, transferable and other deposits and M3 as M2 plus securities other than shares with a maturity up to two years and money market fund shares. Given the lack of detail within deposits, I ignore M1 (see Table 3.2).

3.6.2 Capital flows

I construct the monetary presentation of the balance of payments along the lines of Bê Duc et al. (2008)[9], which boils down (almost exclusively) to applying a sectoral breakdown and distinguishing external transactions of the money-holding sector from those of the money-issuing. Starting with the basic identity of the balance of payments

$$CA + KA + FA + EO = 0 \tag{3.4}$$

where CA is the current account, KA the capital account, FA the financial account and EO the residual errors and omissions. Breaking the financial account into transactions of the money holding (FAMH) and the money-issuing sectors (FAMI), we can rewrite the expression as

$$CA + KA + FAMI + FAMH + EO = 0 \tag{3.5}$$

There are, however, some limitations concerning items for which this breakdown is not available. This is the case of the current and capital accounts, as well as the item errors and omissions, the statistical discrepancy. For these items, Bê Duc et al. (2008) assume that they reflect money-holding sectors' transactions. Thus, we can write $NETMI = FAMI$ and $NETMH = FAMH + CA + KA +$

[9] see also Bank of England (2005)

EO. Finally, recalling that $NETMI + NETMH = 0$

$$NETMI = \Delta NEA = -CA - KA - FAMH - EO \tag{3.6}$$

Total net financial flows can be constructed for the four sectors available - monetary authority, MFIs, general government and other sectors - the outcome could be thought of as a financial account for each of them. Net financial flows for the money issuing and money holding sectors are computed as the result of adding, respectively, on the one hand, net flows for the monetary authority and MFIs and, on the other hand, net flows of the general government and other sectors. Further breakdowns are available for equity and debt. Finally, total money-holding sector flows are obtained by adding the current and capital accounts as well as errors and omissions to the financial flows of those sectors. However, given the small magnitude of both the current account and errors and omissions, I abstract from these and focus on financial account flows only and their split into equity and debt instruments.

The data are taken from the IMF balance of payments dataset, from the January 2012 CD ROM version. There is one limitation concerning FDI as the split between other sectors and banks is not available. However, this shouldn't be a significant caveat since, to a large extent, FDI should be associated to other sectors and not banks. Moreover, by definition, only equity positions of banks should be recorded in FDI, all other types of transactions (mainly loans between affiliates) should be recorded under other investment, which minimizes the impact of the lack of sectoral breakdown in this particular item (see §6.28 of IMF, 2009). To assess whether intra-company loans of other sectors might be influencing results across the equity/debt split, I also constructed an alternative version of the monetary presentation, assuming that these loans are debt and not equity.

3.6.3 Other variables

- Starting with GDP per capita, GDP data is from the IMF World Economic Outlook and population data from the World Bank.

- On the FX regime, this is a dummy variable constructed using Reinhart and Rogoff's (2009) FX regime classification. Specifically, this classification assigns values from 1 to 4, where 1

corresponds to fully fixed regimes and 4 to floating regimes. I take classifications 1 and 2 as fixed regimes and 3 and 4 as floating. The data are taken from the book's website.

- Data for the local claims used for the proxy on the share of foreign banks in the domestic banking sector are from the BIS consolidated banking statistics, taken from the BIS website. Specifically, these correspond to the local currency claims on local residents by all reporting banks and countries on an immediate borrower basis. The share of foreign banks in the domestic banking sector is obtained by scaling the claims by credit. For the purpose of Table 5.2, countries with low presence of foreign banks are defined as being below the median value in the 1999-2007 period and high presence of foreign banks are defined as being above. Claessens and van Horen (2013) create a database with the nationality of banks in the banking systems of a large sample of countries. With these data, they compute the percentage of foreign banks among total banks. They also develop an indicator of the percentage of foreign bank assets among total bank assets which would be ideal for the purposes of this analysis. However, their indicator only starts in 2004 due to Bankscope data availability. For this reason, I use instead a proxy for foreign banking activity with BIS data.

- Data for the change in net external claims used for the flow measures correlations are from the BIS locational banking statistics, taken from the BIS website. These are claims of domestic residents on foreign residents net of responsibilities of domestic residents to foreign residents by all reporting banks and countries.

Figure 3.1: Credit, money and cross-border debt flows - Estonia

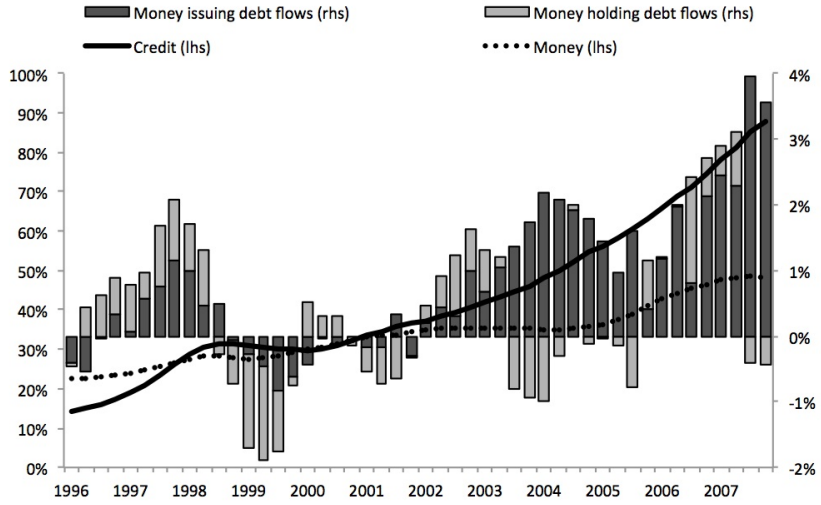


Figure 3.2: Credit, money and cross-border debt flows - Japan

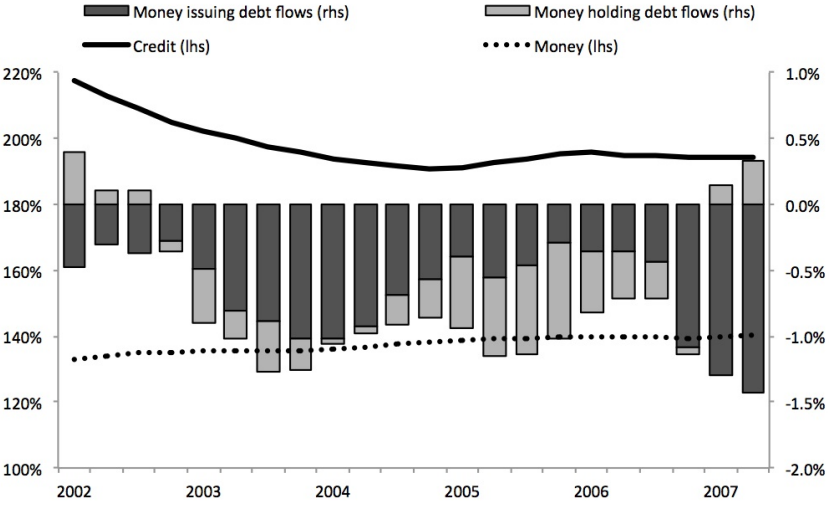


Figure 3.3: Credit, money and cross-border debt flows - Portugal

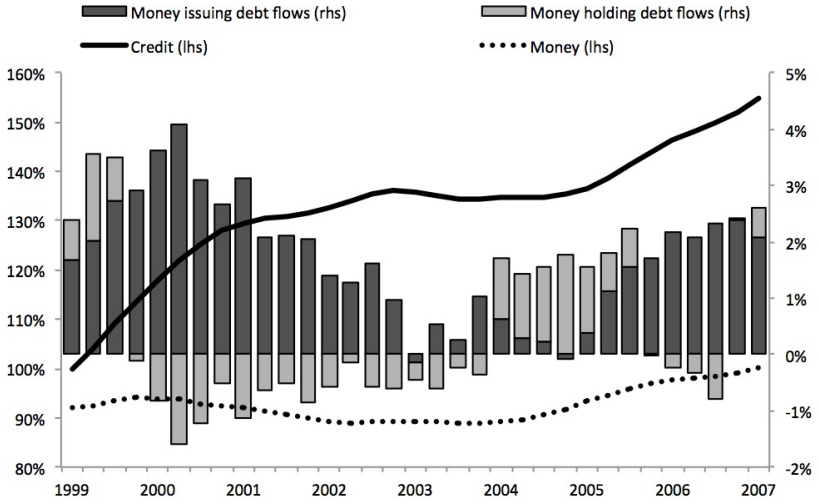


Figure 3.4: Credit, money and cross-border debt flows - Germany

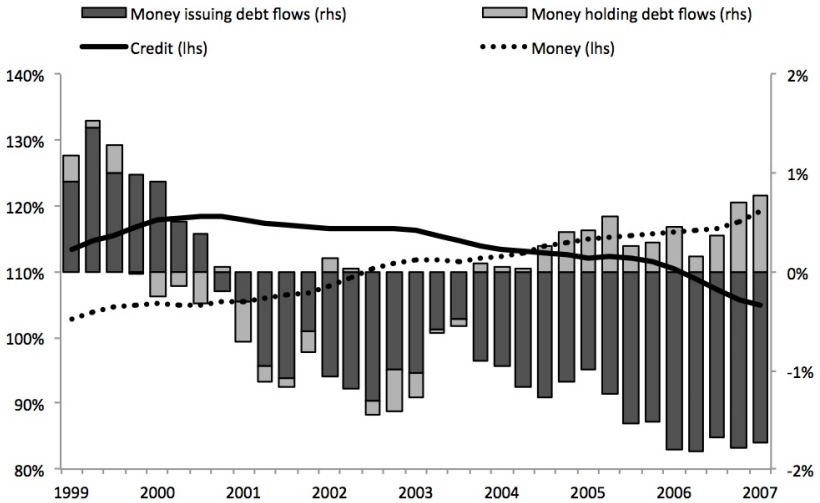


Figure 3.5: Credit growth and net debt of the money-issuing sectors

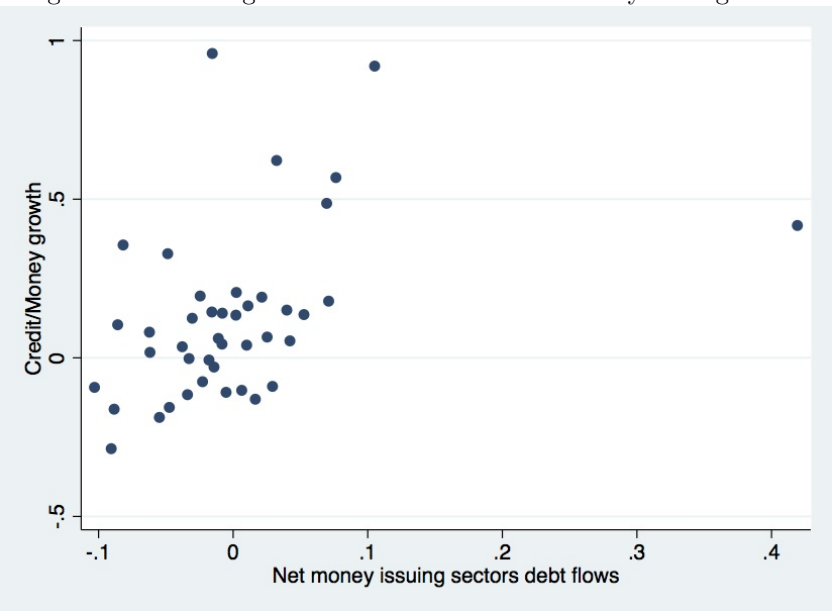


Table 3.1: Consolidated aggregate MFI balance sheet

Assets	**Liabilities**
	Broad money
Loans to domestic non-banks	Currency in circulation
	Deposits (liquid)
	Money market fund shares
	Repurchase agreements
	Debt securities (with limited maturity)
Claims on non-residents (external assets)	Financial liabilities to non-residents (external liabilities)
	Deposits and loans received from non-residents
	Non-monetary liabilities
	Longer-term financial liabilities
	Deposits and loans with agreed maturity
	Deposits redeemable at a period of notice of over 3 months
	Capital, reserves and provisions
Other domestic assets	Other liabilities
including fixed assets	including deposits by central government

Table 3.2: Definition of euro area money aggregates

ECB's definition of euro area money aggregates			
	M1	M2	M3
Currency in circulation	X	X	X
Overnight deposits	X	X	X
Deposits with an agreed maturity up to 2 years		X	X
Deposits redeemable at a period of notice up to 3 months		X	X
Repurchase agreements			X
Money market fund shares/units			X
Debt securities up to 2 years			X
EA countries' monetary aggregates using IFS data			
		M2	M3
Currency in circulation		X	X
Transferable deposits		X	X
Other deposits		X	X
Money market fund shares/units			X
Debt securities up to 2 years			X

Table 3.3: Data availability

Country	Initial	Final	Country	Initial	Final
Argentina	1998	2010	Latvia	2003	2008
Australia	1990	2003	Lithuania	1996	2008
Austria	1999	2005	Luxembourg	2003	2010
Bolivia	1997	2010	Malaysia	2002	2009
Brazil	1995	2010	Malta	1995	2007
Bulgaria	1995	2008	Mexico	1996	2010
Canada	2001	2008	Morocco	2003	2009
Chile	1996	2010	Norway	1994	2006
Colombia	1996	2010	Peru	1992	2010
Cyprus	2001	2007	Philippines	1996	2007
Czech Republic	2002	2008	Poland	2000	2008
Denmark	2000	2008	Portugal	1999	2010
El Salvador	2001	2010	Romania	2001	2010
Estonia	1993	2010	Russia	2000	2010
Finland	1999	2006	Slovakia	2000	2008
France	1999	2010	Slovenia	1994	2006
Germany	1999	2010	South Africa	1992	2010
Greece	2001	2010	Spain	1999	2010
Guatemala	1997	2010	Sweden	2001	2008
Hong Kong	2001	2010	Thailand	1997	2010
Hungary	1995	2008	Turkey	1990	2010
Iceland	2000	2007	United Kingdom	1990	2010
Israel	1990	2010	Uruguay	2001	2010
Italy	1999	2010	Vietnam	1996	2010
Japan	2001	2010			

Note: No money aggregates for Israel and Vietnam

Table 3.4: Broad money aggregates

Country	Source	Series	Country	Source	Series
Argentina	SRF	M3	Latvia	SRF	M3
Australia	SRF	M3	Lithuania	SRF	M2
Austria	Est	M3	Luxembourg	Est	M3
Bolivia	NDM	M'4	Malaysia	SRF	M3
Brazil	SRF	M3	Malta	SRF	M3
Bulgaria	SRF	M3	Mexico	SRF	M3
Canada	NDM	M3 GROSS	Morocco	SRF	M3
Chile	SRF	M3	Norway	SRF	BROAD MONEY(M2)
Colombia	SRF	M3	Peru	SRF	LIQUIDITY
Cyprus	SRF	M2	Philippines	SRF	M3
Czech Republic	SRF	M3	Poland	SRF	M3
Denmark	SRF	M3	Portugal	Est	M3
El Salvador	SRF	M3	Romania	SRF	BROAD MONEY
Estonia	SRF	M2	Russia	SRF	BROAD MONEY
Finland	Est	M3	Slovakia	SRF	M2
France	Est	M3	Slovenia	SRF	M3
Germany	Est	M3	South Africa	SRF	M3
Greece	Est	M3	Spain	Est	M3
Guatemala	SRF	M2	Sweden	SRF	M3
Hong Kong	SRF	M3	Thailand	NDM	BROAD MONEY
Hungary	SRF	M3	Turkey	SRF	M3
Iceland	SRF	M3	United Kingdom	NDM	M4
Israel	-	-	Uruguay	SRF	BROAD MONEY
Italy	Est	M3	Vietnam	-	-
Japan	SRF	M3			

Note: "SRF" are IFS's standardised report forms, "NDM" are IFS's national definitions of money "Est" are author own estimations. No money aggregates for Israel and Vietnam

Table 3.5: Correlations of capital flow measures - 1999-2007 period

	BIS derived flows
MISSUINGD	0.869
MHOLDINGD	-0.414
MISSUINGE	-0.421
MHOLDINGE	-0.639
CAB	-0.148

MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, CAB is the current account balance.

Table 3.6: Summary statistics by country group, 1999-2007 period

	C/GDP	M/GDP	C/M	ΔC/GDP	ΔM/GDP	ΔC/M
Total						
N	424	392	384	376	346	338
Mean	0.742	0.737	1.083	0.040	0.026	0.019
SD	0.490	0.510	0.587	0.100	0.084	0.166
OECD						
N	280	266	258	248	235	227
Mean	0.838	0.746	1.194	0.058	0.029	0.035
SD	0.515	0.396	0.660	0.109	0.086	0.186
Non OECD						
N	144	126	126	128	111	111
Mean	0.554	0.719	0.856	0.006	0.019	-0.014
SD	0.375	0.693	0.287	0.068	0.081	0.108

C/GDP is credit scaled by GDP, M/GDP is money scaled by GDP, C/M is the credit to money ratio.

Table 3.7: Summary statistics by FX regime and foreign bank presence - 1999-2007 period

	C/GDP	M/GDP	C/M	ΔC/GDP	ΔM/GDP	ΔC/M
Total						
N	424	392	384	376	346	338
Mean	0.742	0.737	1.083	0.040	0.026	0.019
SD	0.490	0.510	0.587	0.100	0.084	0.166
Fixed FX						
N	195	181	180	176	162	161
Mean	0.866	0.855	1.135	0.051	0.035	0.034
SD	0.473	0.592	0.579	0.097	0.092	0.087
Floating FX						
N	226	211	204	198	184	177
Mean	0.639	0.636	1.036	0.031	0.018	0.005
SD	0.482	0.401	0.591	0.103	0.076	0.213
High share foreign banks						
N	213	208	200	198	189	185
Mean	0.639	0.749	0.906	0.027	0.021	0.021
SD	0.445	0.581	0.448	0.078	0.083	0.095
Low share foreign banks						
N	211	184	184	178	157	153
Mean	0.846	0.724	1.275	0.056	0.031	0.016
SD	0.513	0.416	0.656	0.119	0.086	0.224

C/GDP is credit scaled by GDP, M/GDP is money scaled by GDP, C/M is the credit to money ratio.

Table 3.8: Summary statistics for euro area countries, 1999-2007 period

	C/GDP	M/GDP	C/M	ΔC/GDP	ΔM/GDP	ΔC/M
Euro area						
N	72	70	70	64	62	62
Mean	1.025	0.857	1.224	0.063	0.035	0.025
SD	0.316	0.216	0.212	0.096	0.073	0.053
Euro area core						
N	36	36	36	32	32	32
Mean	0.978	0.831	1.189	0.034	0.026	0.011
SD	0.222	0.217	0.104	0.076	0.064	0.051
Euro area periphery						
N	36	34	34	32	30	30
Mean	1.071	0.885	1.261	0.092	0.044	0.041
SD	0.386	0.214	0.283	0.106	0.081	0.051

C/GDP is credit scaled by GDP, M/GDP is money scaled by GDP, C/M is the credit to money ratio.

Table 3.9: Credit to money growth 1999-2007 - Quartiles

	1999-2007			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
C/GDP	-0.007	0.040	0.020	0.069
M/GDP	0.429	0.072	0.005	0.017
C/M	-0.073	-0.007	0.034	0.093
MISSUINGD	-0.022	-0.011	0.002	0.018
MHOLDINGD	0.006	0.004	0.009	0.006
MISSUINGE	0.000	0.000	0.000	0.000
MHOLDINGE	0.015	0.018	0.018	0.011
CAB	0.007	-0.011	-0.025	-0.047
FX	3	3	3	1
SFOREIGN	0.139	0.241	0.217	0.172

Note: countries divided into quartiles according to the ratio of credit to money in the 1999-2007 period. Countries in the first quartile have the slowest growth whereas those in the fourth quartile have the fastest growth. Figures presented are the median values within each of the four quartiles for each period. C/GDP is credit scaled by GDP, M/GDP is money scaled by GDP, C/M is the credit to money ratio, MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, CAB is the current account balance, FX is the FX regime classification, assuming value 1 for the most fixed regimes and 4 otherwise, SFOREIGN is the share of foreign banks in total bank assets. Flow variables are scaled by GDP

Table 3.10: Credit to money growth - Terciles

	1999-2003			2003-2007		
	Tercile 1	Tercile 2	Tercile 3	Tercile 1	Tercile 2	Tercile 3
C/GDP	-0.051	0.151	0.270	0.018	0.135	0.385
M/GDP	-0.023	0.164	0.131	0.063	0.060	0.102
C/M	-0.129	0.035	0.223	-0.103	0.065	0.328
MISSUINGD	-0.120	-0.002	0.011	-0.028	-0.010	0.027
MHOLDINGD	0.004	0.015	0.005	-0.004	0.005	0.017
MISSUINGE	0.000	-0.000	0.000	0.000	0.000	-0.001
MHOLDINGE	0.017	0.010	0.004	0.007	0.022	0.021
CAB	-0.010	-0.011	-0.041	0.016	-0.026	-0.077
FX	3	1.5	1	3	3	1
SFOREIGN	0.229	0.218	0.122	0.214	0.234	0.327

Note: countries divided into terciles according to the ratio of credit to money in the 1999-2003 and 2003-2007 period. Countries in the first tercile have the slowest growth whereas those in the third tercile have the fastest growth. Figures presented are the median values within each of the three terciles for each period. C/GDP is credit scaled by GDP, M/GDP is money scaled by GDP, C/M is the credit to money ratio, MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, CAB is the current account balance, FX is the FX regime classification, assuming value 1 for the most fixed regimes and 4 otherwise, SFOREIGN is the share of foreign banks in total bank assets. Flow variables are 4-year averages, scaled by GDP

Table 3.11: Credit regressions

	99-03	99-03	03-07	03-07	Pooled	Pooled
$CREDIT_0$	-0.07	0.04	0.03	0.06	-0.05	-0.02
	(0.10)	(0.10)	(0.09)	(0.08)	(0.06)	(0.05)
Log(GDPpc)	0.07*	-0.04	0.03	-0.08	0.06*	-0.01
	(0.04)	(0.04)	(0.06)	(0.05)	(0.03)	(0.03)
SFOREIGN	-0.42**	-0.14	-0.16**	-0.07	-0.23***	-0.11**
	(0.16)	(0.11)	(0.07)	(0.06)	(0.07)	(0.05)
FX	-0.00	0.04	-0.08	-0.01	-0.04	0.02
	(0.07)	(0.05)	(0.09)	(0.04)	(0.06)	(0.04)
NOECD	-0.09	-0.15**	-0.05	-0.12	-0.07	-0.10**
	(0.08)	(0.06)	(0.11)	(0.09)	(0.06)	(0.05)
CAB	-1.12		-2.40**		-1.86***	
	(0.87)		(0.94)		(0.68)	
MISSUINGD		2.21*		2.45***		2.23***
		(1.25)		(0.69)		(0.50)
MHOLDINGD		1.84		2.32*		2.09***
		(1.10)		(1.24)		(0.72)
MISSUINGE		8.31		-1.20		0.92
		(11.66)		(2.81)		(2.74)
MHOLDINGE		-2.96**		0.18		-0.34
		(1.18)		(0.74)		(0.60)
99-03					-0.07*	-0.07*
					(0.04)	(0.04)
Constant	-0.37	0.58	-0.03	0.86*	-0.22	0.39
	(0.37)	(0.36)	(0.51)	(0.44)	(0.30)	(0.27)
Obs	41	40	46	44	87	84
R squared	0.44	0.66	0.46	0.76	0.42	0.64

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. $CREDIT_0$ is the initial credit/GDP ratio, Log(GDPpc) is log GDP per capita, SFOREIGN is the share of foreign banks in total bank assets, FX is a dummy for the FX regime, NOECD is a dummy for non-OECD countries, CAB is the current account balance, MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, 99-03 is a dummy for the 1999-2003 period.

Table 3.12: Money regressions

	99-03	99-03	03-07	03-07	Pooled	Pooled
$MONEY_0$	0.03	0.07*	-0.00	0.03	0.01	0.04
	(0.04)	(0.04)	(0.07)	(0.08)	(0.07)	(0.06)
Log(GDPpc)	0.04	0.04	0.08**	-0.01	0.06**	-0.01
	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
SFOREIGN	-0.11	-0.11	0.03	0.04	-0.00	0.03
	(0.08)	(0.08)	(0.06)	(0.06)	(0.05)	(0.05)
FX	-0.01	-0.02	0.04	0.09*	0.03	0.07*
	(0.03)	(0.03)	(0.05)	(0.05)	(0.03)	(0.04)
NOECD	-0.07	-0.06	0.19*	0.02	0.08	-0.01
	(0.05)	(0.05)	(0.11)	(0.10)	(0.07)	(0.06)
CAB	-0.89***		-0.93***		-0.79***	
	(0.29)		(0.31)		(0.27)	
MISSUINGD		0.03		-0.17		0.02
		(0.37)		(0.60)		(0.32)
MHOLDINGD		1.22**		1.81**		1.40***
		(0.45)		(0.86)		(0.52)
MISSUINGE		2.82		-1.25		-0.36
		(3.75)		(2.18)		(1.78)
MHOLDINGE		0.74		-1.39		-1.15*
		(0.57)		(0.91)		(0.68)
99-03					0.01	0.01
					(0.02)	(0.02)
Constant	-0.21	-0.26	-0.77*	0.12	-0.49*	0.09
	(0.22)	(0.24)	(0.40)	(0.40)	(0.29)	(0.24)
Obs	29	28	45	43	74	71
R squared	0.64	0.67	0.25	0.43	0.23	0.40

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. $MONEY_0$ is the initial money/GDP ratio, Log(GDPpc) is log GDP per capita, SFOREIGN is the share of foreign banks in total bank assets, FX is a dummy for the FX regime, NOECD is a dummy for non-OECD countries, CAB is the current account balance, MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, 99-03 is a dummy for the 1999-2003 period.

Table 3.13: Credit to money ratio regressions

	99-03	99-03	03-07	03-07	Pooled	Pooled
$CREDIT/MONEY_0$	0.07	-0.01	0.08	-0.02	0.06	-0.01
	(0.21)	(0.20)	(0.06)	(0.09)	(0.05)	(0.07)
Log(GDPpc)	-0.02	-0.07	-0.09*	-0.07	-0.07*	-0.07
	(0.07)	(0.06)	(0.05)	(0.08)	(0.04)	(0.05)
SFOREIGN	-0.22	-0.17	0.04	0.02	-0.00	-0.01
	(0.25)	(0.23)	(0.09)	(0.09)	(0.07)	(0.07)
FXFIXED	0.03	0.06	-0.00	0.01	0.02	0.03
	(0.07)	(0.09)	(0.07)	(0.07)	(0.05)	(0.06)
NOECD	-0.24*	-0.24*	-0.22*	-0.14	-0.24***	-0.23**
	(0.13)	(0.14)	(0.11)	(0.18)	(0.08)	(0.11)
CAB	-1.15		-1.74***		-1.40***	
	(0.92)		(0.55)		(0.50)	
MISSUINGD		2.81**		2.87***		1.97**
		(1.33)		(1.05)		(0.84)
MHOLDINGD		2.20		-0.48		0.62
		(1.87)		(1.01)		(1.02)
MISSUINGE		-0.91		1.84		2.19
		(14.01)		(4.11)		(4.72)
MHOLDINGE		-1.31		2.13*		1.10
		(1.41)		(1.06)		(0.77)
99-03					-0.07	-0.10*
					(0.05)	(0.06)
Constant	0.27*	0.80*	0.91*	0.80	0.69	0.81*
	(0.43)	(0.46)	(0.52)	(0.82)	(0.36)	(0.45)
Obs	29	28	44	42	73	70
R squared	0.48	0.57	0.45	0.51	0.43	0.44

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. $CREDIT/MONEY_0$ is the initial credit/money ratio, Log(GDPpc) is log GDP per capita, SFOREIGN is the share of foreign banks in total bank assets, FX is a dummy for the FX regime, NOECD is a dummy for non-OECD countries, CAB is the current account balance, MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, 99-03 is a dummy for the 1999-2003 period.

Table 3.14: Credit to money ratio regressions - alternative flow specification

	99-03	99-03	03-07	03-07	Pooled	Pooled
$CREDIT/MONEY_0$	0.07	-0.06	0.08	0.02	0.06	-0.00
	(0.21)	(0.24)	(0.06)	(0.08)	(0.05)	(0.07)
Log(GDPpc)	-0.02	-0.05	-0.09*	-0.07	-0.07*	-0.06
	(0.07)	(0.08)	(0.05)	(0.07)	(0.04)	(0.04)
SFOREIGN	-0.22	-0.18	0.04	0.03	-0.00	-0.02
	(0.26)	(0.26)	(0.09)	(0.09)	(0.07)	(0.07)
FX	0.03	0.05	-0.00	-0.01	0.02	0.03
	(0.07)	(0.10)	(0.07)	(0.07)	(0.05)	(0.06)
NOECD	-0.24*	-0.21	-0.22*	-0.12	-0.24***	-0.22**
	(0.13)	(0.15)	(0.11)	(0.17)	(0.08)	(0.11)
CAB	-1.15		-1.74***		-1.40***	
	(0.92)		(0.55)		(0.50)	
MISSUINGD		2.77**		3.34***		2.32***
		(1.37)		(0.96)		(0.87)
MHOLDINGD		1.66		-0.17		0.36
		(1.75)		(0.63)		(0.73)
MISSUINGE		-3.73		2.18		2.23
		(14.31)		(3.09)		(3.80)
MHOLDINGE		-0.74		3.07***		1.73*
		(1.67)		(1.01)		(0.91)
99-03					-0.07	-0.11*
					(0.05)	(0.06)
Constant	0.27	0.58	0.91*	0.72	-0.69*	0.74*
	(0.43)	(0.49)	(0.52)	(0.73)	(0.36)	(0.43)
Obs	29	28	44	42	73	70
R squared	0.48	0.52	0.45	0.54	0.43	0.45

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. $CREDIT/MONEY_0$ is the initial credit/money ratio, Log(GDPpc) is log GDP per capita, SFOREIGN is the share of foreign banks in total bank assets, FX is a dummy for the FX regime, NOECD is a dummy for non-OECD countries, CAB is the current account balance, MISSUINGD is net debt flows of the money-issuing sectors, MHOLDINGD is net debt flows of the money-holding sectors, MISSUINGE is net equity flows of the money-issuing sectors, MHOLDINGE is net equity flows of the money-holding sectors, 99-03 is a dummy for the 1999-2003 period.

Chapter 4

Sectoral balance sheets, leverage and pro-cyclicality

4.1 Introduction

High levels of financial assets and liabilities are a common feature of most modern economies of our times. This process of financialization has attracted substantial attention recently and is documented in different studies along multiple perspectives. For instance, Piketty and Zucman (2014) discuss how wealth-to-income ratios have risen substantially in the past decades in a group of advanced economies to levels which hadn't been observed since the eighteenth and nineteenth centuries. Moreover, Schularick and Taylor (2012) show how credit levels rose to impressive levels in advanced economies in the last decades and how this growth far outpaced that of money aggregates. Others, such as Greenwood and Scharfstein (2013), focus on the rising income share of the financial industry. At the same time, the spectacular increase in cross-border financial activity since the 70s and the unprecedented accumulation of external assets and liabilities (Lane and Milesi-Ferretti, 2007) have also turned the spotlight on external balance sheets.

This process of financialization of economies has led to an increased awareness of the need to better

understand the dynamics of balance sheets and their different components. One of these components is the stock-flow adjustment (SFA), i.e., the changes in financial stocks which are not caused by further transactions carried out by investors. This SFA, which is roughly made up of price and exchange rate variations (as well as other residual adjustments), constitutes the capital gain element of the total return earned by investors; the total investment return is obtained by adding to the latter dividends and interest received/paid, recorded in the income accounts.

There is an almost mechanical effect as to why SFAs have been gaining importance in recent times: as financial stocks increase, even small changes in the underlying prices of assets can lead to substantial shifts in the market value of these stocks. Along these lines and discussing the dynamics of external balance sheets, Obstfeld (2012) argues that, while in the long-run the evolution of balance sheets is largely dictated by flow (current account) dynamics, the SFA may have a very substantial effect in shaping the evolution of (external) balance sheets in the short-run.

Accordingly, the main objective of this paper is to analyze how financial flows and SFAs interact and affect the overall dynamics of balance sheet expansion and leverage in a cross-country setup, encompassing OECD countries and a few other mostly Eastern European countries. In doing so, I pay particular attention to the financial instrument composition and sectoral developments, given the different characteristics of types of capital and institutional sectors.[1]

On the one hand, starting with the financial instrument, the split into the two broad equity and debt categories shows significant differences: while debt instruments are mostly driven by flows and have, on average, very small SFAs, equity instruments are subject to significant valuation changes. On the other hand, the sectoral breakdown is relevant given the possibility of distinct investment behaviour of different institutions regarding asset price movements. Therefore, in broad terms, I look at the relationship between equity and debt flows and SFAs, accounting for the different financialization and leverage levels across the countries considered, and paying particular attention to the differences across sectors as well as developments before and after the outburst of the global financial crisis.

Regression analysis shows that, for both equity and debt, the comovement *within* the same asset

[1]Contributions on other literature strands have also underscored the important relation between the emergence of crises and total balance sheet expansion and structure – see, for instance, Jordà et al. (2012, 2013) and Taylor (2012) – as well as the net external asset position – see Catão and Milesi-Ferretti (2012).

class is strongly dominated by flows and that SFAs play no role in this case. However, the same does not apply to comovement *across* different asset classes. Specifically, while there is no significant comovement between equity flows and either debt flows or SFAs, on the contrary, there is a significant comovement between debt flows and equity SFAs, but not with equity flows. Moreover, this comovement is stronger for equity liability than asset SFAs, and for both asset and liability debt flows; equity asset SFAs display only a weak relationship with debt asset flows.

Further exploring the relationship between debt flows and equity liability SFAs at the sectoral level indicates that there are important differences. Most of this covariation pattern observed for the total balance sheet is driven by financial corporations, on both the asset and liability sides. Within the financial corporations sector, this comovement stems mainly from the monetary financial corporations sector. Considering non-financial corporations, despite also exhibiting significant comovement, the latter is however not as strong as in the case where only debt asset flows are considered.

Importantly, in all these situations, the comovement is positive, indicating that investment in debt instruments and asset price changes are mutually reinforcing. These results are however specific to the pre-crisis period, as they do not hold once the whole period up until 2012 is considered. One final remark should be made regarding the empirical approach used. Importantly, these results aim at providing an initial assessment of the variation and comovement patterns across these variables. Issues pertaining to potential endogeneity and/or omitted variables which may arise in OLS regression context, are left for further research.

The remainder of the paper is organized as follows: Section II goes through the literature on the valuation component of aggregate balance sheets; Section III discusses the data as well as the computations of the different measures used; Section IV provides a motivation using, firstly the US as an example, and then looking at cross-country evidence; Section V introduces the empirical approach and the results obtained; Section VI discusses the results; finally, Section VII concludes.

4.2 The valuation component of balance sheets

Do movements of SFAs tend to be beneficial or otherwise? There is a relatively scarce literature on this topic and the answer to the previous questions is not clear cut. Perhaps one of the first studies of these balance sheet components is that of Gourinchas et al. (2010), which analyses the US SFAs, stressing the country's unique role in global finance. They argue that the US external balance sheet enables risk sharing by providing a sort of worldwide insurance: enjoying higher returns on their investments in normal times - the exorbitant privilege - when global equity markets are performing well and smaller returns in bad times - the exorbitant duty – when the dollar appreciates on the back of its status as a safe haven currency and global equity markets do comparatively worse. Thus, these price movements generate capital gains which lead to a wealth effect from the rest of the world to the US in good times and vice-versa in times of crises. Therefore, according to this perspective, the SFAs of the US external balance sheet have a stabilizing effect at the global scale.

More recently, in turn, Lane (2013) explores the comovement of flows and SFAs of the external balance sheets with a cross-country perspective, for European countries. He finds that flows and SFAs of these countries had a positive comovement in the run up to the crisis and that the correlation turned negative from 2007 onwards. In this sense, they were mutually reinforcing and, hence, destabiling in the first period and the opposite in the second period. Nevertheless, he finds no relationship between the two components when he expands the pool of countries to encompass advanced economies. However, he does not dig more deeply at both the financial instrument and sectoral levels.

Adrian and Shin (2008, 2010a, 2010b, 2012) look at the relationship between total asset and leverage growth of different sectoral balance sheets in the US. They find that while this relationship is negative for households and non-existent for non-financial corporations, other institutions such as investment banks display an active behaviour towards leverage.[2] They discuss how the practice of marking-to-market generates amplification by eliciting responses from those financial corporations to asset price changes, in an effort to maintain a given determined level of leverage. These reactions are highly procyclical and accentuate the financial cycle: when asset prices are increasing, these investors purchase more assets and expand their balance sheets, thereby putting additional upward pressure

[2]Specifically, the dealers and brokers sector in the US Flow of Funds accounts

on prices; on the contrary, declining prices lead to balance sheet reductions and deleveraging, which exacerbates the price fall.[3]

A final mechanism through which SFAs might affect the dynamics of balance sheets is via their impact on leverage. Bakk-Simon et al. (2012), Cuerpo et al. (2012), Giron and Mongelluzzo (2013) and ECB (2011) address the issue of the interaction between asset price valuations and leverage by proposing and building measures of "notional" leverage based on asset and liability stocks resulting exclusively from flow accumulation, i.e., disregarding the SFAs. They show that these measures provide a different picture concerning the leverage of different sectors in the euro area. This is because SFAs tend to influence "headline" measures of leverage by understating the actual active leverage taken on by the different sectors. Moreover, headline leverage measures may experience abrupt changes given that the SFAs component can be subject to significant shifts especially around moments of financial markets tension, while transactions display a much more stable evolution.

4.3 Data

Financial accounts data for both stocks and flows are available online at the Eurostat sector accounts database for European countries. I complement these with the data from the OECD's financial accounts for all available non-European countries; these boil down to Canada, Chile, Israel, Japan, Mexico, Republic of Korea, Switzerland, Turkey and the United States. Altogether, this means that the dataset includes OECD countries plus a few other European Union non-OECD countries. I use non-consolidated data since I am also interested in the intra-sectoral relationships of financial stocks, flows and stock-flow adjustment components. Moreover, resorting to non-consolidated data also has the advantage of higher availability when compared to consolidated.

Turning to the sectoral breakdown, the following sectors are available: non-financial corporations (NFCs), central bank (CB), other monetary and financial institutions (OMFIs)[4], other financial in-

[3]The literature on fire sales also explores the dynamics of asset prices and investment (see for instance ECB, 2014).
[4]Although it also includes money-market funds, I refer to OMFIs loosely as "banks" throughout the paper.

termediaries (OFIs)[5], financial auxiliaries (FAs)[6], insurance companies and pension funds (ICPFs), general government (GG), households (HH)[7] and rest of the world (RoW), which represents the external sector of a given country[8]. In addition to these individual sectors, countries also publish some aggregates, which are especially useful whenever the thinnest level of detail is not provided. For instance, some countries do not publish data for the CB and OMFIs but they publish data for the monetary and financial institutions sector (MFIs) which corresponds to the sum of the latter two.

I group the instruments into two broad categories: equity and debt. Equity corresponds to shares and other equity and, within insurance technical reserves, the net equity of households in life insurance and pension funds; debt corresponds to currency and deposits, securities other than shares, financial derivatives, loans, insurance technical reserves – except for the net equity of households in life insurance and pensions funds – and other accounts receivable (such as trade credits, for instance) and monetary gold and special drawing rights (SDRs).[9]

Table 4.1 summarizes this information, displaying the countries for which data are available and the respective initial and final periods. I also include a column with missing sectoral breakdowns for the cases where some sectors are not provided (although they are included in the relevant aggregates).

As explained, the SFA of a given instrument or item can be defined as

$$SFA_t = VAL_t + OTHER_t \tag{4.1}$$

where VAL_t is the capital gain on the stock of financial assets and liabilities and $OTHER_t$ refers to other non-flow elements that affect financial stocks such as, for example, revisions, reclassifications, methodological changes, statistical discrepancies, changes in reporting methods and/or collection procedures. The term VAL_t is thus the one relevant for economic analysis since it captures the impact that asset price changes bear on balance sheets. Unfortunately, however, SFAs as a whole, as well as

[5]Includes, for instance, invesment funds (except money market), securitization corporations, security and derivative dealers, etc.

[6]Includes, for instance, insurance brokers, loan and security brokers, insurance and pension consultants, etc.

[7]The household sector also includes non-profit institutions serving households (NPISH).

[8]In other words, it's the financial accounts equivalent of balance of payments and international investment statistics.

[9]For a more comprehensive definition of both sectoral and instrument classification, see Eurostat (2013) and European Comission et al. (2009).

their breakdown into VAL_t and $OTHER_t$ are not available at either the Eurostat or the OECD.[10]

The only alternative is therefore to calculate the SFA as a residual of the change in stocks which is not due to flows. Recalling the stock-flow identity, the change in a given stock can be written as

$$STOCK_t - STOCK_{t-1} = FLOW_t + SFA_t \tag{4.2}$$

One can then solve for SFA_t. I apply this method to all countries for which data are available in the Eurostat and OECD databases. It is unfortunately not possible to compute the SFA for Iceland, Israel and Turkey due to lack of either flow or stock data or insufficient data points. These countries are therefore excluded from the analysis. I also exclude Mexico as the SFA is zero in all items/years (i.e., stocks are likely derived solely from flow accumulation).

Once the previous calculations are concluded, notional asset and liability stocks can be determined. For that purpose, I follow Bakk-Simon et al. (2012), Cuerpo et al. (2012), Giron and Mongelluzzo (2013) and ECB (2011) and cumulate existing transactions to the corresponding initial stock, which is straighforward to calculate for all instruments/items in the following manner

$$NSTOCK_t = STOCK_0 + \sum_{i=1}^{t} FLOW_i \tag{4.3}$$

where $NSTOCK_t$ is the notional stock and $STOCK_0$ is the initial stock.

Finally, with all these elements, one can compute the typical debt-to-assets ratio which, in the national accounts framework, is given by debt liabilities divided by total assets. Starting with leverage measured at market value – which I refer to as headline – it can be expressed as

$$HLEV_t = \frac{STOCK^{DL}}{STOCK^{EA} + STOCK^{DA}} \tag{4.4}$$

where the superscript DL stands for debt liabilities, EA for equity assets and DA for debt assets. Complementing this headline measure, I also compute notional leverage – i.e., excluding the SFA

[10]Some (few) countries provide information on this breakdown. One of the few instances where the SFA is discussed is in the context of the Excessive Deficit Procedure (EDP). For instance, Eurostat (2014) was published together with the 2014 EDP notification, and analyses the effects of face valuation, the appreciation/depreciation of foreign currency debt and other changes in volume on the general government financial accounts, for both the euro area aggregate and the member-states, and going down to the financial instrument level.

components – which is trivially given by

$$NLEV_t = \frac{NSTOCK^{DL}}{NSTOCK^{EA} + NSTOCK^{DA}} \tag{4.5}$$

4.4 Stylised facts

In this section, to motivate the purpose of this paper, I discuss the cross-country evidence of the flow and SFA patterns for both total balance sheets and at the sectoral level. I use the countries for which data is available (see Table 4.1) except for Luxembourg, which I exclude from the analysis, as is standard, given the extremely high levels of financial asset and liability stocks, with no paralel in the remaining countries considered.

Tables 4.2 and 4.3 provide descriptive statistics for the flows and SFAs of total and sectoral balance sheets of the countries in these study, broken down by equity and debt instruments, as well as assets and liabilities and, respectively, for the 1995-2007 and 1995-2012 periods. Given the significant differences in countries' financial openness – i.e., in the size of financial stocks, flows and SFAs as percent of own GDP –, I scale the figures by their respective stock instead.

Starting with the total balance sheets, there are five important points worth mentioning. First, concerning equity, both flows and SFAs have similar average values. Second, equity SFAs are more volatile than any other category, and especially in the period 1995-2012. Third, in contrast, the average value of SFAs on debt instruments is virtually zero.[11] Fourth, debt flows are significantly larger on average than any other category in total, for instance, close to twice as large as equity flows. Finally, fifth, including the crisis years has an impact mostly on the equity SFAs, which roughly halve compared to the 1995-2007 period; in turn, debt flows moderate slightly on average. In both cases, volatility increases.

At the sectoral level, average asset equity flows are higher for non-financial corporations, while liability equity flows of financial corporations are larger. On the liability side, SFAs of financial

[11] The comparison between equity and debt SFAs presented here does not pertain to real terms. However, given that, in general, inflation was rather contained in the period under analysis, significant differences between nominal and real values are not expected.

corporations are rather contained; within the latter aggregate, those of the OMFIs are the dominant in the 1995-2007 period. Turning to debt instruments, average flows of financial corporations are slightly higher than those of non-financial corporations, especially in the case of OMFIs. Finally, debt SFAs are negligible across virtually all sectors.

Having established the individual dynamics of these variables, Figures 4.1, 4.2, 4.3 and 4.4 display scatter plots for an initial visual inspection of the relationship between asset and liability flows of both equity and debt instruments and equity liability SFAs. These scatter plots indicate that while equity flows and equity liability SFAs are apparently orthogonal, there seems to be a positive relationship between the latter and debt flows.[12]

How do the dynamics of flows and SFAs affect leverage measures? Figure 4.5 plots average headline and notional leverage across the countries considered. In broad terms, headline leverage is much more volatile than notional leverage. It is downward trending in the initial years and spikes up in the early 2000s; it is again downward trending in the run up to the global financial crisis and again spikes up considerably in 2008. On the contrary, notional leverage is almost always increasing – notably in the pre-crisis years – and has since 2008 slightly abated.

With these points in mind, it is useful to recall Equation 4.4 to get a better feel for the dynamics of both leverage measures. As seen, the SFAs of debt instruments are almost non-existent. Assuming they are nil (i.e., SFA_i^{DA}=$SFA_i^{DL} = 0$), for simplicity sake, one could express the difference in leverage from moment $t2$ to $t1$ as

$$LEV_{t2} - LEV_{t1} = \frac{FLOW_{t2}^{DL}}{(FLOW_{t2}^{EA} + SFA_{t2}^{EA}) + FLOW_{t2}^{DA}} \tag{4.6}$$

Therefore, whenever the term SFA_{t2}^{EA} is sufficiently large, it will dampen the increase in $FLOW_{t2}^{DL}$ and the ratio will be decreasing. On the contrary, the drops in asset prices in the early 2000s and, in particular, in 2008, were sufficiently large to increase the ratio. In turn, when using notional leverage, SFA_{t2}^{EA} will not be considered by definition, thereby making the ratio less volatile and more likely to

[12]Regarding Figure 4.2, removing the outlier visible on the top left corner leads the adjusted line to become slightly upward sloping. However, regressing equity liability flows on equity liability SFAs along the lines of the empirical approach described in the next section yields the same result that there is no statistically significant relationship between these variables.

increase.

4.5 Empirical approach and results

In a formal assessment of the statistical significance of the relationships discussed in the previous section, I study the joint dynamics of flow and SFAs of, in a first subsection, total balance sheets and, in a second subsection, sectoral balance sheets. For that purpose, I use the following general empirical specification

$$\begin{aligned} FLOW_{it} &= \beta^1 + \beta_i^2 \alpha^c + \beta_t^3 \alpha^y + \beta^4 FLOW_{it} + \beta^5 SFA_{it} + \beta^6 STOCK_{it-1}^{TA} + \beta^7 STOCK_{it-1}^{TL} \\ &+ \beta^8 HLEV_{it-1} + \beta^9 NLEV_{it-1} + \varepsilon_{it} \end{aligned}$$

where $FLOW$ is equity or debt/asset or liability flows and SFA is equity or debt/asset or liability SFAs. All flow and SFA measures are scaled by their respective stock – accordingly, in the case of SFAs, they can be seen as an implicit capital gain rate. $STOCK^{TA}$ and $STOCK^{TL}$ are, respectively, lagged total asset and liability stocks scaled by GDP. These latter variables are included to capture the significant differences in financialization levels and to check whether the relationships of interest to this paper hold across countries with different levels of financial positions in relation to economic activity. I also include both lagged headline and notional leverage measures, respectively, $HLEV$ and $NLEV$. As in the case of total asset and liability stocks, these measures are included to check whether the comovement between flows and SFAs is influenced by different leverage levels across countries. α^c and α^y are, respectively, country and year dummies. The former are meant to deal with the heterogeneity in the cross-sectional dimension, capturing country specific fixed effects, associated to their idiossyncratic characteristics; the latter are meant to capture heterogeneity in the time-series dimension, capturing year specific effects which had global repercussions. This is of particular importance given that events such as the global financial crisis or the so-called dotcom crash are included, which likely had a generalised effect on the countries considered. Finally, i is the cross-section country index and a

constant is also included.

Throughout the different regressions, I focus on the period between 1995 and 2007. I start in 1995 because this is the most common starting data point across the series of all countries considered. I end in 2007 to exclude the extraordinary events in financial markets that took place once the global financial crisis and the sovereign debt crisis erupted. In particular, most countries experienced a significant negative spike in the SFA component in 2008, following the generalized declines in global capital markets. Moreover, with the outbreak of the sovereign debt crisis, strained countries in the euro area periphery experienced sharp swings in the market prices of their general government debt securities – a severe devaluation in the first years of crisis (2010, 2011) and then a subsequent increase in valuation more recently, in 2012. However, for completeness, I also add the results for regressions with the whole period including the financial crisis, i.e., 1995-2012.

4.5.1 Total balance sheet, within and across instrument relationships

I start by studying, in this subsection, the relationship between total flows and SFAs of the aggregated balance sheet of the whole economy, for both equity and debt instruments.

Tables 4.4 and 4.5 display the results, respectively, for equity and debt flows. The first two columns of each table display the relationships within the same instrument class (i.e., equity vis-à-vis equity and debt vis-à-vis debt, respectively); the remaining columns display the relationships across different instrument classes (i.e., equity vis-à-vis debt and debt vis-à-vis equity, respectively).

An immediate observation is that, for both equity and debt, within instrument relations are very strongly driven exclusively by flows at the same time that SFAs play virtually no role. This result is likely related to the quadruple entry logic of national accounts, whereby each flow is recorded in both assets and liabilities and in the creditor and debtor sectors.

Moving to the relationships across the different instruments, the scenario is quite different. While there is no significant comovement between equity flows and either debt flows or SFAs (columns 3 to 6 in Table 4.4), in contrast, in some instances, there is a significant comovement between debt flows and equity SFAs, but not equity flows (columns 3 to 6 in Table 4.5). Specifically, this relationship is stronger in the case of equity liability SFAs, and for both asset and liability debt flows. In turn, equity

asset SFAs display significant comovement with debt asset flows only at the 10 percent significance level. Moreover, the coefficients are positive, indicating that increases in the valuation of the equity component on the liability side go hand in hand with larger debt flows, both on the asset and liability sides. One issue arising from these results is that the significant comovement between debt flows and equity SFAs could be due to the omission of the own debt SFAs in the regression, whose effect would be captured by the equity SFA. To check whether that is the case, I reran the same regressions in columns 3 to 6 in Table 4.5 but also including the SFAs of asset and liability debt instruments, respectively in the debt asset and liability flows regressions. It turns out that including the own SFAs in these regressions has, if any, only a very marginal impact on the results (not reported), likely because, as already mentioned, debt SFAs are virtually non-existent, as well as likely unrelated to equity SFAs. Althought there is no significant relationship in the equity flow regressions, I did the similar procedure for regressions in columns 3 to 6 in Table 4.4 and again the results were qualitatively unchanged (not reported). Finally, running these regressions on the 1995-2012 period instead yields qualitatively the same results (not reported).

4.5.2 Sectoral balance sheets, across instrument relationships: debt flows and equity SFAs

To get a better picture of the relationships between debt flows and equity liability SFAs, I focus on the sectoral breakdown to try to determine whether these are generalized across the different sectors or only specific to some. To provide an answer to this question, I focus on the following slightly modified version of the benchmark specification

$$\begin{aligned} FLOW^{D}_{it,k} &= \beta^1 + \beta^2_i \alpha^c + \beta^3_t \alpha^y + \beta^4 FLOW^{EL}_{it,k} + \beta^5 SFA^{EL}_{it,k} + \beta^6 STOCK^{TA}_{it-1,k} + \beta^7 STOCK^{TL}_{it-1,k} \\ &+ \beta^8 HLEV_{it-1,k} + \beta^9 NLEV_{it-1,k} + \varepsilon_{it,k} \end{aligned}$$

where $FLOW^D$ is either debt asset or liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFAs and k is the index for each sector. The remaining variables have the same

interpretation as previously.

Table 4.6 displays the results for the total balance sheet as well as the most individual sectors, the financial and non-financial corporations. Starting with the total balance sheet, significant comovement exists between the equity liability SFA and debt asset flows, but not for debt liability flows. Going through the results for the latter two sectors, as can be seen, although significant positive comovement exists between equity liability SFAs and debt flows of both financial and non-financial corporations, it is stronger for the former. Moreover, while in the case of financial corporations this comovement is present for both debt asset and liability flows, in the case of non-financial corporations, it is only present for debt asset flows.

For a more detailed picture within the monetary financial sectors, Table 4.7 displays the results for the MFI, CB and OMFI sectors. While the aggregate MFI sector presents overall the same relationships – albeit not as strong as for the whole of the financial sectors – the remaining breakdown clearly shows that the OMFI sector is the sole driver of these results as no significant comovement is visible for the CB. A detailed picture within the non-monetary financial sectors (i.e., OFI, FA and ICPF sectors) is also provided in Table 4.8. As can be seen, such comovement between equity liability SFAs and debt flows is not visible for any of these three sectors, i.e., it is specific to the monetary financial sectors.

Finally, Tables 4.9, 4.10 and 4.11 present the results of the previous regressions but for the 1995-2012 period. In broad terms, extending the period leads to a weakening of the relationships considered. In fact, the only instance where the comovement between equity liability SFAs and debt flows exists is in the ICPF sector, contrary to the results for the pre-crisis period.

To wrap up, a word of caution is needed when reading these results, which should be seen as a first attempt towards a better understanding of the channels linking financial investment and asset prices at an aggregate level.

A first issue pertains to the specification used. In more detail, a specification involving lagged SFAs should be appropriate to assess whether financial flows react with higher (lower) investment following positive (negative) asset price developments. However, data at the annual frequency do not seem suited for that purpose as the lag between the price and investment movements is too long. For completeness sake, I nevertheless reran the previous regressions with lagged equity liability flows and

SFAs. In broad terms, while the previous relationships at the aggregate level are no longer present (results not provided), the main relationships are still visible focusing on the MFI sector, namely the positive comovement between debt asset flows and equity liability SFAs (see Table 4.12).

A second issue pertains to the limitations associated to this OLS empirical approach, as already mentioned, namely, the endogeneity of the equity/debt flows and SFAs. These last results obtained with lagged SFAs are however useful in alleviating these concerns and reinforce the main conclusions withdrawn.[13]

4.6 Discussion

The results obtained in the previous section link sectoral balance sheets along three dimensions. First and foremost, they link them across different components of balance sheets: flows and SFAs. Second, across different types of capital: equity and debt instruments. Finally, third, they link the asset and liability sides of balance sheets.

By establishing a positive comovement along these three dimensions, the results of this paper lend support to the views in Adrian and Shin (2008, 2010a, 2010b, 2012) and Admati et al. (2013), who argue that some sectors actively target a given leverage level: according to this view, to maintain that leverage target, sectors respond to valuations of their equity by adjusting their holdings of debt instruments.

However, it should be stressed that these results only indicate *comovement* and not causality. Therefore, they cannot be invoked to support the management of leverage levels and the *active* build up of debt in response to favourable price movements, as well as the opposite scenario of deleveraging whenever prices are moving downwards. It should nevertheless be stressed that the alternative causality direction seems less likely, i.e., an active increase in debt assets leading to an increase in the equity liability valuation. This is an improbable causation link as, according to it, actively buying more debt assets would lead to higher equity valuations: managers would only need to keep buying to increase

[13] One other possible way of dealing with this caveat would be to resort to instrumental variables. However, appropriate instruments for equity flows and SFAs are not straightforward to come by and the lagged values of the explanatory variables are not statistically significant in the first stage regressions (and therefore also not appropriate instruments).

the company's value and, conversely, there would be no incentive to sell assets. Moreover, and also in contrast to these authors, the relationships studied in this paper are more broad based across the different sectors, since not only financial corporations (and therein specifically the OMFI sector) are found to display such comovement, but also, though in not such a pronounced way, non-financial corporations.

This evidence raises also questions regarding the instrument structure of balance sheets. In fact, the equity/debt mix is frequently referred to as an element that should be taken into consideration when assessing the sustainability of balance sheets. The main reason is that while equity instruments are contingent – i.e., they do not entail a contractual obligation by the debtor to pay a specified amount to the creditor in a given moment of time –, debt instruments are not-contingent and imply a pre-specified schedule of interest payments and principal amortizations. In the particular context of external balance sheets, for the above mentioned reasons, equity instruments are said to enable risk sharing among countries partaking in financial integration, in contrast to debt instruments. Along these lines, some authors have been discussing possible ways to introduce elements of contingency in debt instruments and make them less stringent whenever bad outcomes take place – see for instance Brooke et al. (2013). Moreover, there has been some debate on the establishment of measures providing incentive for financial deepening in equity instead of debt instruments using, for instance, a fiscal stance favouring dividend instead of interest payouts.

This paper's results show that, when assessing elements of risk in the composition of balance sheets, equity and debt instruments cannot be looked into in isolation: the interplay between both instruments via the valuation channel must also be taken into consideration. Since SFAs are almost exclusively a feature of equity instruments, the investment in equity might entail risks to the extent that these valuation channels can, in good times, not only mask the build up of underlying leverage, but also foster investment in these debt instruments which could prove to be excessive whenever adverse price movements occur.

4.7 Conclusion

The purpose of this paper is to assess the interaction between flows and SFAs components – comprising price and exchange rate valuations as well as other changes – and how they affect the dynamics of financial balance sheets.

Available data shows that the expansion of balance sheets of advanced economies was mostly done on account of the continuous active decision of carrying out further financial transactions involving mostly debt instruments. At the same time, SFAs on equity instruments contributed substantially to the increasing positions for most of the period until the eruption of the global financial crisis. Together, these two developments had important consequences for leverage measures. On the one hand, headline leverage indicators – computed based on stocks with financial assets evaluated at market prices – seem highly susceptible to these valuation components and tend to underestimate and somewhat shroud the active build up of leverage. On the other hand, leverage measures based on notional stocks, which exclude these valuation elements and focus exclusively on financial transactions, were mostly increasing and clearly illustrate the impact of valuation dynamics.

But how do flows and SFAs interact? In broad terms, regression results indicate that there is a strong positive comovement between debt flows and the valuation component of equity instruments: the higher market value of equity instruments is met with taking up more debt and vice-versa. Moreover, going down to the sectoral level shows that this procyclical behaviour, whereby financial investment in debt instruments moves in tandem with asset price developments, stems mainly from the financial corporations sector. In turn, non-financial corporations also display some of this behaviour, albeit less markedly.

Further research avenues should therefore explore the interaction of these differentiated sectoral patterns relating balance sheet expansion, financial investment and leverage growth at the sectoral level and how their interplay with the market value of assets may estabilize or exacerbate upward and downward price movements. In this context, while this paper has an intra-sectoral focus, potential cross-sectoral comovement patterns, whereby the valuations in one or more sectors spur the balance sheet expansion of others (on top of the own balance sheet effects) could also prove to be signifi-

cant. Furthermore – and to the extent that foreign sources of funding are typically more volatile and procyclical than domestic sources (see Hoggarth et al., 2010 and 2013) – integrating the cross-border component of balance sheets is also important, with an eye on the valuation channels of external assets and liabilities and how they affect total national financial flows. Finally, concentrating on the dynamics of SFAs could also be useful to understand if and how price changes in a given sector affect others.

Figure 4.1: Total balance sheet equity asset flows and equity liability SFAs, scaled by own stock - 1995-2007

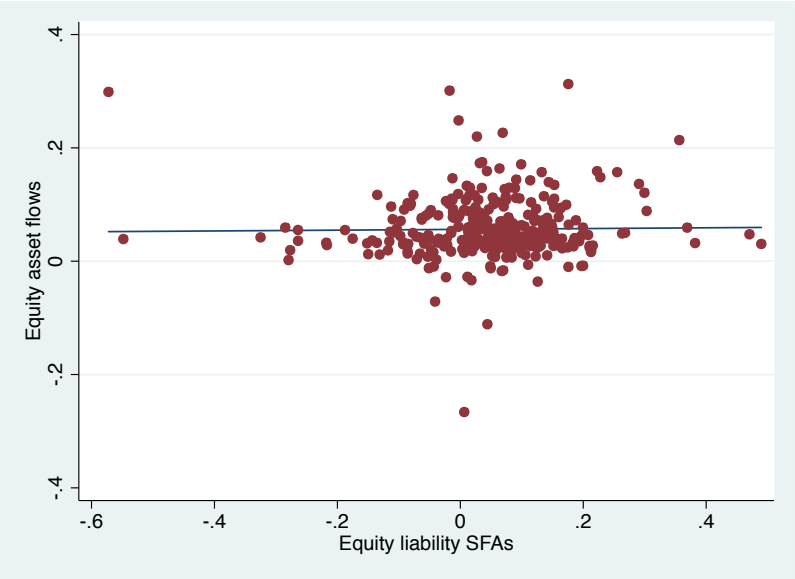


Figure 4.2: Total balance sheet equity liability flows and equity liability SFAs, scaled by own stock - 1995-2007

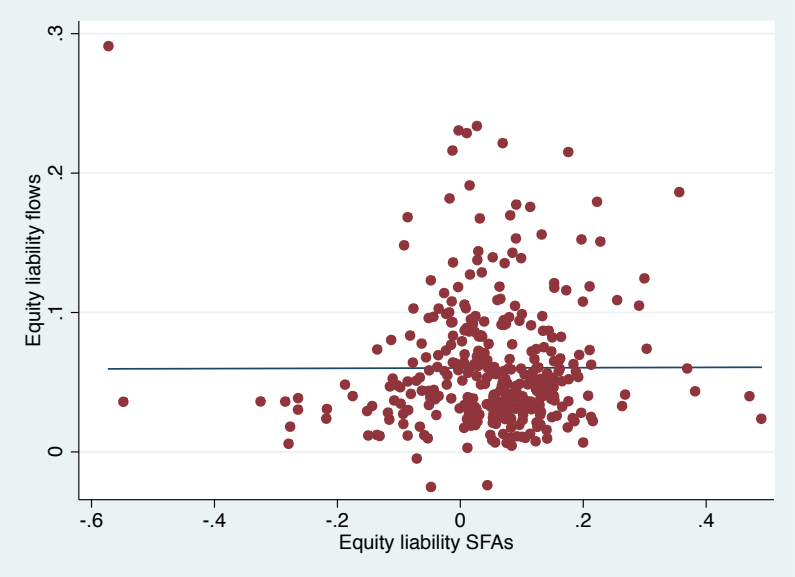


Figure 4.3: Total balance sheet debt asset flows and equity liability SFAs, scaled by own stock - 1995-2007

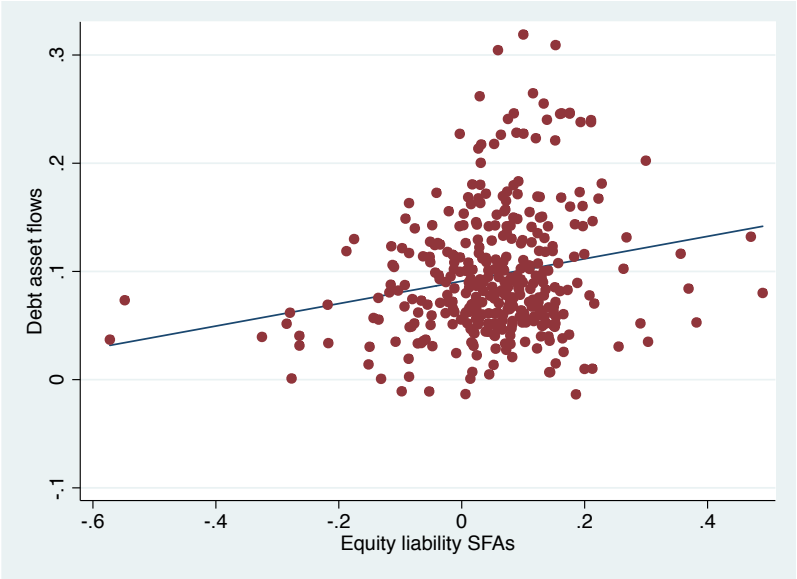


Figure 4.4: Total balance sheet debt liability flows and equity liability SFAs, scaled by own stock - 1995-2007

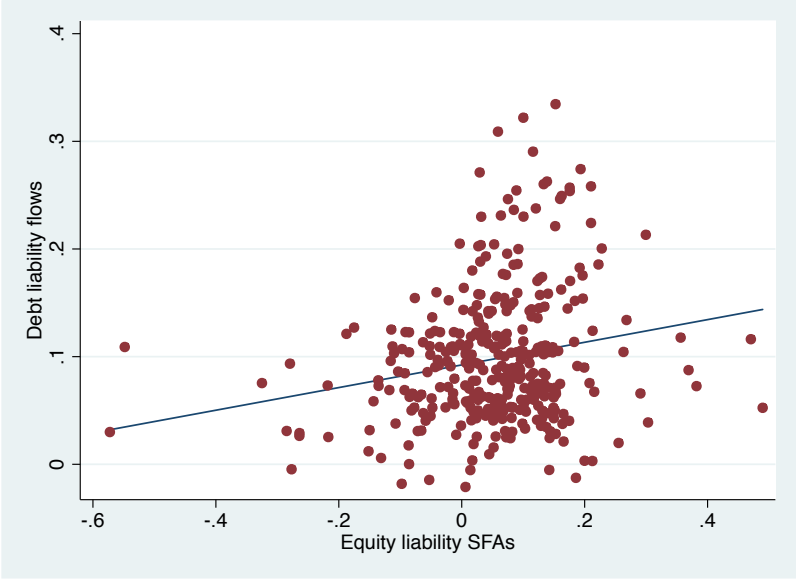


Figure 4.5: Average headline and notional leverage

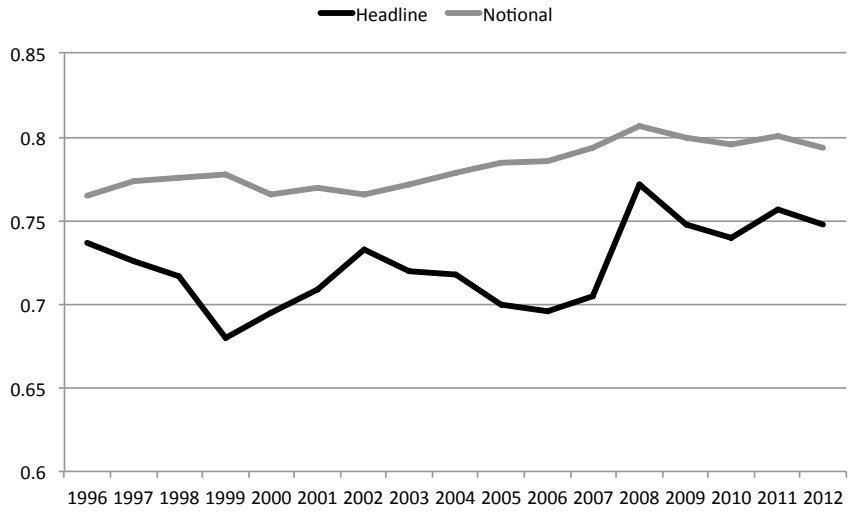


Table 4.1: Data availability

	PERIOD		MISSING BREAKDOWN
	Initial	Final	
AUT	1996	2012	-
BEL	1995	2012	-
BUL	2001	2012	-
CAN	1980	2012	FA
CHE	2000	2010	MFI, OMFI, OFI, FA
CHI	2006	2012	FA
CYP	1996	2012	-
CZE	1995	2012	-
DEU	1996	2012	CB, OMFI
DNK	1995	2012	-
ESP	1981	2012	-
EST	1995	2012	-
FIN	1996	2012	-
FRA	1996	2012	MFI
GBR	1988	2012	CB, OMFI, FA
GRC	1996	2012	FA
HUN	1990	2012	-
IRL	2002	2012	-
ITA	1996	2012	CB, OMFI
JAP	1980	2011	-
KOR	2003	2012	-
LAT	1996	2012	-
LIT	1996	2012	-
LUX	2007	2012	-
MLT	2005	2012	-
NLD	1991	2012	-
NOR	1996	2012	-
POL	1996	2012	CB, OMFI (09-12)
PRT	1996	2012	-
ROM	1999	2012	-
SVK	1996	2012	FA
SVN	2002	2012	-
SWE	1996	2012	FA (95-00)
USA	1980	2012	-

Table 4.2: Summary statistics - flow and stock-flow adjustments (1995-2007)

	$FLOW^{EA}$	SFA^{EA}	$FLOW^{EL}$	SFA^{EL}	$FLOW^{DA}$	SFA^{DA}	$FLOW^{DL}$	SFA^{DL}
Total								
N	371	357	371	357	371	357	371	357
Mean	0.057	0.054	0.060	0.053	0.096	0.002	0.098	0.002
SD	0.051	0.113	0.045	0.117	0.060	0.031	0.062	0.029
Financial corporations								
N	371	357	371	357	371	357	371	357
Mean	0.087	0.043	0.097	0.034	0.106	0.001	0.105	0.002
SD	0.150	0.187	0.097	0.150	0.073	0.040	0.079	0.039
Non-financial corporations								
N	371	357	371	357	371	357	371	357
Mean	0.100	0.020	0.045	0.060	0.099	-0.002	0.090	0.003
SD	0.122	0.208	0.049	0.069	0.080	0.057	0.072	0.045
Monetary financial institutions								
N	351	337	351	337	351	337	351	337
Mean	0.081	0.018	0.080	0.040	0.099	0.004	0.099	0.006
SD	0.294	0.263	0.154	0.233	0.074	0.036	0.078	0.033
Central bank								
N	282	272	291	280	332	320	332	320
Mean	0.002	-1.044	0.155	-0.064	0.059	0.003	0.065	0.001
SD	0.807	15.747	1.611	0.807	0.131	0.058	0.158	0.044
Other monetary financial institutions								
N	324	312	324	312	324	312	324	312
Mean	0.091	0.006	0.085	0.041	0.114	-0.001	0.114	0.001
SD	0.366	0.320	0.131	0.245	0.086	0.043	0.087	0.044
Other financial institutions								
N	363	349	363	349	363	349	363	349
Mean	0.078	0.058	0.092	0.022	0.165	-0.016	0.028	0.001
SD	0.328	0.281	0.217	0.317	0.186	0.117	2.330	0.133
Financial auxiliaries								
N	280	274	289	281	299	291	296	288
Mean	0.000	0.056	0.094	0.038	0.115	0.002	0.035	-0.017
SD	1.050	0.391	0.367	0.512	0.382	0.484	0.560	0.612
Insurance companies and pension funds								
N	371	357	371	357	371	357	371	357
Mean	0.124	0.038	0.127	0.019	0.124	0.002	0.118	-0.010
SD	0.221	0.226	0.136	0.115	0.117	0.066	0.160	0.135

Scaled by own stock. $FLOW^{EA}$ is equity asset flows, SFA^{EA} is equity asset stock-flow adjustments, $FLOW^{DA}$ is debt asset flows, SFA^{DA} is debt asset stock-flow adjustments, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability stock-flow adjustments, $FLOW^{DL}$ is debt liability flows, SFA^{DL} is debt liability stock-flow adjustments.

Table 4.3: Summary statistics - flow and stock-flow adjustments (1995-2012)

	$FLOW^{EA}$	SFA^{EA}	$FLOW^{EL}$	SFA^{EL}	$FLOW^{DA}$	SFA^{DA}	$FLOW^{DL}$	SFA^{DL}
Total								
N	533	519	533	519	533	519	533	519
Mean	0.051	0.027	0.052	0.025	0.078	0.002	0.080	0.003
SD	0.054	0.139	0.050	0.151	0.063	0.039	0.066	0.036
Financial corporations								
N	533	519	533	519	533	519	533	519
Mean	0.071	0.014	0.097	0.010	0.084	0.004	0.081	0.002
SD	0.146	0.205	0.094	0.173	0.078	0.046	0.086	0.047
Non-financial corporations								
N	533	519	533	519	533	519	533	519
Mean	0.083	-0.001	0.038	0.029	0.080	-0.005	0.073	0.001
SD	0.114	0.213	0.055	0.175	0.081	0.062	0.072	0.046
Monetary financial institutions								
N	505	491	505	491	505	491	505	491
Mean	0.049	0.003	0.067	-0.007	0.078	0.008	0.075	0.009
SD	0.392	0.261	0.147	0.291	0.081	0.046	0.086	0.043
Central bank								
N	408	398	414	403	475	463	475	463
Mean	0.031	-0.716	0.113	-0.010	0.061	0.007	0.065	0.001
SD	0.686	13.019	1.352	0.715	0.169	0.058	0.205	0.042
Other monetary financial institutions								
N	464	452	464	452	464	452	464	452
Mean	0.054	-0.006	0.071	-0.009	0.087	0.003	0.085	0.005
SD	0.446	0.310	0.139	0.308	0.093	0.046	0.097	0.047
Other financial institutions								
N	522	508	522	508	522	508	522	508
Mean	0.055	0.017	0.073	0.027	0.119	-0.010	0.019	0.001
SD	0.293	0.305	0.203	0.294	0.194	0.108	1.950	0.129
Financial auxiliaries								
N	409	403	423	415	433	425	430	422
Mean	-0.033	0.023	0.067	-0.027	0.089	0.003	0.029	-0.006
SD	0.948	0.400	0.332	0.948	0.349	0.404	0.495	0.523
Insurance companies and pension funds								
N	533	519	533	519	533	519	533	519
Mean	0.106	0.007	0.106	0.012	0.101	0.005	0.086	-0.003
SD	0.206	0.238	0.131	0.109	0.117	0.061	0.164	0.153

Scaled by own stock. $FLOW^{EA}$ is equity asset flows, SFA^{EA} is equity asset stock-flow adjustments, $FLOW^{DA}$ is debt asset flows, SFA^{DA} is debt asset stock-flow adjustments, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability stock-flow adjustments, $FLOW^{DL}$ is debt liability flows, SFA^{DL} is debt liability stock-flow adjustments.

Table 4.4: Total balance sheet - equity flows (1995-2007)

	$FLOW_{it}^{EA}$	$FLOW_{it}^{EL}$	$FLOW_{it}^{EA}$	$FLOW_{it}^{EL}$	$FLOW_{it}^{EA}$	$FLOW_{it}^{EL}$
$FLOW_{it}^{EA}$		0.508***				
		(0.07)				
SFA_{it}^{EA}		-0.014				
		(0.03)				
$FLOW_{it}^{EL}$	0.990***					
	(0.09)					
SFA_{it}^{EL}	0.037					
	(0.02)					
$FLOW_{it}^{DA}$			-0.060			0.053
			(0.11)			(0.08)
SFA_{it}^{DA}			0.016			-0.048
			(0.14)			(0.11)
$FLOW_{it}^{DL}$				-0.018	0.052	
				(0.08)	(0.10)	
SFA_{it}^{DL}				0.004	0.005	
				(0.11)	(0.15)	
$STOCK_{it-1}^{TA}$	-0.030***	0.026***	-0.005	0.023	-0.003	0.025
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
$STOCK_{it-1}^{TL}$	0.028**	-0.023**	0.005	-0.020	0.003	-0.022
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
$HLEV_{it-1}$	-0.258***	0.075	-0.317***	-0.101	-0.306***	-0.094
	(0.06)	(0.06)	(0.11)	(0.09)	(0.11)	(0.09)
$NLEV_{it-1}$	0.211***	0.016	0.429***	0.243**	0.431***	0.245**
	(0.07)	(0.07)	(0.12)	(0.10)	(0.12)	(0.10)
Constant	0.004	-0.050	-0.087	-0.097**	-0.102*	-0.105**
	(0.04)	(0.03)	(0.06)	(0.05)	(0.06)	(0.05)
Obs	331	331	331	331	331	331
R squared	0.73	0.81	0.46	0.61	0.46	0.62

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is the total asset stock, $STOCK^{TL}$ is the total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scalled by GDP.

Table 4.5: Total balance sheet - debt flows (1995-2007)

	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EA}$			-0.033			0.039
			(0.06)			(0.06)
SFA_{it}^{EA}			0.048*			0.047
			(0.03)			(0.03)
$FLOW_{it}^{EL}$				-0.007	0.089	
				(0.09)	(0.10)	
SFA_{it}^{EL}				0.053**	0.059**	
				(0.02)	(0.03)	
$FLOW_{it}^{DA}$		0.913***				
		(0.03)				
SFA_{it}^{DA}		0.013				
		(0.02)				
$FLOW_{it}^{DL}$	0.962***					
	(0.03)					
SFA_{it}^{DL}	0.000					
	(0.03)					
$STOCK_{it-1}^{TA}$	-0.004	0.002	-0.017	-0.016	-0.022*	-0.013
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
$STOCK_{it-1}^{TL}$	0.004	-0.002	0.019	0.018	0.024	0.015
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
$HLEV_{it-1}$	0.082***	-0.093***	-0.116	-0.204***	-0.113	-0.178**
	(0.03)	(0.03)	(0.07)	(0.07)	(0.07)	(0.07)
$NLEV_{it-1}$	-0.035	0.031	0.003	0.026	-0.029	0.005
	(0.03)	(0.03)	(0.12)	(0.11)	(0.11)	(0.11)
Constant	-0.020	0.036**	0.113	0.145**	0.129**	0.146**
	(0.02)	(0.02)	(0.06)	(0.06)	(0.06)	(0.06)
Obs	331	331	331	331	331	331
R squared	0.97	0.97	0.74	0.77	0.74	0.77

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is the total asset stock, $STOCK^{TL}$ is the total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scalled by GDP.

Table 4.6: Sectoral breakdown - debt flows and equity liability SFAs (1995-2007)

	Total		*FCs*		*NFCs*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EL}$	0.089	0.039	0.153***	0.081	0.111	-0.165**
	(0.10)	(0.06)	(0.04)	(0.05)	(0.14)	(0.08)
SFA_{it}^{EL}	0.059**	0.045	0.071***	0.093***	0.070**	0.032
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)
$STOCK_{it-1}^{TA}$	-0.022*	-0.013	-0.012	-0.011	-0.007	0.007
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)
$STOCK_{it-1}^{TL}$	0.024*	0.015	0.010	0.011	0.001	0.002
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)
$HLEV_{it-1}$	-0.113	-0.178**	-0.247**	-0.267**	-0.080	-0.058
	(0.07)	(0.07)	(0.11)	(0.13)	(0.06)	(0.04)
$NLEV_{it-1}$	-0.029	0.005	0.191*	0.101	0.170**	0.021
	(0.11)	(0.11)	(0.11)	(0.14)	(0.07)	(0.05)
Constant	0.129**	0.146**	0.085*	0.143**	-0.032	0.034
	(0.06)	(0.06)	(0.05)	(0.06)	(0.08)	(0.06)
Obs	331	331	331	331	331	331
R squared	0.74	0.77	0.72	0.67	0.49	0.67

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Table 4.7: MFI sectors breakdown - debt flows and equity liability SFAs (1995-2007)

	MFI		*CB*		*OMFI*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EL}$	0.111***	0.068*	0.033**	0.011	0.092***	0.035
	(0.03)	(0.03)	(0.01)	(0.01)	(0.03)	(0.04)
SFA_{it}^{EL}	0.048**	0.061**	0.015	0.010	0.050***	0.065***
	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	(0.02)
$STOCK_{it-1}^{TA}$	-0.019	-0.016	-0.101***	-0.073	-0.006	-0.011
	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)
$STOCK_{it-1}^{TL}$	0.016	0.014	0.119	0.086*	0.002	0.007
	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)
$HLEV_{it-1}$	-0.113	-0.259	0.045	-0.244	-0.242	-0.307*
	(0.16)	(0.18)	(0.14)	(0.17)	(0.15)	(0.18)
$NLEV_{it-1}$	0.110	0.054	-0.048	-0.070	0.196	0.029
	(0.14)	(0.17)	(0.05)	(0.05)	(0.17)	(0.21)
Constant	0.072	0.213	-0.028	0.312*	0.112	0.275**
	(0.13)	(0.15)	(0.15)	(0.19)	(0.10)	(0.12)
Obs	313	313	259	259	289	289
R squared	0.68	0.64	0.37	0.35	0.74	0.70

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Table 4.8: Non-MFI financial sectors breakdown - debt flows and equity liability SFAs (1995-2007)

	OFI		*FA*		*ICPF*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EL}$	0.154	-0.280	0.175*	-0.024	0.534***	0.512**
	(0.18)	(0.28)	(0.11)	(0.23)	(0.11)	(0.22)
SFA_{it}^{EL}	0.026	0.061	0.001	-0.018	0.058	0.036
	(0.03)	(0.05)	(0.04)	(0.07)	(0.04)	(0.07)
$STOCK_{it-1}^{TA}$	0.079	-0.059	0.073	-0.147	-0.025	-0.014
	(0.06)	(0.08)	(0.08)	(0.20)	(0.02)	(0.04)
$STOCK_{it-1}^{TL}$	-0.076	0.072	-0.072	-0.130	0.029	0.045
	(0.06)	(0.09)	(0.08)	(0.19)	(0.02)	(0.04)
$HLEV_{it-1}$	0.061***	0.038**	-0.017	-0.198*	0.069	-0.076
	(0.02)	(0.02)	(0.05)	(0.11)	(0.15)	(0.27)
$NLEV_{it-1}$	0.001	0.002	-0.009*	-0.014	0.246	0.029
	(0.00)	(0.00)	(0.01)	(0.01)	(0.16)	(0.29)
Constant	-0.010	-0.088	0.200	0.511	-0.046	-0.150*
	(0.11)	(0.14)	(0.24)	(0.40)	(0.05)	(0.09)
Obs	324	324	259	257	331	331
R squared	0.39	0.36	0.23	0.17	0.74	0.49

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Table 4.9: Sectoral breakdown - debt flows and equity liability SFAs (1995-2012)

	Total		*FCs*		*NFCs*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EL}$	0.075	0.072	0.066*	-0.020	0.133*	-0.003
	(0.06)	(0.05)	(0.04)	(0.05)	(0.08)	(0.06)
SFA_{it}^{EL}	-0.001	0.012	0.007	0.017	0.046	0.012
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)
$STOCK_{it-1}^{TA}$	0.001	0.007	0.033	0.039***	0.012	0.031**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
$STOCK_{it-1}^{TL}$	-0.006	-0.013	-0.041	-0.049**	-0.015	-0.031**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
$HLEV_{it-1}$	-0.008	-0.051	-0.134	-0.168*	-0.111**	-0.031
	(0.07)	(0.07)	(0.08)	(0.10)	(0.05)	(0.03)
$NLEV_{it-1}$	-0.180*	-0.184*	0.337***	0.335***	0.101**	-0.014*
	(0.09)	(0.10)	(0.08)	(0.10)	(0.05)	(0.04)
Constant	0.232***	0.260***	-0.008	0.037	0.071	0.108***
	(0.05)	(0.05)	(0.04)	(0.04)	(0.06)	(0.04)
Obs	493	493	493	493	493	493
R squared	0.66	0.67	0.63	0.60	0.47	0.60

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Table 4.10: MFI sectors breakdown - debt flows and equity liability SFAs (1995-2012)

	MFI		*CB*		*OMFI*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EL}$	0.042*	-0.001*	0.041**	0.018	0.033	-0.010
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
SFA_{it}^{EL}	0.004	0.009	0.028	0.022	0.020	0.026
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
$STOCK_{it-1}^{TA}$	0.028**	0.039***	-0.005	0.022	0.039***	0.044***
	(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.01)
$STOCK_{it-1}^{TL}$	-0.040***	-0.053***	-0.009	-0.034	-0.051***	-0.060***
	(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.01)
$HLEV_{it-1}$	-0.019	-0.145	-0.367*	-0.676**	-0.236*	-0.358**
	(0.12)	(0.13)	(0.20)	(0.27)	(0.13)	(0.15)
$NLEV_{it-1}$	0.393***	0.405***	0.059	0.010	0.405***	0.335**
	(0.11)	(0.12)	(0.06)	(0.05)	(0.14)	(0.17)
Constant	-0.151	-0.047	0.486**	0.832***	0.006	0.181*
	(0.09)	(0.10)	(0.23)	(0.30)	(0.08)	(0.09)
Obs	467	467	382	382	429	429
R squared	0.60	0.57	0.21	0.24	0.67	0.65

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Table 4.11: Non-MFI financial sectors breakdown - debt flows and equity liability SFAs (1995-2012)

	OFI		*FA*		*ICPF*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it}^{EL}$	0.159	-0.236	0.137*	0.066	0.644***	0.271**
	(0.14)	(0.23)	(0.08)	(0.16)	(0.06)	(0.11)
SFA_{it}^{EL}	0.032	0.062	-0.001	0.012	0.068**	0.039
	(0.04)	(0.06)	(0.01)	(0.01)	(0.03)	(0.06)
$STOCK_{it-1}^{TA}$	0.120***	0.038	0.007	-0.126	-0.014	0.026
	(0.04)	(0.08)	(0.05)	(0.12)	(0.02)	(0.03)
$STOCK_{it-1}^{TL}$	-0.113***	-0.039	-0.008	0.133	0.009	-0.027
	(0.04)	(0.07)	(0.05)	(0.12)	(0.02)	(0.03)
$HLEV_{it-1}$	0.066***	0.044**	0.006	-0.172*	0.084	-0.270
	(0.02)	(0.02)	(0.05)	(0.10)	(0.11)	(0.22)
$NLEV_{it-1}$	0.002	0.002	-0.008*	-0.015	0.202*	0.336
	(0.00)	(0.00)	(0.00)	(0.01)	(0.11)	(0.20)
Constant	-0.037	0.005	0.169	0.271	0.020	0.075
	(0.05)	(0.09)	(0.11)	(0.17)	(0.02)	(0.06)
Obs	483	483	393	391	493	493
R squared	0.35	0.22	0.23	0.14	0.73	0.39

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Table 4.12: MFI sectors breakdown - debt flows and equity liability SFAs (1995-2007)

	MFI		*CB*		*OMFI*	
	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$	$FLOW_{it}^{DA}$	$FLOW_{it}^{DL}$
$FLOW_{it-1}^{EL}$	0.084**	0.078**	-0.036**	-0.044***	0.105***	0.150***
	(0.03)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)
SFA_{it-1}^{EL}	0.043*	0.030	0.026**	-0.028***	0.046***	0.033
	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	(0.02)
$STOCK_{it-1}^{TA}$	-0.013	-0.012	-0.087**	-0.062	0.000	-0.008
	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)
$STOCK_{it-1}^{TL}$	0.009	0.006	0.114***	0.082	-0.006	0.002
	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)
$HLEV_{it-1}$	-0.084	-0.229	0.039	-0.252	-0.185	-0.263
	(0.17)	(0.18)	(0.14)	(0.16)	(0.16)	(0.18)
$NLEV_{it-1}$	0.162	0.107	-0.004	-0.039	0.191	0.020
	(0.15)	(0.17)	(0.04)	(0.04)	(0.16)	(0.19)
Constant	0.037	0.178	-0.094	0.255	0.089	0.264**
	(0.12)	(0.14)	(0.15)	(0.19)	(0.11)	(0.12)
Obs	313	313	260	260	287	287
R squared	0.67	0.63	0.37	0.36	0.74	0.70

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $FLOW^{DA}$ is debt asset flows, $FLOW^{DL}$ is debt liability flows, $FLOW^{EL}$ is equity liability flows, SFA^{EL} is equity liability SFA, $STOCK^{TA}$ is total asset stock, $STOCK^{TL}$ is total liability stock, $HLEV$ is headline leverage defined as the debt to assets ratio, $NLEV$ is notional leverage defined as the debt to assets ratio. Flow and SFA measures are scaled by the respective stock; stock measures are scaled by GDP.

Chapter 5

Intra-financial assets and credit intermediation

5.1 Introduction

The noteworthy increase of the financial sector's size is a trademark of several economies of our times. On the one hand, the value added share of finance in GDP has been growing in the past century in advanced economies, at the same time that the number of people employed in the sector, as well as the average wages paid, have outpaced those of other economic activities (Philippon and Reshef, 2013 and forthcoming). This evidence has also prompted questions regarding the costs and efficiency of financial intermediation – see Philippon (2013). On the other hand, focusing on financial claims, Greenwood and Scharfstein (2013) conclude that, in the US, not only did the financial sector expand substantially in the past couple of decades, but its growth has been faster than that of the non-financial sectors.[1] Digging further within the US financial sector, Antill et al. (2014) find that the shadow banking sector was the main driver of growth, mostly associated to the securities and asset management activities.

While these contributions have focused on the *total* size of the financial sector balance sheet, other

[1] They propose a credit intermediation index, which is computed as the ratio of total credit in the economy to credit provided to end-user sectors (general government, non-financial corporations and households).

work has instead turned to the size of intra-financial assets, i.e., the size of financial relationships among financial corporations. Again for the US, Bhatia and Bayoumi (2012) document that its financial sector expansion was chiefly due to the increase in claims between financial intermediaries. Due to the lack of a complete who-to-whom picture in the US Financial Accounts[2], Barattieri et al. (2014) opt to compute upper- and lower-bounds to interconnectedness, defined as the claims whose direct counterparts belong to the financial sector scaled by total credit market instruments. In turn, Montecino et al. (2014), faced with the same shortcoming, develop a measure of intra-financial assets based on estimations of who-to-whom positions within the financial sectors. In a subsequent study, Montecino and Epstein (2014) explore the relationship between intra-financial assets, credit and capital formation: they find that, in general, intra-financial assets are negatively associated with gross capital formation. Turning to the euro area, Bakk-Simon et al. (2012) put forward a definition of the shadow banking sector and conclude that the interconnectedness of the shadow banking sector and the regulated banking system is high in the EMU. Moreover, Cour-Thimann and Winkler (2012) argue that the leverage boom in the 2006-2008 period in the euro area was to a large extent associated to the increase of intra-financial sector claims.

The goal of this paper is twofold. First of all, it draws on financial accounts and sectoral balance sheet data to measure, in a harmonized fashion and at the aggregate level, intra-financial assets and interconnectedness among the domestic financial sectors for a broad set of countries mostly encompassing OECD members. This is a relevant contribution as, to the best of my knowledge, there is so far no cross-crountry study pinning down the size of claims within the financial sector. In doing so, the paper documents the rapid expansion of these financial sector intra-sectoral claims in recent years. Second, it seeks to look at the cross-country evidence of the relationship between intra-financial assets and domestic credit to end-user sectors, i.e., how this higher interconnectedness between financial sector institutions is associated to credit provided to the resident non-financial sectors.

Results show that while there is no statistically significant relationship between the growth in intra-financial assets and credit provided to non-financial corporations and the general government, there is however with credit provided to the household sector. Moreover, this relationship stems from claims

[2]Up until very recently know as the US Flow-of-Funds accounts.

among non-bank and across non-bank and bank financial corporations, but not from intra-bank claims. Taken together, this evidence lends support to the idea that the growth of intra-financial claims was associated to activities such as securitization – which establishes financial links across monetary and non-monetary financial corporations – and expanded mostly on the back of residential mortgage and consumption associated lending. Importantly, these results aim at providing an initial assessment of the variation and comovement patterns across these variables: issues related to potential endogeneity and/or omitted variables, which may arise in OLS regression context, are left for further research.

The remainder of the paper is organized as follows: Section II discusses the data sources for the intra-financial assets and credit measures; Section III goes through the stylised facts and most salient aspects found in the data; the empirical approach is presented in Section IV, together with the main results; finally, Section V concludes.

5.2 Data

This section goes through the data used in the paper. First, it discusses the data on financial stocks and the measure used to determine intra-financial positions[3] among the financial sectors. In a second subsection, it discusses available credit measures and the breakdown between credit provided to the different end-user sectors.

5.2.1 Intra-financial assets

Financial accounts and sectoral accounts are used to determine intra-financial assets. These data are available for almost all OECD countries and a few other Eastern european from both the OECD and Eurostat online databases. In broad terms, they include flows and stocks of financial assets and liabilities for a number of different instruments (loans, deposits, shares, debt securities, etc.). Furthermore, they are broken down according to the following sectoral classification: non-financial corporations (NFCs), central bank (CB), other monetary and financial institutions (OMFIs)[4], other

[3] I use the terms intra-financial positions, intra-financial claims and intra-financial assets interchangeably throughout the paper.

[4] Although it also includes money-market funds, I refer to OMFIs loosely as "banks" throughout the paper.

financial intermediaries (OFIs)[5], financial auxiliaries (FAs)[6], insurance companies and pension funds (ICPFs), general government (GG), households (HH)[7] and rest of the world (RoW), which represents the external sector of a given country[8]. In addition to these individual sectors, countries also publish some aggregates, which are especially useful whenever the thinnest level of detail is not provided. For instance, some countries do not publish data for the CB and OMFIs but they publish data for the monetary and financial institutions sector (MFIs) which corresponds to the sum of the latter two.[9]

Of particular importance for the purposes of this paper, most countries publish these national financial accounts data both on a consolidated basis (i.e., excluding intra-sectoral claims) and non-consolidated (i.e., including intra-sectoral claims). Therefore, taking the difference between the non-consolidated and consolidated positions for a given sector or aggregate yields, by definition, these intra-sectoral claims: for instance, for the financial corporations aggregate sector – encompassing all financial corporations from banks to insurance companies and pension funds – the latter would yield, by construction, the intra-financial positions among all financial corporations.

More formally, I define intra-financial position (IFA) of a given sector or aggregate group of sectors S in a given period t as the difference between non-consolidated and consolidated positions (i.e., including all types of equity and debt claims) for a given sector or group of sectors or

$$IFA_t^S = STOCK_t^{nc} - STOCK_t^c \tag{5.1}$$

where the superscripts nc and c stand for non-consolidated and consolidated data, respectively.

But what exactly is this measure capturing? To get a better intuition, the following expression breaks the previous one into its different components

$$IFA_t^S = \sum_{i=1}^{n} INTRA_{i,t} + \sum \binom{n}{k} INTER_{k,t} \tag{5.2}$$

[5]Includes, for instance, invesment funds (except money market), securitization corporations, security and derivative dealers, etc.

[6]Includes, for instance, insurance brokers, loan and security brokers, insurance and pension consultants, etc.

[7]The household sector also includes non-profit institutions serving households (NPISH)

[8]In other words, it's the financial accounts equivalent of balance of payments and international investment statistics.

[9]For a more comprehensive definition of the sectoral classifications, see Eurostat (2013) and European Comission et al. (2009)

where $INTRA$ is intra-sectoral position, $INTER$ is inter-sectoral position. The second term in the previous expression is the binomial coefficient $\binom{n}{k} = \frac{n!}{k!(n-k)!}$ where n is the overall number of sectors and $k = 2$ given that pairs of bilateral inter-sectoral positions are considered. All previous subscripts/superscripts remain the same.

Consider first the case of a single individual sector, say that of the OMFI. In this case, the second term trivially is null – i.e., there is no inter-sectoral position as only one sector is considered – and only the intra-sectoral relationship within that same sector exists. I label this position IFA^{OMFI}. In turn, when considering the aggregate MFI, one gets two intra-sectoral positions (CB[10] and OMFI) and one inter-sectoral position between these two sectors. I label this position IFA^{MFI}. Finally, when considering the intra-financial assets of all financial corporations, n will be five (CB, OMFI, OFI, FA and ICPF), which implies a total of five individual intra-sectoral positions ($INTRA^{CB}$, $INTRA^{OMFI}$, etc.) and ten different pairings of inter-sectoral positions ($INTER^{CB,OMFI}$, $INTER^{CB,OFI}$, etc.). I label this position IFA^{FC}.

All these latter measures have the advantage of portraying the inter-linkages between financial sectors without involving any estimations and in a uniform fashion across all countries. Importantly, measuring intra-financial assets in this fashion captures *domestic* interconnectedness, it does not capture positions among financial corporations which are held across countries' boundaries. In this sense, this approach could be seen as yielding a lower estimate for the overall (i.e., domestic and international) value of these positions.

Furthermore, it is possible to get a better picture of the relationship between, on the one hand, non-bank and, on the other hand, bank and non-bank financial corporations, using a combination of the previous intra-financial asset measures. Specifically, by subtracting from the total intra-financial assets of financial corporations those of the MFI sectors, one gets the intra-financial positions of the non-bank sectors (i.e., OFIs, FAs and ICPFs) and the inter-sectoral positions across the bank and non-bank sectors. More formally,

[10]Despite being conceptually relevant, in practical terms no intra-financial position is normally expected for the CB sector as it normally only encompasses one entity.

$$
\begin{aligned}
IFA_t^{RES} &= IFA_t^{FC} - IFA_t^{MFI} \\
&= INTRA_t^{OFI} + INTRA_t^{FA} + INTRA_t^{ICPF} + INTER_t^{CB,OFI} + INTER_t^{CB,FA} \\
&+ INTER_t^{CB,ICPF} + INTER_t^{OMFI,OFI} + INTER_t^{OMFI,FA} + INTER_t^{OMFI,ICPF} \\
&+ INTER_t^{OFI,FA} + INTER_t^{OFI,ICPF} + INTER_t^{FA,ICPF}
\end{aligned}
$$

where IFA_t^{RES} is the residual intra-financial measure.

There are however some limitations associated to the availability of financial accounts data. First of all, although most countries that publish (non-consolidated) national financial sectoral accounts also publish consolidated data, a few notable exceptions exist such as the US (Table 5.1 displays sectoral accounts data availability[11]). The second concerns the sectoral details available which, although rather extensive, are not always sufficient or adequate for some purposes. For instance, one cannot remove the central bank from the total financial sector, which would be useful to isolate the claims of the private financial corporations from those that arose between these and central banks in the context of accommodative non-standard monetary policy taken in some countries since the outburst of the global financial crisis.

5.2.2 Credit data

The growing importance of the non-monetary financial sectors' credit intermediation role across many economies implies that, ideally, the domestic credit measure used should, to the extent possible, also capture credit provided by these sectors to NFCs, households and the general government. Unfortunatelly, this combination of lender and borrower sectors is not possible to obtain resorting to available datasets.

Starting with IMF's IFS database, series with credit to the private non-financial sectors provided

[11] I also include a column with missing sectoral breakdowns for the cases where some sectors are not provided (although they are included in the relevant aggregates). Although data are available for Slovakia, in some instances consolidated figures are larger than non-consolidated, resulting in unlikely negative intra-financial positions. For this reason, I remove this country from the analysis.

by both deposit taking corporations and other financial institutions exist – respectively, lines 22d and 42d. In fact, these are the series used by Beck et al. (2009) when they construct their measures of private credit by deposit money banks and private credit by deposit money banks and other financial institutions.[12] Additionally, credit provided to the public sector is also available at IFS. Unfortunately, for most countries, the series referring to private credit provided by other financial institutions are not filled in[13], which renders the information useless. The bottom line is that the non-bank lending sectors are poorly covered in these IFS series and the borrower sector split into NFCs and households is not available.

The BIS staff has recently put together a new credit dataset for some forty countries (details are provided in Dembiermont et al., 2013). In broad terms, this new dataset differs from the IFS credit series (or any other typical credit measure) in two main aspects: it includes (i) cross-border credit directly to domestic non-banks and (ii) credit provided by domestic non-banks. However, the available lender and borrower sectors breakdowns are either (i) all borrowing sectors vis-à-vis NFCs or households – i.e., including foreign lenders – or (ii) credit provided by banks to NFCs and households – i.e., without the split into the two individual sectors. To sum up, not only is it not possible to narrow down the domestic bank and non-bank lending sectors, but also one cannot isolate domestic credit to NFCs and households.

Finally, national financial accounts data is very much the same as the BIS credit database (probably one of its sources). With these data, one gets the total credit provided by all domestic sectors as well as the foreign sector to NFCs, households and the general government separately. Specifically, credit corresponds to the following national accounts items: currency and deposits, securities other than shares, financial derivatives, loans, insurance technical reserves except the net equity of households in life insurance and pensions funds and other accounts receivable (such as trade credits, for instance). However, it is not possible to isolate cross-border credit provided directly to the non-financial sectors. Nevertheless, once more resorting to consolidated data, which is available for most countries, it is possible to remove intra-sectoral financing, which tends to be a significant source of funding in the

[12] See the online database for details.

[13] Information is avalaible only for Cyprus, Norway, Romania and Sweden and still, in some of these countries, the data does not cover the whole period considered in this paper.

case of NFCs.

In light of the discussion above, and also for consistency given that these data are also used for the intra-financial assets measure, I also resort to national financial accounts data as a measure of debt/credit.[14]

5.3 Stylised facts

A number of stylised facts are presented in this section. For convenience, it is broken down into three subsections. In the first subsection, a general overview on the growth of intra-financial assets is provided. In the second and third subsections, the growth in intra-financial assets is looked at together with, respectively, growth in credit to end-user non-financial sectors and cross-border financial positions.

5.3.1 Overview

There is hardly a stronger initial point to make when discussing the cross-country empirics of financial balance sheets than referring to the sizable growth experienced in the last decades. In Figure 5.1, total asset and liability stocks are added and scaled by own GDP for the countries considered in this paper, where initial refers to 1995 and final to 2012.[15] All countries without exception experienced an increase: in 1995, the average size of financial assets and liabilities was just short of eleven and a half times that of GDP, rising to close to nineteen times in 2012. In some countries, such as in Ireland, the UK, Cyprus and the Netherlands, the increase was clear and impressive.

The same impressive increase is also observable for the intra-financial positions of the financial corporations, presented in Figure 5.2. With only very few exceptions, most countries underwent a substantial deepening of the financial interconnections of their respective financial sectors. Clearly, countries known for their sizable financial systems – such as Ireland, the UK or Cyprus – stand out. But they enjoy the relatively close company of others such as the Netherlands, France and Spain, as

[14] I use the terms debt and credit interchangeably throughout the paper.

[15] Except for countries for which data for one or both of these years is not available – see Table 5.1. I exclude Luxembourg throughout the analysis given its extremely high levels of financial assets and liabilities.

well as Denmark and Sweden: even for these countries with a less prominent finance industry, figures around 100 percent of GDP are not uncommon. In turn, Eastern European economies – for instance, Bulgaria, Latvia, Lithuania and Romania – record the lowest figures.

How does this evidence compare with the increase of the financial stocks of the remaining non-financial sectors of these economies? Is it that the financial growth of these sectors was in line with that of the financial sectors? To try to answer this question, I calculated the credit intermediation index of Greenwood and Scharfstein (2013) for the same set of countries, dividing the total debt of all sectors, both financial and non-financial sectors, by that of non-financial sectors. The results are displayed in Figure 5.3. The evolution is now more diverse, countries are more or less split half-way into those where the financial sectors share in the total credit provided to the economy increased and those where the end-users' share gained relevance. On the one hand, countries such as Ireland, the UK and the Netherlands are clear examples of cases where financial sector growth largely outpaced that of the non-financial sectors. On the other hand, other countries such as Spain, and to a lesser extent France, also experienced a significant increase of financial sector claims but which was compensated by the growth of other end-user sectors. However, in general terms, those countries where the overall level of financial assets and liabilities grew the most or where the level is the highest also experienced a faster growth of the credit intermediation index.

5.3.2 Intra-financial assets and credit to end-user sectors

Going into more detail at the country level in search for the relations among these variables, Figures 5.4, 5.6, 5.8 and 5.10 display intra-financial assets together with credit to non-financial corporations and households for two advanced and two emerging economies: France and the Netherlands, Hungary and Latvia, respectively.

Starting with France, the increase in intra-financial assets went hand in hand with the increase in both non-financial corporation and household credit, althought the latter has a smoother evolution than the former. The relations between these variables are not so clear cut in the case of the Netherlands. First of all, intra-financial assets remained broadly unchanged between 1998-2004 and only thereafter did they start to increase. At the same time, while household credit was constantly

increasing throughout, NFC credit somewhat increased until 2001 and then began a downward trend until 2012. Developments in Hungary and Latvia are broadly in line. In both countries, intra-financial assets experienced a sharp increase starting roughly in 2001 and up until the global financial crisis (2008-2009). At the same time, both NFC and household credit underwent a significant increase, suggesting a strong positive comovement between these variables.

Therefore, to sum up: while the relationship between intra-financial assets and credit is not so straightforward for the advanced economies considered – it comoves with NFC credit in the case of France, but not in the case of the Netherlands – it seems more stable in the case of Hungary and Latvia. Finally, both sets of charts also support the idea that the share of household credit in total credit provided in the economy is higher for advanced countries (with higher GDP per capita).

Table 5.2 presents cross-country descriptive statitics. Starting with the intra-financial asset measures, those of the overall financial corporations aggregate display faster growth. In the pre-crisis period, most of this growth was driven by IFA^{RES}, while in the crisis period IFA^{MFI} growth picks up. Average growth of NFC and household debt was very similar in the period before the crisis, but in the crisis period household debt growth slowed down to half of NFC debt which was only slightly less than in the pre-crisis period. Finally, concerning general government debt growth, it was slightly negative in the pre-crisis period and it became rapidly growing once the crisis broke out, against the background of automatic stabilizers and government stimulus packages.

To get a better feel and for easier visual inspection of the relation between intra-financial assets and debt, Charts 5.12, 5.13 and 5.14 present scatter plots for each of the end-user sectors, focusing on the period from 1995 to 2012. In broad terms, while intra-financial assets and NFC and general government debt appear to be orthogonal, there seems to be a positive relationship with household debt.

A possible channel through which this relationship might be established is securitization: when credit institutions resort to financial vehicle corporations (FVCs), which are part of the non-bank financial corporations, to securitize loans on their portfolio, these operations create financial interconnections among these different financial sectors and therefore contribute to the overall intra-financial

positions of financial corporations.[16]

But why would there be a relationship between intra-financial assets of financial corporations and household credit but not with NFC credit, as well as credit to general government? Data on securitization is unfortunately relatively scarce – one of the few exceptions is data the ECB publishes, since reference month December 2009, on outstanding amounts of loans securitized through an FVC and not derecognised from the balance sheets of banks for the euro area aggregate.[17] Interestingly, these data are also broken down by the sector to which the underlying loans were extended: general government, other financial corporations excluding MFIs, non-financial corporations and households. Figure 5.15 shows that, since 2009 and until the second quarter of 2014, more than three quarters of the total outstanding amounts of securitized loans pertains to household loans; the remaining share is almost exclusively NFC loans, as other sectors have virtually no expression.[18] Accordingly, these figures lend support to a stronger relationship of intra-financial assets and household credit as opposed to NFC credit.

5.3.3 Intra-financial assets and financial integration

At first sight, a strong relationship should be expected between the size and growth of intra-financial assets and international financial activity as financial corporations have a lead role in the process of financial integration of economies. Financial sectors from lending economies typically extended cross-border loans to financial sectors in borrowing economies which then channelled these funds to the end-user sectors, as local banks should possess more information and be in a better position to allocate these funds to entities within their own jurisdiction. The intermediation chain linking foreign funding and loans to domestic sectors can have different extensions. In some countries, funding to domestic end-user sectors was carried out by domestic banks which accessed international capital markets for funding. However, in other countries, the intermediation chain was longer: large banks channeled foreign funding inside domestic borders, these funds were then further lent to smaller domestic banks

[16] See the appendix for more details on how securitization operations are recorded in sectoral balance sheet accounts.

[17] Strickly speaking, these data do not include securitization involving the derecognition of loans from the balance sheet of bank. Nevertheless, these are mostly residual given the current regulatory environment, which establishes strict rules for loans to be removed from the balance sheet of banks.

[18] A possible reason for this higher share of household loans in total securitized loans is the fact that they are relatively standardized, especially when compared with NFC loans.

and finally the latter extended loans to the domestic end-user sectors.

Figures 5.5, 5.7, 5.9 and 5.11 display the rest of the world sector asset and liability positions together with intra-financial assets for the same countries considered above: France, Netherlands, Hungary and Latvia. These figures confirm the apparent positive relationship between both variables, i.e., the increase in intra-financial assets of the financial corporations seems to have gone hand in hand with the process of financial integration of these countries.

Importantly, financial integration is a matter only of the gross asset and liability positions with the rest of the world and has no bearing on the net position of a given country. In other words, it is not necessarily the case that countries that were net recipients of funding were also the ones where the intra-sectoral claims of financial sectors grew the most and vice-versa. For instance, the growth of intra-sectoral claims of German financial corporations was substantial in the run-up to the crisis while, at the same time, the country had a current account surplus and was therefore exporting capital, most notably to other banks in the euro area periphery countries. Figure 5.16 provides evidence thereof, displaying the average intra-financial asset position growth and the average current account[19] (ordered by decreasing intra-financial asset position growth) in the 1995-2007 period for the countries considered in this paper – it turns out that there is no clear relationship between the two variables.

5.4 Econometric evidence

In this section, a formal assessment of the statistical significance of these relationships is carried out. In a first subsection, I look at the relationship between intra-financial assets growth and financial integration and, in a second, I extend the analysis to credit to NFCs, households and the general government.

5.4.1 Intra-financial assets and financial integration

Starting with the relationship between intra-financial assets and financial integration, I use the following specification

[19] Current account data is from the IMF's WEO.

$$\Delta IFA_{it}^{S} = \beta^{1} + \beta_{i}^{2}\alpha^{c} + \beta_{t}^{3}\alpha^{y} + \beta^{4}IFA_{it-1}^{S} + \beta^{5}log(GDP_{it-1}^{pc}) + \beta^{6}\Delta FI_{it} + \varepsilon_{it}$$

where the dependent variable, IFA^{S}, is intra-financial assets of a given sector S scaled by GDP: in this case, I focus on the total financial corporations aggregate sector. Moving to the right hand side variables, $log(GDP^{pc})$ is lagged log GDP per capita[20], FI are different financial integration measures – net and gross asset and liability RoW positions of both equity and debt instruments, as well as IFI, the sum of the rest of the world asset and liability positions scaled by GDP –, α^{c} and α^{y} are, respectively, country and year dummies. The former are meant to deal with the heterogeneity in the cross-sectional dimension, capturing country specific fixed effects, associated to their idiossyncratic characteristics; the latter are meant to capture heterogeneity in the time-series dimension, capturing year specific effects which had global repercussions. This is of particular importance given that events such as the global financial crisis or the so-called dotcom crash are included, which likely had a generalised effect on the countries considered. A constant is included. Δ is the first difference operator.

The lagged variables are introduced to capture possible convergence effects, whereby countries with lower initial level of intra-financial assets and/or GDP per capita experience faster growth. As for the financial integration variables, I use rest of the world positions[21] scaled by GDP to gauge cross-border stock growth. I use both net and gross measures as well as equity and debt measures. Finally, IFI is also commonly employed as a measure of financial integration/openness.

Results for these regressions are displayed in Table 5.3. In broad terms, they indicate that, of all variables considered, only IFI displays a strong significant comovement with intra-financial assets. Interestingly, exploring net or gross measures, or their breakdown between equity and debt – which is found to be relevant to explain domestic credit growth (see for instance Lane and McQuade, 2014 and Carvalho, 2014)– does not play a role in this case. In fact, it seems that only the growth of financial integration itself is the relevant variable correlating with the growth of intra-financial positions. Intuitively, this result is sensible to the extent that intra-financial assets were on the rise both in countries

[20] The data on GDP are from the IMF WEO database and on population from the World Bank.

[21] Although balance of payments and international investment position data are typically used as cross-border financial flow/stock measures, I rely on rest of the world sector of national accounts data in this case for consistency sake with the remaining variables, as they are also derived from the same dataset.

where credit underwent a significant increase and/or which received substantial capital inflows during the period as well as in countries where credit was subdued and which were net exporters of capital. In both the latter cases, the common element was the fact that the cross-border positions were expanding, irrespective of whether the net financial asset position was positive or negative or of instrument composition.

5.4.2 Intra-financial assets and credit to end-user sectors

Having looked at the relationship between intra-financial assets and financial integration, it is now time to consider credit provided to end-user sectors. Specifically, I expand the previous specification in the following way:

$$\begin{aligned}\Delta IFA^{S}_{it} &= \beta^{1} + \beta^{2}_{i}\alpha^{c} + \beta^{3}_{t}\alpha^{y} + \beta^{4}\Delta IFI_{it} + \beta^{5}\Delta NFCDEBT_{it} + \beta^{6}\Delta HHDEBT_{it} \\ &+ \beta^{7}\Delta GGDEBT_{it} + \beta^{8}IFA^{S}_{it-1} + \beta^{9}IFI_{it-1} + \beta^{10}log(GDP^{pc}_{it-1}) + \beta^{11}NFCDEBT_{it-1} \\ &+ \beta^{12}HHDEBT_{it-1} + \beta^{13}GGDEBT_{it-1} + \varepsilon_{it}\end{aligned}$$

where, again, the dependent variable, IFA^{S}, is intra-financial assets of a given sector S scaled by GDP. Moving to the right hand side variables, $NFCDEBT$ is NFC debt scaled by GDP, $HHDEBT$ is household debt scaled by GDP, $GGDEBT$ is general government debt scaled by GDP and all remaining variables have the same interpretation as before.

Given the strong relationship between cross-border financial integration and the size of intra-financial positions as discussed in the previous subsection, the variable IFI is included in this specification. In addition to what was already mentioned regarding $log(GDP^{pc})$, its inclusion in this specification should also be seen in connection with empirical evidence suggesting that household sector debt levels as well as their share in total credit are higher in advanced economies (see Beck et al., 2012). Additionally, I also include lagged levels of NFC, household and general government debt scaled by GDP, as well as cross-border financial stocks, which once more are meant to capture possible convergence effects.

I start by running the regression for IFA^{FC}, i.e., the total of intra-financial positions for all financial corporations. However, a subsequent interesting question would be to dig more deeply within these sectors and understand whether this relationship stems from intra-sectoral positions of banks and non-banks and/or inter-sectoral positions between the bank and non-bank sectors. Therefore, I also run the same equation but using instead the intra-financial positions of the MFI sector (IFA^{MFI}), encompassing both banks and the central bank. Finally, to assess the importance of inter-sectoral relationships between bank and non-bank financial corporations, I also ran the same regression for IFA^{RES} which, as explained, does not consider the positions within the MFI sector.

Results for the whole period (1995-2012), the period exluding the global financial crisis (1995-2007) and the crisis period (2008-2012) are displayed, respectively, in Tables 5.4, 5.5 and 5.6. Starting with debt measures, these results confirm the visual inspection of the scatter plots: only the growth rate of household debt significantly correlates with intra-financial assets growth, specifically with both IFA^{FC} and IFA^{RES}, but not IFA^{MFI}, and for all periods considered. In turn, both NFC and general government debt growth display no significant comovement with the interconnectedness of the financial sectors. The only exception is general government debt and IFA^{MFI} and in the period including the crisis; this is also the only case where the intra-financial positions of the MFI sectors show significant comovement with any of the debt measures considered. The latter likely reflects the adoption of exceptional measures in response to the global financial crisis: unconventional monetary policy measures adopted in most advanced economies such as liquidity provision to banks undergoing funding strains with the shut down of financial markets, at the same time that government stimulus packages and/or automatic stabilizers led to a sharp increase in public debt levels, likely translated into higher interlinkages between these two particular sectors. Finally, the fact that there is no evidence of significant comovement between (domestic) interbank positions growth and NFC and household debt growth is supportive of shorter domestic bank intermediation chains.

Turning to the growth of cross-border positions, it is statistically significant in most cases, corroborating the view that growth in (domestic) intra-financial positions went hand in hand with the financial integration of economies. Interestingly, while ΔIFI strongly (and significantly) correlates with ΔIFA^{FC} in all periods, it displays significant comovement with ΔIFA^{RES} in the period ex-

cluding the global financial crisis and with ΔIFA^{MFI} in the crisis period. Again, these results might reflect exceptional measures taken in the context of the global financial crisis. The above mentioned unconventional monetary policies, in the case of the euro area, manifested themselves in a substantial increase of the so-called TARGET2 positions between the ECB and the Eurosystem's national central banks: surplus countries such as Germany recorded net asset positions vis-à-vis the Eurosystem while deficit countries, for instance in the periphery, recorded net liability positions. Most importantly, due to the decentralized nature of the liquidity provision, there was an across the board increase in these positions, which are recorded as both cross-border – the leg involving the ECB and the national central banks – and also as positions between national central banks and domestic banks – when the liquidity is finally channeled domestically to the comercial banking system.

The lagged levels of the intra-financial positions of the different sectors considered are not always significant. Whenever there is significant comovement, the coefficients have a negative sign and thus support the idea of convergence, whereby countries with higher levels experience lower intra-financial assets growth. The same applies to GDP per capita, which also has a negative coefficient whenever it is significant. Looking at the lagged levels of debt across the different sectors, again household debt is the relevant variable, with few exceptions. However, in this case, there is a positive relationship between the lagged level of household debt and growth in intra-financial assets in the period including the global financial crisis.[22]

To sum up, these results provide support to the idea that the substantial increase in intra-financial positions observed in recent years went hand in hand with developments in credit to the household sector. Specifically, the higher levels of interlinkages and interconnectedness in general likely reflect the expansion of financial activities such as securitization and asset management which, to the extent that they involve different (private) financial corporations belonging to different institutional sectors, are conducive to an increase in the financial links between these different financial sectors. In turn, not only does the growth in credit provided to NFCs display no significant comovement with these

[22]As additional robustness checks, I included other variables in these regressions which however didn't qualitatively affect the results. In particular, I used an adaptation of the financial structure ratio proposed by Čihák et al. (2012), i.e., the ratio of size indicators for financial corporations – proxied by the total assets of financial corporations – and financial markets – proxied by stock market capitalization (Čihák et al. (2012) focus instead on *bank* assets instead of the whole of financial corporations.).The purpose is to distinguish countries with more market-based systems, which offer end-user sectors a larger scope of alternative financing possibilities.

increased financial sectors links, but also developments in the inter-bank positions bear no relationship with credit to the private sectors.

5.5 Conclusion

This paper provides two main contributions. First, it looks at the cross-country evidence of intra-financial claims of the financial sectors. For that purpose, it hinges on a simple and harmonized way of measuring intra-financial positions using consolidated and non-consolidated aggregate financial accounts data and which can be used for different sectors or groups of sectors, restricted however to data availability. The measure proposed documents the rapid and impressive growth of intra-financial asset positions within the financial sectors across most advanced economies in recent times. Second, it shows that growth in financial positions within the financial sectors is associated with household credit but not with NFC and general government credit. Moreover, this relationship stems from financial links involving non-bank corporations and across the latter and banks, and not from intra-bank claims.

In this sense, these results are in line with other studies which argue that (i) an increasing share of the total credit provided in advanced economies is channeled to the household sector and, in particular, for housing purposes (Jordà et al., 2014) and (ii) that securitization practices – which establish financial links across bank and non-bank financial corporations – were fundamental in this process by transforming illiquid financial instruments into tradable securities (Bhatia and Bayoumi, 2012). Also, the higher share of household loans in the total securitized loans might reflect the higher level of harmonization of such types of contracts as opposed to NFC loans.

These results have important implications for financial stability and macroprudential policy. On the one hand, while credit to the non-financial corporate sector is typically associated with investment in productive activity, credit to the household sector is generally used to finance real estate purchase or consumption and hence likely to generate a more limitated impact on growth (if any at all). In fact, Beck et al (2012) find cross-country evidence supporting this view, that while bank lending to the non-financial corporations sector is associated to GDP growth, the same does not apply to credit to households. Accordingly, to the extent that household sector credit has a more tenuous (if any) relation

with growth, these results indicate that the increased interconnectedness among the financial sectors is not necessarily conducive to productive investment and long-run growth.[23]. On the other hand, it should also be stressed that some of these intra-financial assets are particularly flightly even when compared to standard deposits, and may contribute to system-wide runs and fire-sales. For instance, Hanson et al. (2014) discuss how US money market funds were pivotal in transmiting instability to financial institutions in the aftermath of the Lehman bankruptcy: these funds provided an important share of the US funding of global banks and, when facing a run, they imposed serious financial strain on global financial instituions which dependend on them to fund their dollar assets.

Furthermore, the expansion of the non-bank financial sectors and their interconnections with the regulated banking sector should be looked into against the background of developments in leverage and procylical behaviour – see Bakk-Simon et al. (2012), who show that most of the increase in leverage in the financial sectors of the euro area in the run up to the crisis was generated in the non-bank financial sectors, and Constâncio (2012) who argues that the shadow banking sector is an important source of procyclical behaviour. Finally, higher levels of financial interconnectedness are also found to dampen the monetary policy transmission mechanism and are put forward by Barattieri et al. (2014) as one of the reasons behind the time-varying effects of monetary policy shocks on real variables.

[23]On the relationship between credit and growth see also Arcand et al. (2012), Beck et al. (2014) and Levine et al. (2000)

5.6 Appendix: securitization in sectoral balance sheet accounts

In broad terms, the recording of securitization operations involves the balance sheets of banks, financial vehicles and, in some instances, the original borrower sector. In practice, it depends on whether the loans are kept on the balance sheet of the originator of the loan, i.e., whether they are derecognized or not.

- In the case of derecognized operations, a reduction on the asset side of the originator's balance sheet is recorded, the size of the securitized loans, which is offset by an increase in proceedings received from the financial vehicle. At the same time, the securitized loans will be recorded on the original financial vehicle's balance sheet and the counterpart sector of these is the original debtor sector.

- In the case of not derecognized operations, there is no reduction on the asset side of the originator's balance sheet as the securitized loans remain. However, given that the originator will still receive cash in return for the securitized loans, an entry on its liability side is needed to balance these operations. For this reason, a deposit vis-à-vis the financial vehicle is recorded. Importantly, this deposit is kept outside those that are relevant for monetary aggregates, so as not to affect the latter. Finally, the securitized loans will be recorded on the original financial vehicle's balance sheet but this time around the counterpart sector will be the loan originator, so that the there is no double counting of loans granted to the original debtor sector.

Figure 5.1: Total financial asset and liability stocks - percent of GDP

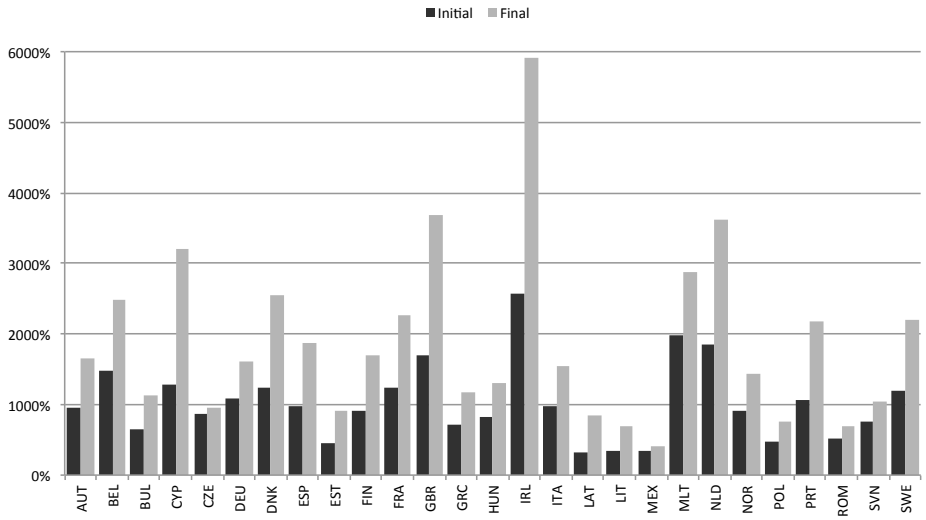
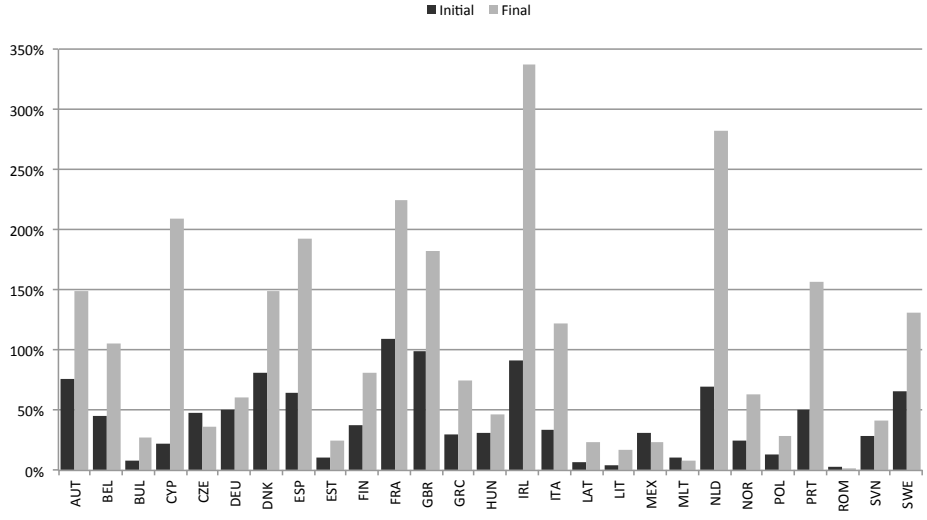
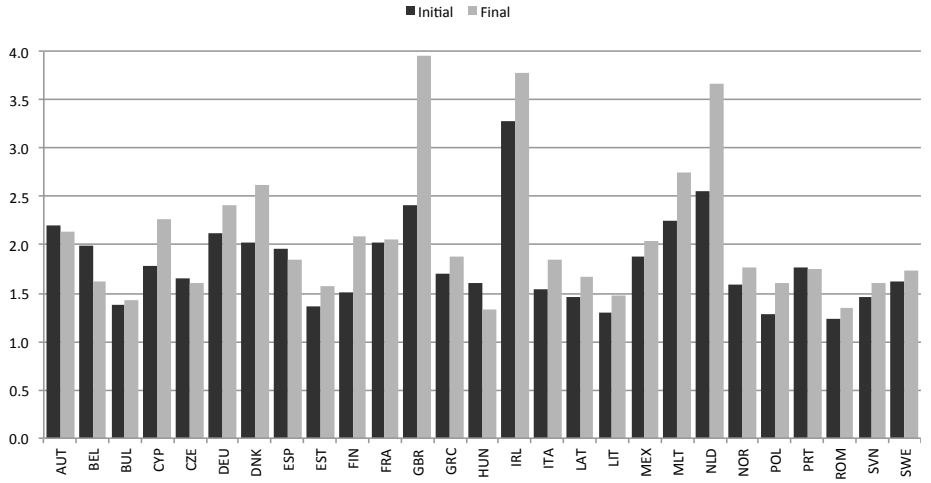


Figure 5.2: Intra-financial positions of financial corporations



24

Figure 5.3: Credit intermediation index



25

Figure 5.4: Intra-financial assets and credit to NFCs and households - France

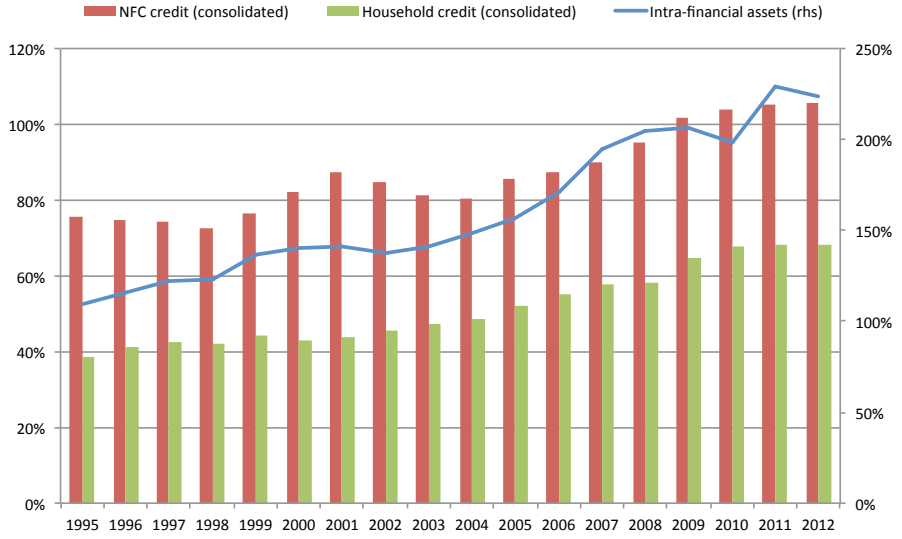


Figure 5.5: Intra-financial assets and rest of the world positions - France

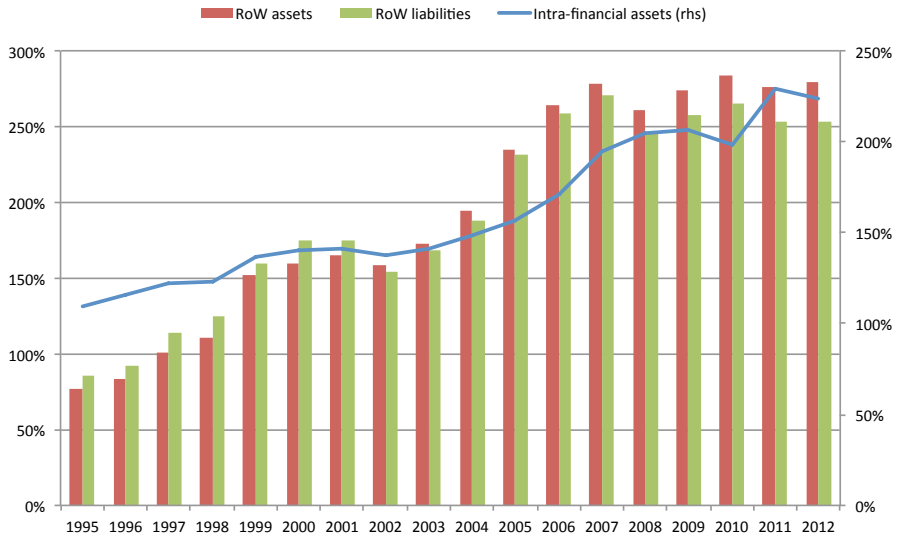


Figure 5.6: Intra-financial assets and credit to NFCs and households - Netherlands

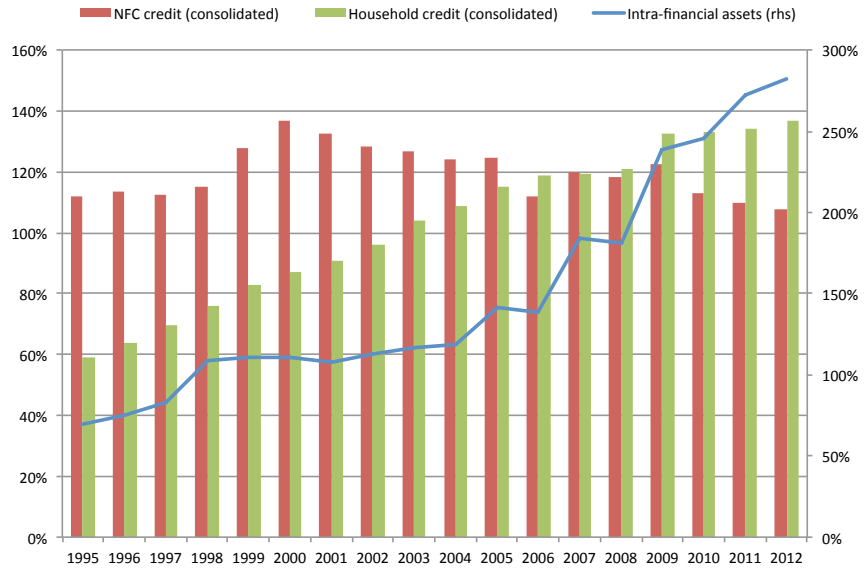


Figure 5.7: Intra-financial assets and rest of the world positions - Netherlands

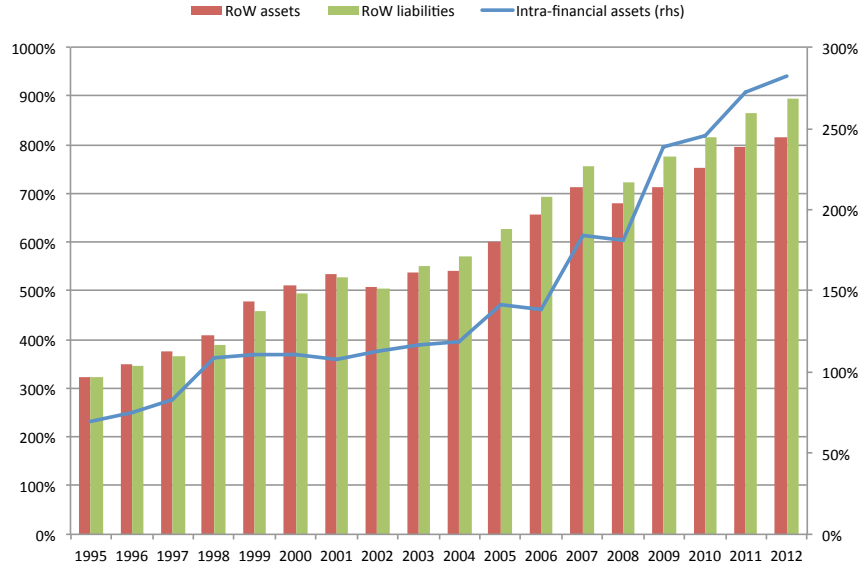


Figure 5.8: Intra-financial assets and credit to NFCs and households - Hungary

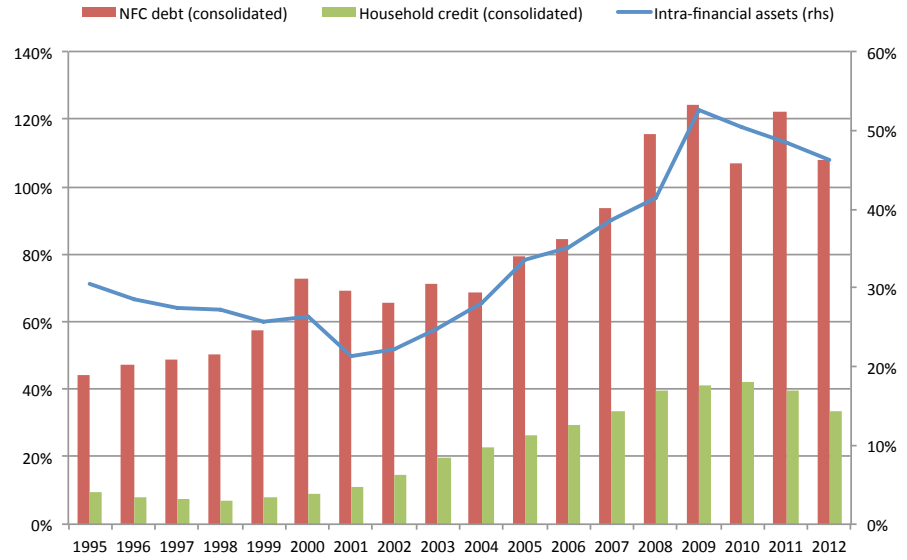


Figure 5.9: Intra-financial assets and rest of the world positions - Hungary

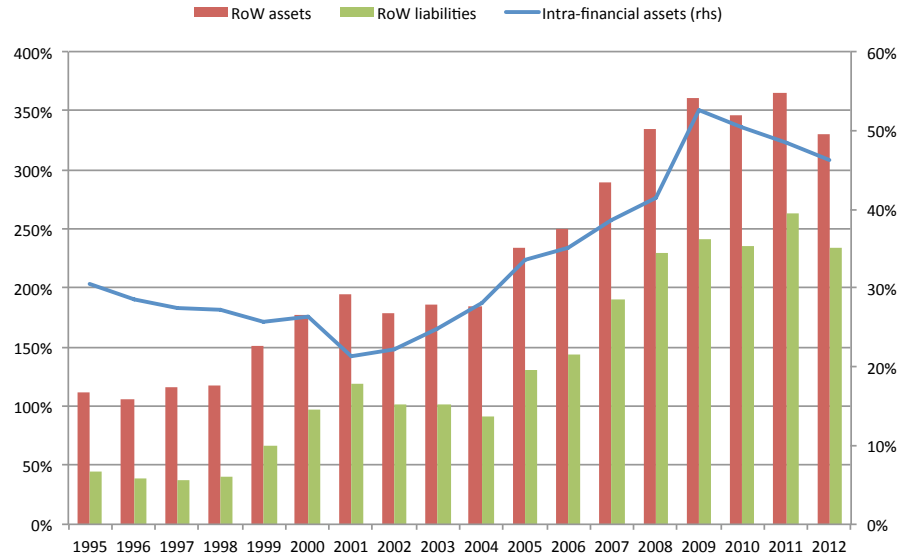


Figure 5.10: Intra-financial assets and credit to NFCs and households - Latvia

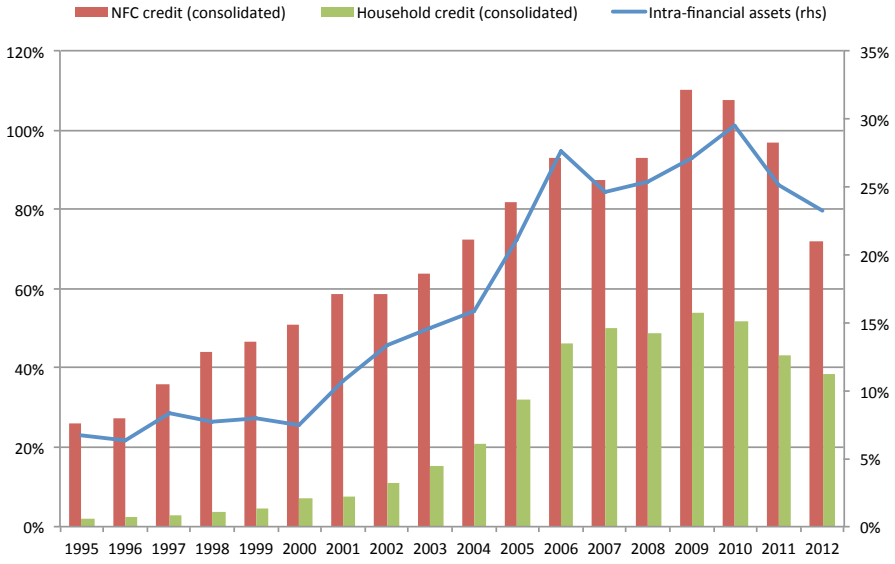


Figure 5.11: Intra-financial assets and rest of the world positions - Latvia

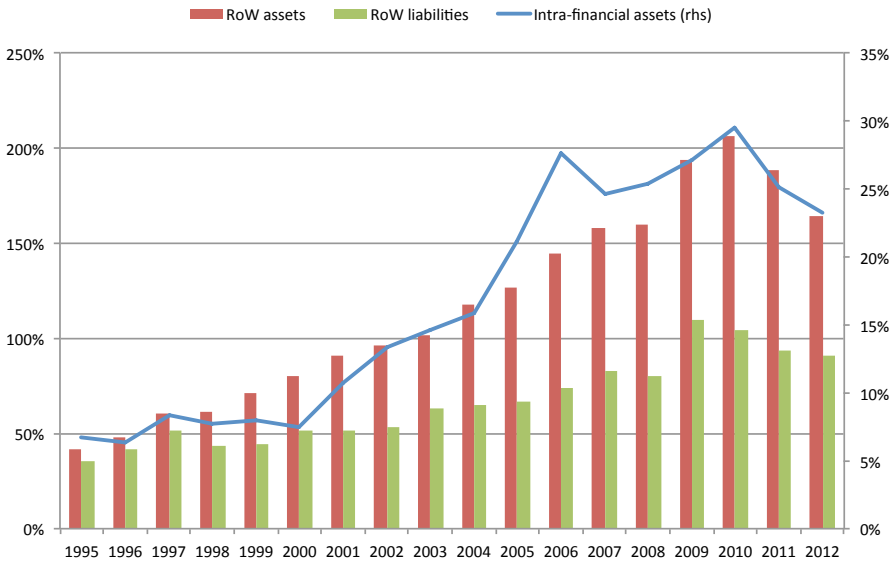


Figure 5.12: Intra-financial assets and total credit to non-financial corporations - annual growth rates (1995-2012)

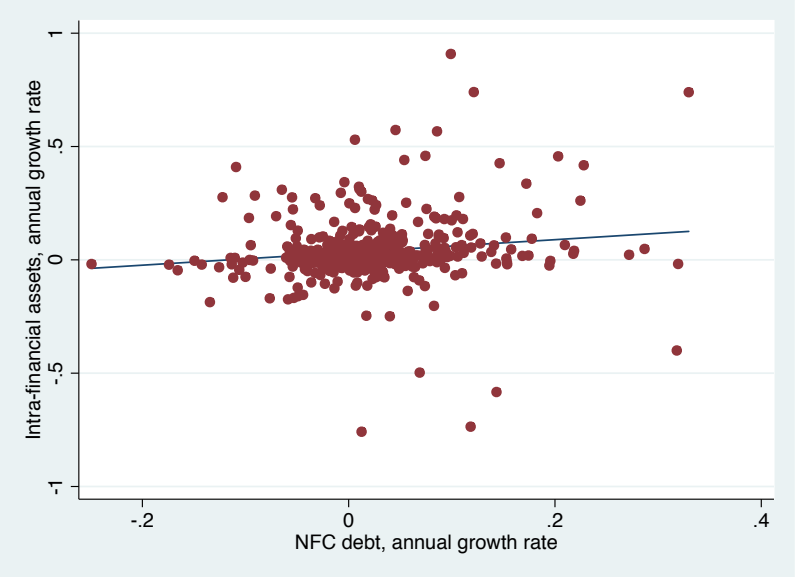


Figure 5.13: Intra-financial assets and total credit to households - annual growth rates (1995-2012)

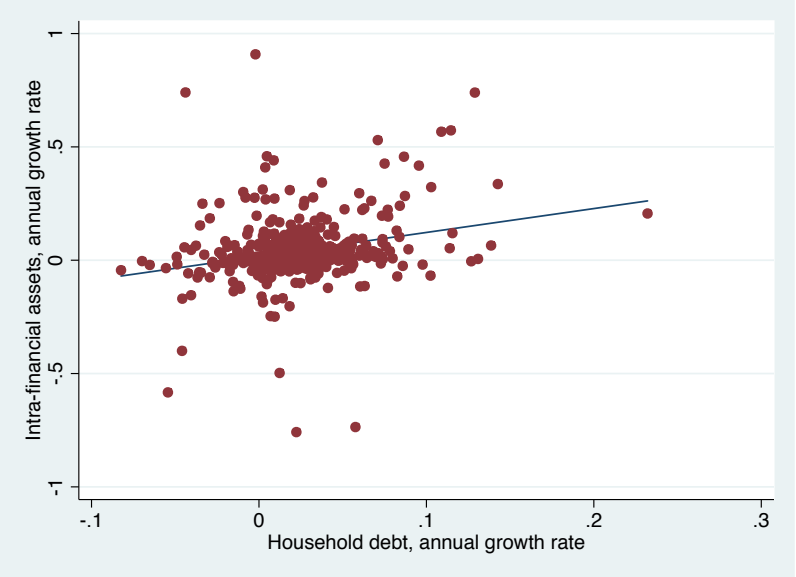


Figure 5.14: Intra-financial assets and total credit to the general government - annual growth rates (1995-2012)

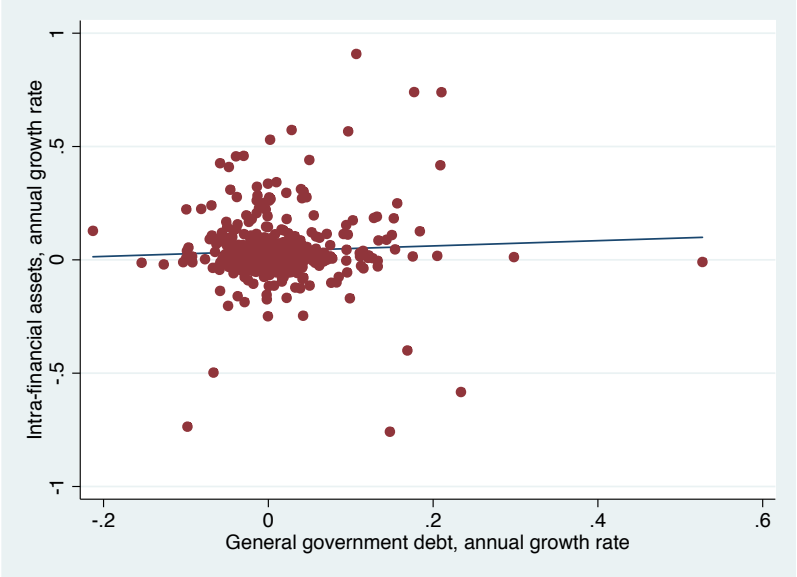


Figure 5.15: Securitised loans in the euro area - shares per sector

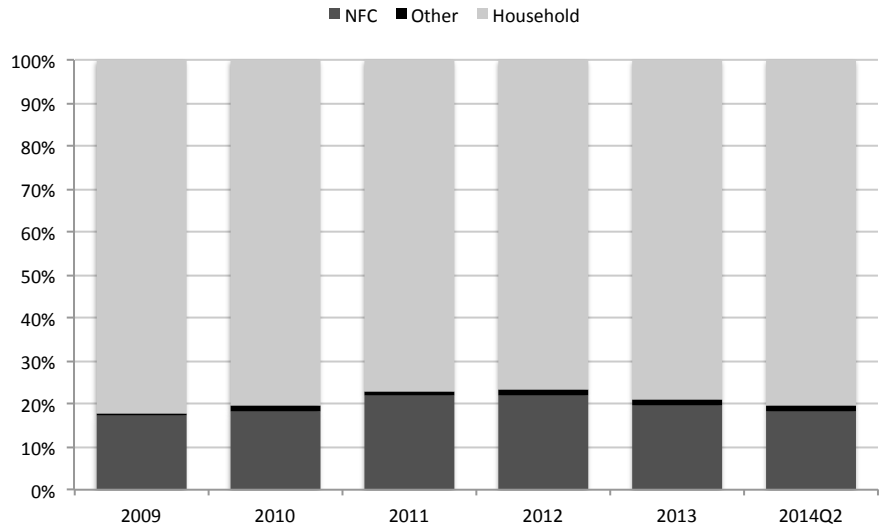
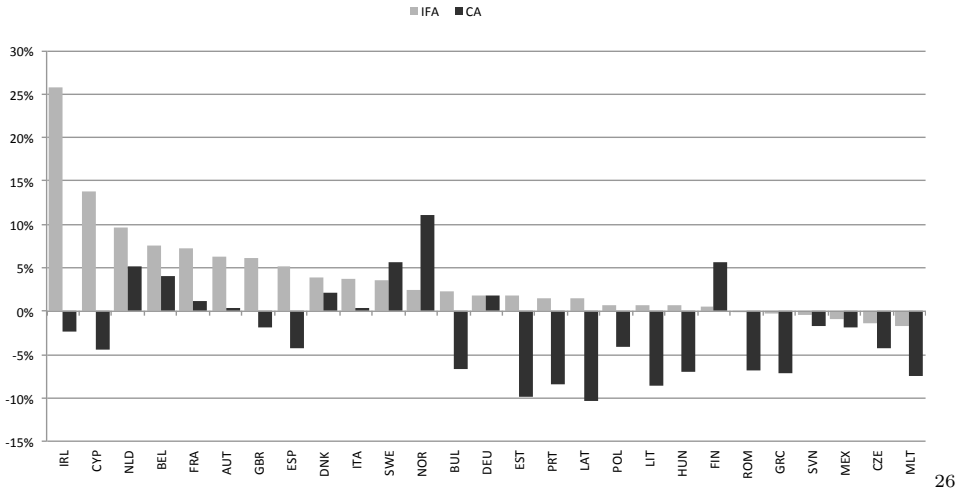


Figure 5.16: Intra-financial assets and current account - average annual growth rates (1995-2007)



26

Table 5.1: Data availability - sectoral accounts

	PERIOD		MISSING BREAKDOWN
	Initial	Final	
AUT	1995	2012	-
BEL	1994	2012	-
BUL	2000	2012	-
CYP	1995	2012	-
CZE	1995	2012	MFI, CB, OMFI, OFI, FA, ICPF
DEU	1991	2012	CB, OMFI, FA (91-96)
DNK	1994	2012	-
ESP	1989	2012	-
EST	1994	2012	-
FIN	1995	2012	-
FRA	1995	2012	MFI
GBR	1990	2012	CB, OMFI, FA
GRC	1995	2012	FA
HUN	1989	2012	-
IRL	2001	2012	CB, OMFI
ITA	1995	2012	CB, OMFI
LAT	1995	2012	-
LIT	1995	2012	-
LUX	2006	2012	-
MEX	1997	2009	-
MLT	2004	2012	-
NLD	1991	2012	-
NOR	1995	2012	-
POL	1995	2012	CB, OMFI (09-12)
PRT	1995	2012	-
ROM	1998	2012	-
SVK	1995	2012	FA
SVN	2001	2012	-
SWE	1995	2012	FA (95-00)

Table 5.2: Summary statistics

	IFA^{FC}	IFA^{MFI}	IFA^{RES}	$NFCDEBT$	$HHDEBT$	$GGDEBT$
1995-2012						
N	432	399	388	433	433	438
Mean	0.040	0.015	0.024	0.024	0.021	0.011
Median	0.017	0.006	0.008	0.019	0.017	0.001
SD	0.143	0.104	0.096	0.071	0.035	0.062
1995-2007						
N	300	277	266	301	301	306
Mean	0.038	0.011	0.026	0.025	0.026	-0.008
Median	0.019	0.007	0.009	0.021	0.022	-0.007
SD	0.102	0.055	0.081	0.063	0.031	0.038
2008-2012						
N	132	122	122	132	132	132
Mean	0.044	0.024	0.020	0.022	0.011	0.053
Median	0.012	0.004	0.005	0.012	0.008	0.041
SD	0.207	0.169	0.123	0.087	0.039	0.083

$NFCDEBT$ is total credit to the NFCs, $HHDEBT$ is total credit to households, $GGDEBT$ is total credit to the general government, IFA^{FC} is intra-financial assets of the financial sectors, IFA^{MFI} is intra-financial positions of the MFI sector, IFA^{RES} IFA^{RES} is the difference between IFA^{FC} and IFA^{MFI}. All variables are scaled by own nominal GDP and in first difference.

Table 5.3: Intra-financial assets and cross-border financial integration - regression results

	ΔIFA^{FC}_{it}	ΔIFA^{FC}_{it}	ΔIFA^{FC}_{it}	ΔIFA^{FC}_{it}	ΔIFA^{FC}_{it}
$\Delta TOTALN_{it}$	0.047				
	(0.05)				
$\Delta EQUITYN_{it}$		0.043			
		(0.04)			
$\Delta DEBTN_{it}$		0.063			
		(0.12)			
$\Delta TOTALA_{it}$			0.083		
			(0.05)		
$\Delta TOTALL_{it}$			0.046		
			(0.07)		
$\Delta EQUITYA_{it}$				0.079*	
				(0.04)	
$\Delta EQUITYL_{it}$				0.094	
				(0.11)	
$\Delta DEBTA_{it}$				0.122	
				(0.14)	
$\Delta DEBTL_{it}$				-0.012	
				(0.13)	
ΔIFI_t					0.066**
					(0.03)
IFA^{FC}_{it-1}	-0.059	-0.059	-0.081	-0.079	-0.081
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)
$log(GDP^{pc}_{it-1})$	-0.077**	-0.079**	-0.083**	-0.089***	-0.083**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Constant	0.912**	0.927**	0.963***	1.028***	0.962***
	(0.37)	(0.37)	(0.35)	(0.34)	(0.35)
Obs	299	299	299	299	299
R squared	0.36	0.36	0.39	0.39	0.39

Dependent variable is IFA^{FC}, intra-financial assets of the financial sectors scaled by GDP. Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. $TOTALN$ is net total cross-border (RoW) positions scaled by GDP, $EQUITYN$ is net equity cross-border (RoW) positions scaled by GDP, $DEBTN$ is net debt cross-border (RoW) positions scaled by GDP, $TOTALA$ is total asset cross-border (RoW) positions scaled by GDP, $TOTALL$ is total liability cross-border (RoW) positions scaled by GDP, $EQUITYA$ is equity asset cross-border (RoW) positions scaled by GDP, $EQUITYL$ is equity liability cross-border (RoW) positions scaled by GDP, $DEBTA$ is debt asset cross-border (RoW) positions scaled by GDP, $DEBTL$ is debt liability cross-border (RoW) positions scaled by GDP, IFI is the sum of total cross-border (RoW) asset and liability positions scaled by GDP, $log(GDP^{pc})$ is log GDP per capita. Δ is the first difference operator.

Table 5.4: Intra-financial assets and credit to end-user sectors - regression results for the whole period

	1995-2012				
	ΔIFA_{it}^{FC}	ΔIFA_{it}^{MFI}	ΔIFA_{it}^{RES}	ΔIFA_{it}^{MFI}	ΔIFA_{it}^{RES}
ΔIFI_{it}	0.102***	0.070***	0.032	0.071***	0.033
	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta NFCDEBT_{it}$	0.002	0.068	-0.102	0.071	-0.092
	(0.11)	(0.11)	(0.09)	(0.12)	(0.09)
$\Delta HHDEBT_{it}$	0.769***	0.180	0.557***	0.187	0.544***
	(0.26)	(0.23)	(0.20)	(0.23)	(0.20)
$\Delta GGDEBT_{it}$	0.095	0.244**	-0.132	0.250**	-0.110
	(0.26)	(0.12)	(0.20)	(0.12)	(0.21)
IFA_{it-1}^{FC}	-0.242***				
	(0.08)				
IFA_{it-1}^{MFI}		-0.234***		-0.258***	-0.076
		(0.07)		(0.08)	(0.06)
IFA_{it-1}^{RES}			-0.128*	-0.060	-0.144**
			(0.07)	(0.04)	(0.07)
IFI_{it-1}	0.009	-0.004	0.008	0.000	0.013**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$log(GDP_{it-1}^{pc})$	-0.166***	-0.059**	-0.060***	-0.074***	-0.073***
	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)
$NFCDEBT_{it-1}$	-0.062	-0.092	-0.001	-0.087	0.006
	(0.07)	(0.06)	(0.05)	(0.06)	(0.05)
$HHDEBT_{it-1}$	0.485***	0.211***	0.224***	0.238***	0.235***
	(0.11)	(0.08)	(0.08)	(0.08)	(0.08)
$GGDEBT_{it-1}$	-0.030	-0.096	0.067	-0.088	0.070
	(0.07)	(0.06)	(0.05)	(0.06)	(0.05)
Constant	1.596***	0.767***	0.322	0.906***	0.470*
	(0.38)	(0.29)	(0.20)	(0.30)	(0.24)
Obs	431	398	388	388	388
R squared	0.41	0.40	0.32	0.41	0.32

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. IFA^{FC} is intra-financial assets of the financial sectors scaled by GDP, IFA^{MFI} is intra-financial positions of the MFI sector scaled by GDP, IFA^{RES} is the difference between IFA^{FC} and IFA^{MFI}, IFI is the sum of total cross-border (RoW) asset and liability positions scaled by GDP, $log(GDP^{pc})$ is log GDP per capita, $NFCDEBT$ is total NFC debt scaled by GDP, $HHDEBT$ is total household debt scaled by GDP, $GGDEBT$ is total general government debt scaled by GDP. Δ is the first difference operator.

Table 5.5: Intra-financial assets and credit to end-user sectors - regression results for the pre-crisis period

	1995-2007				
	ΔIFA_{it}^{FC}	ΔIFA_{it}^{MFI}	ΔIFA_{it}^{RES}	ΔIFA_{it}^{MFI}	ΔIFA_{it}^{RES}
ΔIFI_{it}	0.069***	0.002	0.060***	0.009	0.060***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta NFCDEBT_{it}$	0.045	0.080	-0.068	0.096	-0.068
	(0.13)	(0.08)	(0.12)	(0.08)	(0.12)
$\Delta HHDEBT_{it}$	0.696**	0.119	0.528**	0.069	0.529**
	(0.28)	(0.19)	(0.25)	(0.17)	(0.25)
$\Delta GGDEBT_{it}$	-0.207	-0.054	-0.073	-0.143*	-0.075
	(0.13)	(0.08)	(0.10)	(0.08)	(0.10)
IFA_{it-1}^{FC}	-0.244***				
	(0.08)				
IFA_{it-1}^{MFI}		-0.133		-0.190*	-0.014
		(0.10)		(0.10)	(0.07)
IFA_{it-1}^{RES}			-0.109	-0.135***	-0.113
			(0.09)	(0.04)	(0.09)
IFI_{it-1}	0.041***	0.012*	0.013	0.025***	0.014
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$log(GDP_{it-1}^{pc})$	-0.115***	0.008	-0.094***	0.014	-0.094***
	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)
$NFCDEBT_{it-1}$	0.086	-0.019	0.081	-0.002	0.083
	(0.09)	(0.03)	(0.10)	(0.03)	(0.10)
$HHDEBT_{it-1}$	0.100	0.074	0.043	0.046	0.043
	(0.12)	(0.06)	(0.11)	(0.06)	(0.11)
$GGDEBT_{it-1}$	0.030	-0.101**	0.127*	-0.076	0.127*
	(0.08)	(0.05)	(0.07)	(0.05)	(0.07)
Constant	1.119***	0.022	0.687**	-0.032	0.694**
	(0.42)	(0.22)	(0.33)	(0.22)	(0.33)
Obs	299	276	266	266	266
R squared	0.46	0.37	0.39	0.42	0.39

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. IFA^{FC} is intra-financial assets of the financial sectors scaled by GDP, IFA^{MFI} is intra-financial positions of the MFI sector scaled by GDP, IFA^{RES} is the difference between IFA^{FC} and IFA^{MFI}, IFI is the sum of total cross-border (RoW) asset and liability positions scaled by GDP, $log(GDP^{pc})$ is log GDP per capita, $NFCDEBT$ is total NFC debt scaled by GDP, $HHDEBT$ is total household debt scaled by GDP, $GGDEBT$ is total general government debt scaled by GDP. Δ is the first difference operator.

Table 5.6: Intra-financial assets and credit to end-user sectors - regression results for the crisis period

	2008-2012				
	ΔIFA_{it}^{FC}	ΔIFA_{it}^{MFI}	ΔIFA_{it}^{RES}	ΔIFA_{it}^{MFI}	ΔIFA_{it}^{RES}
ΔIFI_{it}	0.096**	0.066**	0.035	0.066**	0.033
	(0.04)	(0.03)	(0.02)	(0.03)	(0.02)
$\Delta NFCDEBT_{it}$	-0.263	-0.321	0.112	-0.312	0.104
	(0.34)	(0.31)	(0.19)	(0.29)	(0.19)
$\Delta HHDEBT_{it}$	1.512**	0.453	1.150**	0.457	1.152**
	(0.64)	(0.46)	(0.48)	(0.46)	(0.47)
$\Delta GGDEBT_{it}$	0.282	0.461**	-0.176	0.463**	-0.175
	(0.27)	(0.21)	(0.19)	(0.22)	(0.18)
IFA_{it-1}^{FC}	-0.681***				
	(0.19)				
IFA_{it-1}^{MFI}		-0.468***		-0.465***	-0.129
		(0.17)		(0.17)	(0.13)
IFA_{it-1}^{RES}			-0.728***	-0.032	-0.716***
			(0.17)	(0.15)	(0.16)
IFI_{it-1}	0.048	-0.004	0.041*	-0.003	0.046**
	(0.04)	(0.03)	(0.02)	(0.03)	(0.02)
$log(GDP_{it-1}^{pc})$	-0.595*	0.405	0.378*	0.411	0.288
	(0.33)	(0.29)	(0.22)	(0.30)	(0.20)
$NFCDEBT_{it-1}$	-0.529	-0.676**	0.187	-0.671**	0.182
	(0.42)	(0.33)	(0.22)	(0.32)	(0.22)
$HHDEBT_{it-1}$	2.612***	1.225**	1.401**	1.258**	1.437**
	(0.93)	(0.51)	(0.64)	(0.58)	(0.63)
$GGDEBT_{it-1}$	0.490*	0.303	0.259	0.315	0.245
	(0.26)	(0.23)	(0.21)	(0.25)	(0.20)
Constant	-8.106**	-4.348	-5.960**	-4.460	-4.939**
	(3.83)	(3.34)	(2.72)	(3.46)	(2.38)
Obs	132	122	122	122	122
R squared	0.67	0.63	0.65	0.64	0.66

Robust standard errors in parenthesis. ***, **, * denote significance at 1, 5 and 10 percent levels respectively. Country and time dummies included. IFA^{FC} is intra-financial assets of the financial sectors scaled by GDP, IFA^{MFI} is intra-financial positions of the MFI sector scaled by GDP, IFA^{RES} is the difference between IFA^{FC} and IFA^{MFI}, IFI is the sum of total cross-border (RoW) asset and liability positions scaled by GDP, $log(GDP^{pc})$ is log GDP per capita, $NFCDEBT$ is total NFC debt scaled by GDP, $HHDEBT$ is total household debt scaled by GDP, $GGDEBT$ is total general government debt scaled by GDP. Δ is the first difference operator.

Chapter 6

Conclusion

Foreign ownership of securities issued by euro area residents has increased considerably since the introduction of the euro and in the run up to the global financial crisis while, at the same time, long-term interest rates were declining in the period. The second chapter of this dissertation set out to see whether the increase in cross-border holdings had an impact on long-term interest rates, as is already documented for the United States in several studies. Exploring this question would allow understanding whether this empirical finding could be generalised for other countries or whether it is specific for the United States, bearing in mind the foreign exchange management carried out by the Chinese authorities, targetting the dollar. The chapter shows that there is in fact a statistically significant impact: all else equal, the increase in foreign holdings in the period led to a decrease in euro area long-term interest rates of 1.55 percentage points. These results are relevant both from a euro area and a global perspective, as they show that the phenomenon of lower long-term interest rates due to foreign bond buying is not exclusive to the United States and foreign inflows into euro area debt securities may have added to increased risk appetite and hunt-for-yield at the global level.

While this chapter focuses on the pre-crisis period – with foreign holdings increasing and yields experiencing the ensuing downward impact – they are also relevant at the current juncture in the opposite scenario. Specifically, informal evidence points to the Chinese authorities recently running

down their foreign exchange reserves to stem the renminbi depreciation pressure, specially since the collapse of Chinese financial markets in the summer of 2015. At the same time, the sharp fall in the oil price brought about by the strategy of over-supply, carried out by some OPEC members, has severely impacted some of the oil exporting countries' public budgets and currencies. In fact, some were forced to abandon their peg to the dollar has a consequence. A decumulation of holdings by some of these countries might have a significant upward impact on the long-term interest rates of major advanced economies, whose monetary policy stance is currently very loose. While it is presumed that the dollar has the largest share in these reserves, the impact on the euro area could be of a particular relevance, as it could hinder the effectiveness of the undergoing APP programme.

The relationship between credit and cross-border capital flows has been extensively explored in several different ways in numerous studies. However, the same is not the case regarding money and, especially, both credit and money. Studying credit and money together with financial integration has desirable features. On the one hand, it links the asset and liability sides of the domestic banking sector in the same framework. On the other hand, historical evidence shows that the two variables had a distinct evolution broadly since the 1970s, with credit growing faster than money. The latter coincides with a period of rapid cross-border financial integration and the resurgence of crisis episodes and has been associated with the expansion of banks' non-monetary liabilities.

For these reasons, the third chapter explores the relationship between credit, money and international capital flows. It shows that the sectoral composition of flows is an important component with different implications for domestic credit and money holdings. In particular, while net debt flows of non-banks display comovement with broad money, net debt flows of banks seem to be more relevant in explaining credit dynamics and co-move with the decoupling between the two variables. In other words, according to this evidence, in addition to contributing to credit growth and the expansion of the asset side of domestic banks' balance sheets, the cross-border banking activity has gone hand in hand with a change in the mix between monetary and non-monetary liabilities of banks and, in this sense, it is associated with the expansion of bank's non-monetary liabilities. This evidence helps understand how capital flows interact with the joint dynamics of money and credit aggregates as well as with the

funding of banks and the shape and composition of banks' liabilities.

Most modern day economies are characterised by increasing financial stocks, in some cases reaching as high as several times the size of GDP. For this reason, understanding the dynamics of balance sheet components is an issue of pressing importance. One of these elements is the SFAs – comprising price and exchange rate valuations as well as other changes – which are becoming increasingly important to the extent that stocks are bigger: even small price changes can lead to substancial shifts in valuations.

Therefore, the purpose of the fourth chapter is to assess the interaction between the flow and SFA components and how they affect the dynamics of financial balance sheets. Available data shows that the expansion of balance sheets of advanced economies was mostly done on account of the continuous active decision to carry out further financial transactions involving mostly debt instruments. At the same time, SFAs on equity instruments contributed substantially to the increasing positions for most of the period until the eruption of the global financial crisis. In broad terms, regression results indicate that there is a strong positive comovement between debt flows and the valuation component of equity instruments: the higher market value of equity instruments is met with taking up more debt and vice-versa. Moreover, going down to the sectoral level shows that this procyclical behaviour, whereby financial investment in debt instruments moves in tandem with asset price developments, stems mainly from the financial corporations sector. In turn, non-financial corporations also display some of this behaviour, albeit less markedly.

This chapter thus shows how different dimensions of balance sheets are linked: across transactions and non-transaction components; the liability and the asset sides; and across different asset classes (equity and debt). In this way – and despite the significant avenues for future research –, it casts light on how shocks might be transmitted and amplified across balance sheets. Finally, it also lends support to the literature on the pro-cyclicality of leverage, and how price and valuation changes might elicit financial investment decisions via a given target leverage level.

Finally, the fifth chapter builds on the fourth by looking at the positions established between different financial sectors, which is also a characteristic seen across most advanced economies and a topical issue associated to the advent of macroprudential policy. The quantification of the financial

sectors' interconectedness is not straighforward given significant data gaps. Literature on this topic is still in its initial stages and has mostly resorted to estimations of these positions and focused on the US.

Against this background, this chapter provides two main contributions. First, it looks at the cross-country evidence of intra-financial claims of the financial sectors. For that purpose, it hinges on a simple and harmonized way of measuring intra-financial positions using consolidated and non-consolidated aggregate financial accounts data and which can be used for different sectors or groups of sectors, restricted however to data availability. The measure proposed documents the rapid and impressive growth of intra-financial asset positions within the financial sectors across most advanced economies in recent times. Second, it shows that growth in financial positions within the financial sectors is associated with household credit but not with NFC and general government credit. Moreover, this relationship stems from financial links involving non-bank corporations and across the latter and banks, and not from intra-bank claims. In this sense, these results are in line with other studies which argue that (i) an increasing share of the total credit provided in advanced economies is channeled to the household sector and, in particular, for housing purposes and (ii) that securitization practices – which establish financial links across bank and non-bank financial corporations – were fundamental in this process by transforming illiquid financial instruments into tradable securities. Also, the higher share of household loans in the total securitized loans might reflect the higher level of harmonization of such types of contracts as opposed to NFC loans.

The main conclusions in this last chapter should be seen in the light of recent studies which have reassessed the relationship between financial development and growth. Recent studies have found that while financial deepness is an essential requisite for economic growth, it can also be a drag whenever it is excessive (see Cecchetti and Kharoubi, 2012 and IMF 2015). In other words, this is a bell-shaped relationship where there are benefits for further financial development at low levels but, above a certain point – Cecchetti and Kharoubi (2012) place it at around 100 percent of GDP –, more finance is actually detrimental for productivity growth. On the one hand, this happens because the financial sector competes with other sectors for resources – for instance, it attracts high skilled workers which would otherwise find employment in other sectors. On the other hand, excessive finance is oftentimes

associated with overinvestment in less productive sectors, such as construction and real estate. In subsequent work, Cecchetti and Kharoubi (2015) argue that the high colateral of real estate activities is a driver of the investment in this relatively low productivity activity. This chapter complements these studies by shedding light on how financial sectors have grown from within, with the increase in intra-financial assets, and how these links have contributed to low productivity activities, in this way questioning the extent to which this growth in finance will ultimately bear fruits.

Bibliography

Chapter 2

[1] Bandholz, H., J. Clostermann and F. Seitz (2009), "Explaining the US bond yield conundrum", Applied Financial Economics, Vol. 19(7), pp. 539–50.

[2] Bauer, M. D. and C. J. Neely (2012), "International Channels of the Feds Unconventional Monetary Policy", Federal Reserve Bank of St. Louis, Working Paper No. 2012-028A

[3] Beltran, D., M. Kretchmer, J. Marquez and C. Thomas (2013), "Foreign Holdings of U.S. Treasuries and U.S. Treasury Yields", Journal of International Money and Finance, Vol. 32, pp. 1120–1143

[4] Bernanke, B. S. (2005), "The Global Saving Glut and the U.S. Current Account Deficit", speech delivered at the Sandridge Lecture, Virginia Association of Economists, Richmond, Va., March 10.

[5] Bernanke, B. S. (2007), "Global Imbalances: Recent Developments and Prospects", speech delivered at the Bundesbank Lecture, Berlin, Germany, September 11.

[6] Bertaut, C., L. P. DeMarco, S. Kamin and R. Tryon (2012), "ABS inflows to the United States and the global financial crisis", Journal of International Economics, Vol. 88(2), pp. 219–34.

[7] Bertaut, C., R. Tryon (2007), "Monthly Estimates of U.S. Cross-Border Securities Positions", Board of Governors of the Federal Reserve System International Finance Discussion Papers No. 910.

[8] Boivin, J. and M. P. Giannoni (2008), "Global Forces and Monetary Policy Effectiveness", National Bureau of Economic Research, Inc NBER Working Papers 13736.

[9] Chinn, M. and J. Frankel (2005), "The euro area and world interest rates", Wisconsin and Harvard mimeo.

[10] Chinn, M. and J. Frankel (2007), "Debt and interest rates - the US and the euro area", Economics Discussion Paper 2007-11.

[11] Diebold, F. X., C. Li and V. Z. Yue (2008), "Global yield curve dynamics and interactions: A dynamic Nelson-Siegel approach", Journal of Econometrics, Vol. 146(2), pp. 351–63.

[12] ECB (2011), "Inflation expectations in the euro area: a review of recent developments", European Central Bank, Monthly Bulletin February 2011.

[13] ECB (2014), "The international role of the euro", European Central Bank.

[14] Favero, C. and F. Giavazzi (2008), "Should the euro area be run as a closed economy?", American Economic Review, Papers and Procedings Vol. 98(2), pp. 138–145.

[15] Gagnon, J., M. Raskin, J. Remache and B. Sack (2010), "Large-scale asset purchases by the federal reserve - did they work?", Federal Reserve of New York Staff Report 441.

[16] Greenspan, A. (2005), "Testimony before the committee on banking, housing, and urban affairs of the US Senate on February 16, 2005."

[17] Greenwood, R. and D. Vayanos (2010), "Price pressure in the government bond market ", American Economic Review, Papers and Procedings Vol. 100, pp. 585–590.

[18] Gujarati, D. N. (1995), "Basic Econometrics, 3rd edn,", McGraw-Hill, Singapore.

[19] Kaminska, I., A. Meldrum and J. Smith (2011), "A global model of international yield curves: no-arbitrage term structure approach", Bank of England Working Paper No. 419.

[20] Kiley, M. T. (2008), "Estimating the common trend rate of inflation for consumer prices and consumer prices excluding food and energy prices, 2003-2007", Board of Governors of the Federal Reserve System, Finance and Economics Discussionr Series No. 2008-38.

[21] Lane, P. and G. M. Milesi-Ferretti (2007), "Europe and global imbalances", Economic Policy, 22(51), pp. 519–573.

[22] Milesi-Ferretti, G. M., F. Strobbe and N. Tamirisa (2010), "Bilateral financial linkages and global imbalances a view on the eve of the financial crisis", International Monetary Fund Working Paper No. 10/257.

[23] Neely, C. J. (2010), "The Large-Scale Asset Purchases Had Large International Effects", Federal Reserve Bank of St. Louis Working Paper No. 2010-018D.

[24] Pesaran, M. H. and Y. Shin (1999), "An autoregressive distributed lag modelling approach to cointegration analysis ", Chapter 11 in Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Strom S (ed.). Cambridge University Press: Cambridge.

[25] Pesaran, M. H., Y. Shin and R. J. Smith (2001), "Bounds testing approaches to the analysis of level relationships ", Journal of Applied Econometrics Vol. 16, pp. 289–326.

[26] Treasury Department, Federal Reserve Bank of New York, and Board of Governors of the Federal Reserve System (2008), "Report on foreign holdings of US securities as of June 2007 ".

[27] Treasury Department, Federal Reserve Bank of New York, and Board of Governors of the Federal Reserve System (2012), "Report on foreign holdings of US securities as of June 2011 ".

[28] Van Landschoot, A. (2008), "Determinants of yield spread dynamics: euro versus US dollar corporate bonds", Journal of Banking and Finance Vol. 32, pp. 2597-2605.

[29] Vayanos, D. and J.-L. Vila (2009), "A preferred-habitat model of the term structure of interest rates", National Bureau of Economic Research, Inc NBER Working Papers 15487.

[30] Warnock, F.E., and V.C. Warnock (2009), "International capital flows and U.S. interest rates", Journal of International Money and Finance, Vol. 28, pp. 903–19.

Chapter 3

[31] Aizenman, J., and Y. Jinjarak (2009), "Current account patterns and national real estate markets", Journal of Urban Economics, Vol 66, No 2, pp.75-89.

[32] Baeriswyl, R. and M. Ganarin (2011), "The non-inflationary Great Leverage", mimeo, Swiss National Bank.

[33] Bank of England (2006), "Monetary and financial statistics", Centre for Central Banking Studies, Bank of England Handbooks in Central Banking No. 25.

[34] Bê Duc, L., F. Mayerlen and P. Sola (2008), "The monetary presentation of the euro area balance of payments", European Central Bank Occasional Paper No. 96.

[35] Bordo, M., B. Eichengreen, D. Klingebiel and M. S. Martinez-Peria (2001), "Is the Crisis Problem Growing More Severe?", Economic Policy: A European Forum 32: pp.5175.

[36] Bruno, V. and H. S. Shin (2013), "Capital flows, cross-border banking and global liquidity", NBER Working Paper No. 18942.

[37] Cetorelli, N. and L. S. Goldberg (2011), "Global banks and international shock transmission: evidence from the crisis ", International Monetary Fund Economic Review 59(1), pp. 41-76.

[38] Cetorelli, N. and L. S. Goldberg (2012), "Banking globalization and monetary transmission ", Journal of Finance 67(5), pp. 1811-1843.

[39] Claessens, S. and N. van Horen (2012), "Foreign banks: trends, impact and financial stability", International Monetary Fund Working Paper No. 12/10.

[40] Cloyne, J., R. Thomas, A. Tuckett and S. Wills (2015a), "An empirical sectoral model of unconventional monetary policy: the impact of QE", The Manchester School 83(S1), pp 51-82.

[41] Cloyne, J., R. Thomas, A. Tuckett and S. Wills (2015b), "A sectoral framework for analysing money, credit and unconventional monetary policy", Bank of England Staff Working Paper No.556.

[42] Dembiermont, C., M. Drehmann and S. Muksakunratana (2013), "How much does the private sector really borrow? A new database for total credit to the private non-financial sector ", Bank for International Settlements Quarterly Review March 2013, pp.65-81.

[43] ECB (2008), "The external dimension of monetary analysis ", European Central Bank Monthly Bulletin August 2008, pp. 71-84.

[44] Friedman, M. (1970), "The Counter-Revolution in Monetary Theory", Institute of Economic Affairs Occasional Paper No. 33.

[45] Forbes, K. and F. Warnock (2012), "Capital flow waves: Surges, stops, flight, and retrenchment", Journal of International Economics 88(2), pp. 235-251.

[46] Hahm, J.-H., H.S. Shin and K. Shin (2011), "Non core bank liabilities and financial vulnerability", NBER Working Paper No. 18428.

[47] Hoggarth, G., L. Mahadeva and J. Martin (2010), "Understanding international bank capital flows during the recent financial crisis", Financial Stability Paper No. 8, Bank of England.

[48] Hoggarth, G., J. Hooley and Y. Korniyenko (2013), "Which way do foreign branches sway? Evidence from the recent UK domestic credit cycle", Financial Stability Paper No. 22, Bank of England.

[49] International Monetary Fund (2009), "Balance of payments and international investiment position manual 6th edition", International Monetary Fund.

[50] Jordà, O., M. Schularick and A. P. Taylor (2012), "When credit bites back leverage business cycles and crises", Economic Policy: A European Forum 32: pp.5175.

[51] Jordà, O., M. Schularick and A. P. Taylor (2013), "Sovereigns versus banks: crises, causes and consequences", CEPR Discussion Paper No. 9678.

[52] Johnson, H. (1972), "The monetary approach to balance of payments theory", The Journal of Financial and Quantitative Analysis, Vol. 7, No. 2, Supplement: Outlook for the Securities Industry (Mar., 1972), pp. 1555-1572.

[53] Kemp, D. S. (1975), "A monetary view of the balance of payments", Federal Reserve Bank of St. Louis, pp. 14-22.

[54] Lane, P. and G. M. Milesi-Ferretti (2012), "External adjustment and the global crisis", Journal of International Economics 88(2), pp. 252-265.

[55] Lane, P. and P. McQuade (2014), "Domestic credit growth and international capital flows", The Scandinavian Journal of Economics Vol 116 (1), pp. 218-252.

[56] McCauley, R. N. (2012), "Risk-on/risk-off, capital flows, leverage and safe assets", Bank for International Settlements Working Paper No. 382.

[57] Mendoza, E. G. and M. E. Terrones (2008), "An anatomy of credit booms: evidence from macro aggregates and micro data", NBER Working Paper No. 14049.

[58] Niepmann, F. (2013), "Banking across borders", mimeo, Federal Reserve Bank of New York.

[59] Polak, J.J. (2001), "The Two Monetary Approaches to the Balance of Payments: Keynesian and Johnsonian", International Monetary Fund Working Paper 01/100

[60] Reinhart, C. and V. Reinhart (2008), "Capital flow bonanzas an encompassing view of the past and present", National Bureau of Economic Research, Working paper No. 14321.

[61] Reinhart, C. and K. Rogoff (2009), "This time is different - Eight centuries of financial folly ", Princeton University Press.

[62] Sá, F., and T. Wieladek (2010), "Monetary policy, capital inflows and the housing boom ", Bank of England Working Paper No. 405.

[63] Schularik, M. and A. M. Taylor (2012), "Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870-2008", American Economic Review 102(2), pp. 1029-1061.

[64] Spiegel, M. M. (2009a), "Monetary and Financial Integration in the EMU: Push or Pull?", Review of International Economics 17(4), pp. 751776.

[65] Spiegel, M. M. (2009b), "Monetary and financial integration: Evidence from the EMU", Journal of The Japanese and International Economies 23, pp. 114130.

[66] Taylor, A. M. (2012), "The Great Leveraging ", Centre for Economic Policy Research, Discussion Paper 9082.

[67] Vasquez-Ruiz, H. (2012), "The link between foreign capital flows and housing prices: a panel data estimation ", mimeo.

Chapter 4

[68] Admati, A.R., P.M. DeMarzo, M.F. Hellwig and P. Pfeiderer (2013), "Fallacies, irrelevant facts, and myths in the discussion of capital regulation: why bank equity is not socially expensive", Stanford University Graduate School of Business Working Paper No. 2065.

[69] Adrian, T. and H.S. Shin (2008), "Financial intermediaries, financial stability, and monetary policy", Federal Reserve Bank of New York Staff Report No. 346.

[70] Adrian, T. and H.S. Shin (2010a), "Liquidity and leverage", Journal of Financial Intermediation 19, pp. 418-437.

[71] Adrian, T. and H.S. Shin (2010b), "The changing nature of financial intermediation and the financial crisis of 2007-09", Federal Reserve Bank of New York Staff Report No. 439.

[72] Adrian, T. and H.S. Shin (2014), "Procyclical leverage and value-at-risk", Review of Financial Studies Vol 27 (2), pp. 373-403.

[73] Antill, S., D. Hou and A. Sarkar (2014), "Components of U.S. financial sector growth, 1950-2013 ", Federal Reserve Bank of New York, Economic Policy Review Vol 20 (2).

[74] Bakk-Simon, K., C. Giron, H. Hempell, A. Maddaloni, F. Recine and S. Rosati (2012), "Shadow banking in the euro area: an overview", European Central Bank Occasional Paper No. 133.

[75] Bindseil, U., A. Winkler (2012), "Dual liquidity crises under alternative monetary frameworks - a financial accounts perspective ", European Central Bank Working Paper 1478.

[76] Brooke M, R Mendes, A Pienkowski and E Santor (2013), "Sovereign Default and State-Contingent Debt", Bank of England Working Paper No. 27.

[77] Catão, L. and J.M. Milesi-Ferretti (2013), "External liabilities and crises", International Monetary Fund Working Paper No. 13/113.

[78] Cour-Thimann, P. and B. Winkler (2012), "The ECB's non-standard monetary policy measures: the role of institutional factors and financial structure", Oxford Review of Economic Policy Vol 28 (4), pp. 765-803.

[79] Cuerpo, C., I. Drumond, J. Lendvai, P. Pontuch and R. Raciborski (2013), "Indebtedness, deleveraging dynamics and macroeconomic adjustment", European Comission Economic Paper No. 447.

[80] European Central Bank (2011), "The financial crisis in the light of the euro area accounts: a flow-of-funds perspective", European Central Bank Monthly Bulletin October 2011, pp. 99-120.

[81] European Central Bank (2014), "Fire sales in the euro area banking sector, European Central Bank Financial Stability Review November 2014, pp. 99-108.

[82] European Comission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2009), "System of national accounts 2008",.

[83] Eurostat (2013), "European system of accounts 2010", European Comission.

[84] Eurostat (2014), "Stock-flow adjustment (SFA) for the Member States, the Euro area and the EU28 for the period 2010-2013, as reported in the April 2014 EDP notification", European Comission.

[85] Giron, C. and S. Mongelluzzo (2013), "Bank leverage and the credit cycle in the euro area: a bayesian semi-parametric approach", In B. Winkler et al. (Ed.) A flow-of-funds perspective on the financial crisis, Vol. I, Palgrave Macmillan

[86] Gourinchas, P. O., H. Rey and N. Govillot (2010), "Exorbitant privilege and exorbitant duty", Institute for Monetary and Economic Studies, Bank of Japan.

[87] Greenwood, R., and D. Scharfstein (2013), "The growth of finance ", Journal of Economic Perspectives, 27(2) pp. 3-28.

[88] Hoggarth, G., L. Mahadeva and J. Martin (2010), "Understanding international bank capital flows during the recent financial crisis", Financial Stability Paper No. 8, Bank of England.

[89] Hoggarth, G., J. Hooley and Y. Korniyenko (2013), "Which way do foreign branches sway? Evidence from the recent UK domestic credit cycle", Financial Stability Paper No. 22, Bank of England.

[90] Jordà, O., M. Schularick and A. P. Taylor (2012), "When credit bites back leverage business cycles and crises", Economic Policy: A European Forum 32: pp.5175.

[91] Jordà, O., M. Schularick and A. P. Taylor (2013), "Sovereigns versus banks: crises, causes and consequences", CEPR Discussion Paper No. 9678.

[92] Lane, P. (2013), "Capital flows in the euro area ", European Economy Economic Paper No. 497.

[93] Lane, P. and G.M. Milesi-Ferretti (2007), "The External Wealth of Nations Mark II ", Journal of International Economics 73, pp. 223-250.

[94] Obstfeld, M. (2012), "Does the current account still matter? ", American Economic Review 102(3), pp. 1-23.

[95] Philippon, T. (2008), "Why Has the U.S. Financial Sector Grown so Much? The Role of Corporate Finance. ", National Bureau of Economic Research Working Paper No. 13405.

[96] Philippon, T. and A. Reshet (2013), "An International Look at the Growth of Modern Finance ", Journal of Economic Perspectives, 27(2) pp. 73-96.

[97] Piketty, T. and G. Zucman (2014), "Capital is back: wealth-income ratios in rich countries, 1700-2010 ", Quarterly Journal of Economics, forthcoming.

[98] Schularick, M. and A. M. Taylor (2012), "Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870-2008", American Economic Review 102(2), pp. 1029-1061.

[99] Taylor, A. M. (2012), "The Great Leveraging ", Centre for Economic Policy Research, Discussion Paper 9082.

Chapter 5

[100] Antill, S., D. Hou and A. Sarkar (2014), "Components of U.S. financial sector growth, 1950-2013", Federal Reserve Bank of New York, Economic Policy Review Vol 20 (2).

[101] Arcand, J-L., E. Berkes and U. Panizza (2012), "Too much finance?", International Monetary Fund Working Paper 12/161.

[102] Barattieri, A., M. Eden and D. Stevanovic (2014), "Financial sector interconnectedness and monetary policy transmission", mimeo.

[103] Bakk-Simon, K., C. Giron, H. Hempell, A. Maddaloni, F. Recine and S. Rosati (2012), "Shadow banking in the euro area: an overview", European Central Bank Occasional Paper No. 133.

[104] Beck, T., H. Degryse and C. Kneer (2014), "Is more finance better? Disentangling intermediation and size efects of financial systems", Journal of Financial Stability Vol 10, pp. 50-64.

[105] Beck, T., A. Demirgüc-Kunt and R. Levine (2009), "Financial institutions and markets across countries and over time – data and analysis", World Bank Policy Research Working Paper 4943.

[106] Beck, T., B. Büyükkarabacak, F. Rioja and N. Valev (2012), "Who gets the credit? And does it matter? Household vs. firm lending across countries", The B.E. Journal of Macroeconomics Vol 12 (1).

[107] Bhatia, A., T. Bayoumi (2012), "Leverage? What leverage? A deep dive into the US flow of funds in search of clues to the global crisis", International Monetary Fund Working Paper 12/162.

[108] Carvalho, D. (2014), "Financial integration and the Great Leveraging", Banco de Portugal Working Paper No 7—2014.

[109] Čihák, M., A. Demirgüc-Kunt, E. Feyen and R. Levine (2012), "Benchmarking financial systems across the world", The World Bank Policy Research Working Paper No 6175.

[110] Constâncio (2012), "Shadow banking - the ECB perspective", Speech given at the European Comission "Towards better regulation of the shadow banking system".

[111] Cour-Thimann, P. and B. Winkler (2012), "The ECB's non-standard monetary policy measures: the role of institutional factors and financial structure", Oxford Review of Economic Policy Vol 28 (4), pp. 765-803.

[112] Dembiermont, C., M. Drehmann and S. Muksakunratana (2013), "How much does the private sector really borrow? A new database for total credit to the private non-financial sector", Bank for International International Quarterly Review March 2013, pp.65-81.

[113] European Comission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2009), "System of national accounts 2008",.

[114] Eurostat (2013), "European system of accounts 2010", European Comission.

[115] Greenwood, R., and D. Scharfstein (2013), "The growth of finance", Journal of Economic Perspectives, 27(2) pp. 3-28.

[116] Hanson, S.G., D. Scharfstein and A. Sunderam (2014), "An evaluation of money market fund reform proposals", Harvard and NBER, mimeo.

[117] Jordà, O., M. Schularick and A. P. Taylor (2014), "The Great Mortgaging: housing finance, crises, and business cycles ", Federal Reserve Bank of San Francisco Working Paper No. 2014-23.

[118] Lane, P. and P. McQuade (2014), "Domestic credit growth and international capital flows", Scandinavian Journal of Economics, 116(1) pp. 218-252.

[119] Levine, R., N. Loyaza and T. Beck (2000), "Financial intermediation and growth: causality and causes", Journal of Monetary Economics, 46 pp. 31-77.

[120] Montecino, J. and G. Epstein (2014), "Intra-financial lending, credit and capital formation", University of Massachusetts Amherst Working Paper No. 345.

[121] Montecino, J., G. Epstein and I. Levina (2014), "Long-term trends in intra-financial sector lending in the U.S. 1950-2012", University of Massachusetts Amherst Working Paper No. 344.

[122] Philippon, T. (2013), "Has the U.S. Finance Industry Become Less Efficient? On the Theory and Measurement of Financial Intermediation", NBER Working Paper No. 18077.

[123] Philippon, T. and A. Reshef (2013), "An International Look at the Growth of Modern Finance", Journal of Economic Perspectives, 27(2) pp. 73-96.

[124] Philippon, T. and A. Reshef (forthcoming), "Wages and human capital in the U.S. financial industry ", Quarterly Journal of Economics

Chapter 6

[125] Cecchetti, S.G. and E. Kharroubi (2012) Reassessing the impact of finance on growth", Bank for International Settlements Working Paper No 381.

[126] Cecchetti, S.G. and E. Kharroubi (2015) Why does financial sector growth crowd out real economic growth?", Bank for International Settlements Working Paper No 490.

[127] International Monetary Fund (2015) Rethinking financial deepening: stability and growth in emerging markets", International monetary Fund Staff Discussion Note No 15/08.