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## Lost in translation? ECB's monetary impulses and financial intermediaries' responses

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White Paper No. 36

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# Lost in translation? ECB's monetary impulses and financial intermediaries' responses

Günter W. Beck\* Hans-Helmut Kotz† Natalia Zabelina‡

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## Abstract

Non-bank (-balance sheet) based financial intermediation has become considerably more important over the last couple of decades. For the U.S., this trend has been discussed ever since the mid-1990s. As a consequence, traditional monetary transmission mechanisms, mainly operating through bank balance sheets, have apparently become less relevant. This in particular applies to the bank lending channel. Concurrently, recent theoretical and empirical work uncovered a “risk-taking channel” of monetary policy. This mechanism is not confined to traditional banks but has been found to operate also across the spectrum of financial intermediaries and intermediation devices, including securitization and collateralized lending/borrowing. In addition, recent empirical evidence suggests that the increasing importance of shadow-banking activities might have given rise to a so-called “waterbed effect”. This is a mediating mechanisms, dampening or counteracting typically to be expected reactions to monetary policy impulses. Employing flow-of-funds data, we can document also for the Euro Area that a trend towards non-bank (not necessarily more ‘market’-based) intermediation has occurred. This is, however, a fairly recent development, substantially weaker than in the U.S. Nonetheless, analyzing the response of Euro Area bank and nonbank financial intermediaries to monetary policy impulses, we find some notable behavioral differences between mainly deposit-funded and more ‘market’-based financial intermediaries. We also detect, inter alia, the existence of a (still) fairly weak, but potentially policy-relevant, “waterbed” effect.

Keywords: Non-bank financial intermediation, interest-rate channel, credit channel, risk-taking channel of monetary policy, market-based financial intermediation, monetary transmission mechanism, waterbed effect.

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# 1 Introduction – the declining importance of bank balance sheets

The Great Financial Crisis (GFC), which broke in mid-summer of 2007, has led to a fundamental reconsideration of the macroeconomic role of financial intermediaries in the academic literature (and beyond). For a long time, in leading macro models, banks, or financial intermediaries more generally, were rendered as barely more than rather passive frictions, if at all. Monetary policy was without money and macroeconomics could also do without financial institutions. With most economies becoming massively derailed in the wake of a financial system close to implosion, this view has been definitely put to rest. There is meanwhile no denial, financial intermediaries count and they do have a significant impact on the real (non-financial) side of the economy.<sup>1</sup>

Of course, even before the Great Financial Crisis numerous studies had been conducted, examining the importance of financial intermediaries for the transmission of monetary policy impulses. Generally, these analyses focused on banks and uncovered the existence of a so-called credit channel. In seminal contributions, in particular Bernanke and Blinder (1988) and Bernanke and Gertler (1995) argue that, in the presence of financial frictions, mainly rooted in information asymmetries (and agency costs), optimizing behavior of banks typically amplifies real effects of monetary policy shocks. There are basically two points of attack: A monetary policy impulse might directly affect banks' lending capacity: the bank-lending channel. This is the lender's perspective. Or, second, the propagation of monetary policy impulses could impact on firms' capacity to borrow. Changing policy rates might, for instance, affect the level of internally generated funds (cash flow) as well as the value of a firm's assets and hence net worth. This (firm) balance sheet channel is thus largely about collateral values and the access to funds. Meanwhile, the GFC has led to a renewed interest in these two channels. Recently published work includes Gambacorta and Marques-Ibanez (2011) and Jiménez et al. (2012).<sup>2</sup>

Woodford (2010), however, doubts whether in particular the bank lending channel is still of economic relevance. He postulates rather that

“... we need models in which intermediation plays a crucial role, but in which

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<sup>1</sup>We will not go into dating the crisis: But, initially, in the summer of 2007, upheavals in interbank money markets were conventionally understood as a temporary turmoil only. In line with this perception, the crisis was declared a number of times as finished during fall and winter of 2007. A reassessment only took place during the course of 2008, the gravity of the situation became evidently undeniable after the defaults of Lehman, AIG etc. in the fall of 2008.

<sup>2</sup>See Section 2 for a more comprehensive overview of the literature on this topic.

intermediation is modeled in a way that better conforms to current institutional realities. In particular, we need models that recognize that a market-based financial system - one in which intermediaries fund themselves by selling securities in competitive markets, rather than collecting deposits subject to reserve requirements - is not the same as a frictionless system..." (Woodford, 2010, page 21).

In this quote, Woodford (2010) implicitly refers to two (long-established) trends in the financial sector which, over some two decades, have palpably changed the role of intermediaries in modern economies.<sup>3</sup> The first consists of a substantial decline in the relative importance of traditional banks compared to non-bank (or shadow bank) financial intermediaries, i.e. asset managers (e.g. insurance companies, pension funds as well as mutual funds). But it also concerns the comparative (nota bene: not absolute) decline of (interest-income producing) on-bank-balance sheet activities, compensated by an increased emphasis put on off-balance, fee-generating activities of traditional banks. Finally, a telling indicator is the decline in retail deposits relative to interbank or wholesale funds.<sup>4</sup>

Woodford (2010) is primarily referring to the U.S. where these developments have been diagnosed since the mid-1990s [Edwards/Mishkin 1996; or Boyd/Gertler 1994]. Europe and in particular the Euro Area (EA), however, have also experienced a significant evolution in the structure of their financial intermediary sector.<sup>5</sup> As Figure 1 shows (see appendix), relative to deposit-based monetary financial institutions (MFIs), the group of non-bank 'other financial intermediaries' (OFIs), primarily covering investment funds and so-called securitization companies, has become significantly more important in recent years. This also holds true for insurance corporations and pension funds, which come under the heading of ICPFs. This is largely the upshot of the enormous growth of assets under management of investment funds (in

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<sup>3</sup>This holds true for intermediaries as institutions, not for the functions which are performed in the financial sector. In much of the literature, a binary view of financial sectors prevails: bank- or (capital) market-based. In this vein, retail deposits are opposed to funding via issuance of debt. But there is of course a whole spectrum of instruments and institutions involved in between. Sales and repurchase agreements, for example, are largely bilateral OTC agreements, no public markets directly involved. This collateralized large-scale lending by for instance money market funds or insurance companies is, for the borrowers, i.e. banks, functionally equivalent to deposits. Hence, while we also use, given its currency in the literature, the term 'market'-based we think in terms of non-bank balance sheet activities which might be capital market based, or not.

<sup>4</sup>The latter have also been, quite appropriately, dubbed 'bought' deposits. During the GFS, they have proven particularly vulnerable to runs.

<sup>5</sup>Quite obviously, the EA is (still) characterized by some financial market heterogeneity. And attempts at creating both, a banking as well as a capital markets union, should ultimately provide for deeper integration.

particular bond, equity and mixed funds). In fact, during the period under review, securitization companies have slightly shrunken (see Figure 2), not too difficult to understand in light of the trouble created by SIVs, conduits etc.

Interestingly, in the period ahead of the GFC, flow-of-funds data show no clear trend concerning the relative sizes of the EA's financial sub-sectors. The same holds true for the structure of the liability side of the balance sheets of EA's financial intermediaries. Panel (a) of Figure 3 demonstrates that until around 2010 currency and deposits (i.e. short-term liabilities) have kept a largely constant role as a source of financing.<sup>6</sup> Only since 2012, a declining trend appears. Panels (b) to (d) of Figure 3 suggest that this development is mirroring the increasing role of OFIs in financial intermediation activities. MFIs have left their position largely unchanged, but OFIs have reallocated funds towards longer tenors (more remunerative, in expectation, but also riskier).

Overall, the just established evidence on the role of short-term funds and market-based instruments in the funding liquidity of financial intermediaries suggests that traditional monetary policy propagation mechanisms, operating via bank balance sheets, do still have a dominating import in the EA. However, also in light of the observed trends towards more 'market'-based financing,<sup>7</sup> a third channel of monetary policy transmission, operating via the financial-intermediation system, will, going forward, play an important and potentially intensifying role.

The latter channel - going back to Borio and Zhu (2008) - is frequently referred to as the "risk-taking channel" of monetary policy. Its propagation mechanism works as follows (Adrian and Shin (2010)): changes in central banks' policy rates influence the risk-taking capacity of financial intermediaries via their impact on the value of intermediaries' capital. As a consequence, e.g., a cut in short-term interest rates, mechanically associated with a commensurate increase in banks' capital values, implies that the marginal loan, not granted before the change in the policy rate, now becomes attractive. Lower rates imply a greater risk-bearing capacity. Evidence on the empirical relevance of the risk-taking channel for banks is amongst others provided by Jimenéz et al. (2014). Recent studies by Becker and Ivashing (2015) and Choi and Kronlund (2015) also show that fixed-income funds as well as insurance companies (which often have a return promise to honor) tend to take higher risks in a low-interest-rate environment. This is very much in line with the risk-taking

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<sup>6</sup>A pronounced uncertainty as well as a low level of interest rates (and a compressed yield curve), of course, spoke in favor of such a portfolio structure.

<sup>7</sup>This is due to a whole roster of regulatory innovations – Basel III and Solvency II – as well as the envisaged construction of a capital markets union. As a consequence, a continuation of this trend is to be expected.

reading of the monetary policy transmission.<sup>8</sup>

Nelson et al. (2015) make another interesting observation associated with the shift from a deposit to a more wholesale and institutionalized funding of the financial system: employing U.S. data, these authors find evidence in favor of a so-called “waterbed effect”. This notion should capture the phenomenon that a contractionary monetary policy shock implies a decline in total assets of traditional (commercial) banking while the opposite is true for activities non-bank (shadow) banking. At first glance, this seems counterintuitive. However, the authors demonstrate that this fits well with an increased comparative attractiveness of securitization activity by shadow banks.

The objective of this study is threefold. First, employing latest flow-of-funds data (including Q4/2015) we want document how the (broadly defined) financial intermediary system in the EA has evolved since the turn of the century. As the discussion of the relative role of the pertinent transmission mechanisms in a more deposit- vs. an off-bank-balance sheet/’market’-based intermediation system has made clear, an assessment of these trends is of substantial usefulness. As we have already seen above, in the EA the importance of (retail) deposit-based financing has, opposed to what has been going on in the U.S., declined only marginally. One obvious implication of this finding is that results obtained for the U.S. should be treated in this regard with some caution. They cannot simply be transferred to the EA. Separate analyses, based on EA data, are therefore highly advised (almost mandatory).

Secondly, we provide a policy oriented overview of the recently (again) very dynamic literature studying the role of financial intermediaries in the context of the monetary transmission mechanism. In this we account for (a) studies focussing primarily on banks and the credit channel as well as (b) theoretical and empirical contributions related to the risk-taking channel as well as non-bank financial intermediaries (in particular asset managers).

Thirdly, inspired amongst others by recent findings of Nelson et al. (2015), we empirically examine the behavior of major financial intermediary sectors in the EA in response to a monetary policy decision. To this end, we follow Christiano et al. (1996) and Bonci (2012), employ Euro-Area flow-of-funds data and use standard VAR modelling techniques. However, unlike these authors, we take a detailed, granular look at balance-sheet positions of financial intermediaries .

Our motivation to take into account the overall financial intermediary sector

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<sup>8</sup>Section 2 contains a more comprehensive overview of the literature on the risk-taking channel.



(and its major subsectors) also derives from the perspective on finance underlying our analyses. Wherever suitable (and possible), we follow Merton (1995) and take a “functional approach” to finance. Thus, our focus is not on the ‘institution’, undertaking a certain financial activity, but on the ‘function’ this activity is supposed to fulfill. And such activities can be discharged under different institutional disguises. Thus, we attempt to capture functionally equivalent activities, wherever in the financial intermediation sector they might be performed. And flow-of-funds data are particularly promising to conduct such analyses.

Our results show, unsurprisingly and in line with canonical views, that the financial-intermediation sector in the aggregate decreases its activities in response to a contractionary monetary policy innovation. However, we observe notable differences in the behavior of subsectors, more particularly of MFIs and OFIs in reaction to a given monetary policy decision. More specifically, MFIs tend to cut back on long-term lending whereas OFIs, after a contractionary monetary policy shock, are prone to increase the duration of their assets. In other words, we also observe for the EA case some indications of a “waterbed effect” as documented by Nelson et al. (2015). The sector’s overall reaction, however, is dominated by the behavior of the MFI sector. This is due to its still very dominant role. Also, in line with our intuition, the long-term oriented ICPF sector reacts only moderately to a monetary policy innovation.

The rest of this paper is structured as follows. Section 2 provides an overview of the literature on the role of financial intermediaries in the monetary transmission mechanism, focusing on the most recent developments. This literature in particular emphasizes the risk-taking channel. In Section 3, we then present our data and exhibit the chosen methodology. Section 4 presents and discusses our empirical results. Section 5 summarizes and concludes.

## **2 Financial intermediaries in the monetary transmission mechanism: Literature overview**

Studies examining the role of financial intermediaries in the transmission mechanism of monetary policy have traditionally focused (almost exclusively) on banks. Basically, three transmission channels have been identified. And in all of them, banks (bank balance sheets) play the dominant part. These are the interest-rate, the credit- and the risk-taking channels of monetary policy, each of which will be shortly discussed

in the following.<sup>9</sup>

According to the interest-rate channel, monetary policy affects the real activity of an economy (captured by potential output) since a change in the policy rate translates into a change in the interest rates at which economic agents can borrow. User cost of funds increase and hurdle rates rise. This should dampen interest-rate sensitive expenditures, in particular capital expenditures (as well as housing and consumer durables). An important assumption underlying this channel is that relative prices are sticky, at least for a while. This would allow for a change in nominal interest rates also to impact real interest rates.<sup>10</sup> Those are the rates which ultimately count for capital expenditures. Moreover, it is also surmised that banks pass on modified refinancing costs, resulting from altered policy rates, to their borrowers. The extent to which this happens is influenced by factors related both to the demand- and the supply-side of the credit allocation process. An important demand-side factor is given by the option of potential borrowers to obtain funding from other sources (intermediated by non-bank banks or in primary capital markets). They will also respond in line with their expectations about the trajectory of output and interest rates. Concerning potential supply-side determinants, the industry structure of the banking sector, its contestedness, plays a decisive role.

The interest-rate channel represents an elementary constituent of (New-)Keynesian macro models. It was the dominant mechanism explaining the effects of monetary policy on real variables in closed-economy versions of this framework until the GFC. Empirically, the fit of these models has been considered to be of a satisfying quality, see, e.g., Del Negro et al. (2005) or Roberts (2005).

More specific evidence related to the importance of the interest-rate channel is provided by Angeloni et al. (2003) who find that much of the variation in output after a monetary policy shock can be explained by movements in interest-rate sensitive investments as well as consumption of durable goods. According to their paper, market-frictions are not the main driving force for variations in investment. With reference to these findings, the authors suggest that the interest-rate channel dominates other propagation mechanisms in Finland, Germany, Luxembourg, and Spain, but this does not hold for Austria, Belgium, France and Italy.

Hofmann (2006) studying the pass through of money market rates to bank retail lending rates shows that after the creation of the European Monetary Union (EMU)

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<sup>9</sup>A very informative and comprehensive overview of the role of banks in the transmission of monetary policy (with a focus on the EA) is provided by ECB (2008).

<sup>10</sup>Substantial micro evidence on the stickiness of prices in the EA is presented by Alvarez et al. (2006).

lending rates in France, Italy and Spain have become more responsive, whereas this result does not apply for Germany.

The credit channel of monetary policy (see, e.g., Bernanke and Blinder, 1988 and Bernanke and Gertler, 1995) hypothesizes that, in addition (or as a complement) to interest rates, frictions in financial markets have an impact on the availability of funds – access to credit – for non-financial (i.e. real sector) firms. The credit channel comes in two versions. It either works via (a) the balance sheets of banks or (b) balance sheet (and income accounts) of borrowers, that is firms. In the former case, it is denoted as “bank lending channel”, in the latter it is referred to as “balance sheet channel”.

According to the bank lending channel, an increase (decrease) bank reserves engineered by the central banks, that is, reflecting an expansionary (contractive) monetary policy, entices banks to increase (decrease) the amount of lending to ‘real’ economy firms.<sup>11</sup> A crucial assumption underlying this mechanism is that reserves (or other funding sources) for banks are only imperfect substitutes. Moreover, it is also surmised that borrowers mainly depend on bank loans to obtain external funds.<sup>12</sup>

Empirical support in favor of the relevance of the bank lending channel is provided by Kashyap and Stein (1995, 2000). Employing disaggregated bank balance sheet data for the U.S. over the periods 1976 to 1992 and 1976 to 1993, these authors find that smaller banks, with less liquid assets, are affected relatively stronger by a given monetary policy. This provides evidence in favor of the existence of a bank-lending channel. For EA countries, comparable supportive evidence is presented by De Santis and Surico (2013), who concentrate on Germany and Italy, and Jimenéz et al. (2012), who employ Spanish data.

The balance sheet channel focusses on borrowers, positing information asymmetries (between borrowers and banks), generating a wedge between the costs of internal or external financing. This gap, dubbed external finance premium, is negatively related to the value of a borrower’s assets. Accordingly, an accommodative monetary policy, leading to an appreciation of a firm’s assets, will reduce its external finance premium. It will improve access to and reduce costs of external funds, concurrently boosting the attractiveness of investments. The positive impact of a lower policy

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<sup>11</sup>This allusion to ‘bank reserves’ fits, of course, the imagery of U.S. monetary policy. For a European context, one would obviously refer to the main refinancing operations.

<sup>12</sup>This premise is, by and large, true for small and medium-sized companies – unless their loans are bundled or securitized. But also for larger firms there appears to exist a ‘pecking order’, as an upshot of information asymmetries between borrower and lender. Only the very big firms can substitute with ease between banks and/or markets; see Myers 1977.

rate on the firm's assets value can be caused by better profit prospects or a lower discount factor, emanating from a reduced policy rate.

To empirically test for the existence of a balance sheet channel the literature uses - similarly to studies of the bank lending channel - differences in the impact of monetary policy decisions across firms (see Beck et al. (2014)). Employing data from the U.S. manufacturing sector for the period from 1974 to 1991, Oliner and Rudebusch (1996) find that hikes in interest rates, which tend to increase the external finance premium, will lead to a re-allocation of credit flows from small, more bank-dependent firms to larger companies. Bougheas et al. (2006), using micro data from U.K. firms for the period from 1990 - 1999, also document that smaller, younger and more risky firms are affected significantly more strongly by monetary policy actions than bigger, older and less risky firms.

Ciccarelli et al. (2013) use data from the ECB's Bank Lending Survey (BLS) for 12 EA countries to analyse the credit channel during crisis as well as in normal times over the period 2002 to 2011. Their results suggest that the banking lending channel was important during the crisis years 2008 and 2009 but has not played any further role in the transmission of monetary impulses afterwards. The authors suggest that these results are driven by the policy framework chosen by the ECB at that time which mostly aimed at providing banks with access to funding liquidity (a policy adroitly called: enhanced credit support). Moreover, the authors also find that the balance sheet channel has played a significant role over the complete sample period, again affecting small firms more strongly.

In another study, Ciccarelli et al. (2014) employ again BLS data for 10 EA countries over the period 2002 to 2014 and data from the U.S. Senior Loan Officer (SLO) Survey over the period 1992 to 2013. Analyzing the behavior of three types of loans (business, mortgages and consumer) the authors find that changes in overnight interest rates have an impact on credit availability for all three loan categories. Moreover, their evidence suggests that the credit channel has an impact on output and inflation via the availability of credit. Furthermore, the authors also show that the quantitative impact of the credit channel on firms is higher via the bank-lending channel (which concerns lenders) than via demand and the balance-sheet channel (standing in for borrowers). For private sector households, however, the demand channel plays a greater role.

The 'risk-taking' channel stands for the third propagation mechanism of monetary policy. It has received considerable attention in recent years. According to Altunbas et al. (2010), there are several factors involved which could give rise to such a

mechanism. Firstly, an increase in the value of assets, collateral, income and cash-flows, typically associated with a reduction in the policy rate, lowers banks' estimates of default probabilities and valuation volatilities in loan portfolios. As a consequence, their risk tolerance and thus preparedness to accept risk should increase. This implies the granting of loans to borrowers who would not have been considered otherwise.<sup>13</sup> Ruckes (2004) and Dell' Ariccia and Marquez (2006) argue, moreover, that lower policy rates may reduce the incentives of banks to screen their borrowers, i.e. increase adverse selection. Given that interest rates charged on loans decrease with monetary easing, this may encourage banks to relax their credit standards and lead to increased risk-taking.

Secondly, low policy rates might generate what Rajan (2005) labelled as a "search for yield" on the side of financial intermediaries. According to this line of reasoning, in particular asset managers (which often have promised minimal returns) take on more risks in an environment of low (nominal) interest rates. Rajan (2005) ascribes this search for yield to behavioral, contractual and/or institutional reasons, broadly related to the market structure in the banking sector (degree of competition), to the design of remuneration system for loan officer or portfolio managers as well as to shortcomings in banking regulation and supervision.

Campbell and Cochrane (1999) argue that the impact of monetary policy on risk-taking behavior might result from investors' habit formation. They show risk aversion declining in periods of relatively high consumption. Given that low interest rates boost economic activity and - as a consequence - imply relatively high consumption, investors' risk aversion should, in response to monetary easing, fall.

Another approach to explain the existence of a risk-taking channel relates to the operational implementation of monetary policy as well as the communication policies of a central bank. Diamond and Rajan (2009), e.g., suggest a possible insurance effect, in the case that monetary policy decisions become more predictable (e.g. through perceived 'puts' or forward guidance). As an upshot, agents expect that the central bank will ease monetary policy in the event of bad economic outcomes. Concurrently, this whets banks' appetite for risk.

Empirical evidence on the risk-taking channel is amongst others provided by Jimenéz et al. (2014) who use an extensive set of micro data from the Spanish credit register, stretching the period between 1984-2006 and containing a comprehensive information set on both loan demand by firms as well as loan supply by banks. Their findings suggest that, in the short term, a reduction of the policy rate is followed

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<sup>13</sup>For further references on this point, see also Adrian and Shin (2009) and Borio and Zhu (2008).

by a decrease in the default probability on outstanding loans (mainly at variable interest rate, in the Spanish case). This is plausible since borrowers' interest burdens (squeezing their cash flow) are reduced. In the medium-term, however, banks tend to grant more risky loans in response to a monetary easing as lending standards soften. This might reflect a search for yields as well as improved collateral values of borrowers. In total, the empirical evidence in Jimenéz et al. (2014) on the Spanish banking market confirm the existence of a risk-taking channel of monetary policy.

Using a similar approach as Jimenéz et al. (2014), Ioannidou et al. (2009) analyze Bolivian credit register data over the period 1999-2003. The focus of their work lies both on the impact of expansionary monetary policy on the quantity of new loans (increase) as well as on interest rates charged for these new loans (relative reduction). They again find evidence in favor of the theoretical considerations outlined above.

Altunbas et al. (2010) analyze banks' balance sheet information across 16 countries over the period 1998-2008. Employing a number of different interest rates, the authors evaluate the relative importance of monetary policy for the risk-taking behavior of banks. Their findings suggest that unusually low policy rates over an extended period of time translate into excessive risk-taking by banks.

Adrian and Shin (2010) show that the risk-taking channel is not constrained to banks but also holds for non-bank banks or "shadow banks", i.e., entities which conduct bank-like activities without being subject to banking regulation. Unlike traditional banks, these non-bank banks finance their activities not by taking deposits but by collateralized borrowing – repos – or issuing (mainly short-term) debt instruments. In the presence of mark-to-market accounting, the monetary policy transmission via these institutions is according to Adrian and Shin (2010) as follows: a change in the policy rate directly translates into a change in the term spread which in turn determines the marginal profitability of an extra loan. If, e.g., interest rates decrease, term spreads subsequently rise, making additional lending profitable. As a consequence, the net interest rate margin, i.e., the difference between the interest income (generated on the asset side of the intermediary's balance sheet) and interest expenses (reflecting the cost of liabilities) raises. This implies an appreciation of a bank's capital. The higher (more valuable) capital base, the larger the balance sheet or risk-taking capacity of the intermediary. A logical corrolary is the extension of additional loans. Finally, the expansion of the intermediary's balance sheet reduces the market price of risk.

Employing U.S. flow-of-funds data for traditional banks, shadow banks (issuers of asset-backed securities, finance companies and funding corporations) and broker-

dealers, Adrian and Shin (2010) demonstrate that the balance-sheets of the latter two help to explain future real activity better than those of traditional banks. This bears witness to the distinct roles of the different financial intermediaries in the monetary transmission mechanism. Moreover, employing a panel regression, they document a negative relationship between the level of the Federal funds rate and the balance-sheet size of intermediaries.

In another interesting, recent contribution, Nelson et al. (2015) employing similar data as Adrian and Shin (2010) provide VAR evidence according to which U.S. commercial banks decrease their balance-sheets in response to a monetary tightening whereas shadow banks (defined as in Adrian and Shin, 2010) book additional business. The authors christen this phenomenon metaphorically as “waterbed effect”. Securitization, accounted for in the non-bank part of the financial sector, becomes comparatively more attractive after an increase in interest rates.

The risk-taking channel is not confined to intermediaries conducting narrowly defined bank-type activities though. Examining the bond investment behavior of insurance companies, Becker and Ivashing (2015) show that these institutions “reach for yield” in choosing their investments, also. Similarly, Choi and Kronlund (2015) document reach-for-yield behavior also for U.S. bond mutual funds.<sup>14</sup>

### 3 Data and methodology

#### 3.1 Accounting for financial stocks and flows

As in Adrian and Shin (2010) and Nelson et al. (2015), our financial variables are derived from sectoral balance-sheet information, however our focus is on European rather than U.S. data. More specifically, our empirical analysis is based on the EA’s quarterly economic and financial accounts.<sup>15</sup> They capture income and spending flows, their (tauto-) logical corollary, viz. financial flows as well as the resulting changes in stocks of financial assets and liabilities, all in nominal terms. And, by brute force of accounting principles, a consistent and closed system of flows between sectors and their respective balance sheets (stocks) arises. As de Rougemont and Winkler (2014) emphasize, the flow-of-funds approach enforces consistency in three dimensions: uses and sources have to match, between sector flows balance, and, flows

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<sup>14</sup>Acharya and Naqvi (2015) develop a model of financial intermediation in which agency problems lead to “reach-for-yield” behavior by asset managers. In this model, a lowering of the policy rate induces increased risk taking.

<sup>15</sup>For a detailed exposition, see in particular de Rougemont and Winkler (2014) on whom we largely rely.

result in (precisely) equivalent changes in stocks. While this might appear obvious, even pedestrian, honoring these constraints is not a stronghold of conventional models.

We exclusively employ balance-sheet data of the financial intermediary sector from the ECB's (and Eurostat's) EA accounts data ("Quarterly Sector Accounts"). The statistics are compiled by national institutions and the Eurosystem. The series which we employ represent actual transactions (pure revaluation effects are corrected) having taken place in a given asset class within the respectively considered period. The data is quarterly, ranging from 1999 until Q4/2014, thus covering the pre-crisis, crisis and post-crisis periods.<sup>16</sup>

Data are provided for the overall financial intermediary sector (denoted as financial corporations, or FC) and the three subsectors: monetary financial institutions (credit institutions and money market funds, short MFI), insurance corporations and pension funds (ICPF) as well as other financial intermediaries (OFI). Since the implementation of ESA 2010 (see below), OFI data can be broken down into investment funds (other than money market funds) and OFIs without investment funds.

Financial data per sector are available in aggregate form (total financial assets/liabilities) as well as for numerous asset classes. The latter include monetary gold and SDRs, currency and deposits, debt securities, loans, equity, insurance, pensions and standardized guarantee schemes, financial derivatives and employee stock options as well as other accounts receivable/payable. Debt securities and loans, moreover, can be distinguished on the basis of their (original) maturity.

The conceptual framework underlying the EA accounts (EEA) is derived from the European System of National and Regional Accounts (ESA). In 2014, ESA 2010 replaced ESA 1995. Data based on the new system became available at the beginning of 2015 and are underlying the analysis performed in this paper.

Flow-of funds data have been typically tabulated with sectors in columns and rows covering the respective markets (or instruments) in which sectors interact (Tobin and Brainard, 1963 and Barwell and Burrows, 2014).<sup>17</sup> Columns can be understood as budget constraints, they have to add-up (to balance), i.e., spending has to be funded. And rows must show market clearing, i.e. add-up to zero. This holds obviously true for EAA. They provide a framework of (compiling) data, not a model (Winkler, 2010). But, at a minimum, they do allow "asking meaningful questions" (Constancio, 2014). In particular, following authors such as Christiano et al. (1996); Adrian and Shin

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<sup>16</sup>See also ECB and Eurostat (2007) as well as ECB (2012) for further background information on these data.

<sup>17</sup>Semmler (2011) has integrated in an interesting way these views in more conventional models.



(2010); Bonci (2012); Nelson et al. (2015), we employ the available balance-sheet data to study the response of the overall financial intermediary sector and the different subsectors to a monetary policy shock. Methodologically, our analysis relies on a standard VAR approach outlined in the following subsection.

The financial variables are complemented by EA macro variables obtained from the ECB’s Statistical Data Warehouse, also briefly described below.

### 3.2 A Structural VAR-Model

To examine the response of banks and other, ‘market’-based financial intermediaries to a monetary policy shock we employ a standard (structural) vector-autoregressive (VAR) model approach. That is, we impose no analytical restrictions on the data-generating process. In addition to macroeconomic variables such as GDP, domestic prices, a variable capturing international developments and a monetary policy variable, we include sector-specific balance-sheet variables. The latter allows us to analyze how a shock to monetary policy affects these variables. To keep the number of parameters to be estimated manageable, we adopt the approach followed by Christiano et al. (1996) and apply a “marginal strategy” in our analysis. As a consequence, we start our empirical investigation with specifying a low-dimensional VAR model consisting of typically used macro variables, testing its statistical properties and subsequently evaluating its economic appropriateness. If the results from these assessments turn out to be satisfying, we proceed with adding the various balance-sheet variables from the financial intermediaries to the “base VAR” model, one at a time. We then explore their respective responses to a monetary policy shock.<sup>18</sup>

Including four macro variables in our base specification, the resulting VAR model takes the following form:

$$AY_t = B_0 + B_1Y_{t-1} + \varepsilon_t, \quad (1)$$

Here  $Y_t$  denotes the  $4 \times 1$  vector  $Y_t = (y_t, p_t, pcom_t, i_t)'$  with  $y$  being equal to real GDP,  $p$  representing the consumer price index (CPI),  $pcom$  being the world commodity index and  $i$  representing the EONIA interest rate. A graphical illustration of the data is given in Figure 5. Following Peersman and Smets (2001), we employ data in (log) levels (with the exception of the interest rate). Due to the short time period for which EA flow-of-funds data series are available we do not perform an explicit consideration of co-integration amongst variables. However, the chosen

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<sup>18</sup>Similar approaches have been followed more recently by Bonci and Columba (2008), Gameiro (2010) and Bonci (2012).

log-level transformation of the variables allows for an implicit co-integration in the data though. Moreover, as Sims et al. (1990) emphasize, standard asymptotic tests are still valid if the VAR is estimated in levels, even if the variables are co-integrated.

The  $4 \times 4$  matrices  $A$  and  $B_1$  denote the structural parameters of the current and one-period lagged endogenous variables.  $B_0$  represents a  $4 \times 1$  vector of constants. The  $4 \times 1$  vector  $\varepsilon_t$  contains the structural shocks. The model we estimate corresponds to the reduced form of Equation (1), given by:

$$Y_t = C_0 + C_1 Y_{t-1} + e_t, \quad (2)$$

with  $C_0 = A^{-1}B_0$ ,  $C_1 = A^{-1}B_1$  and  $e_t = A^{-1}\varepsilon_t$ . To identify the structural shocks we impose a recursiveness assumption. More specifically, we assume that the most exogenous variable is given by GDP, followed by the CPI, the world commodity price index and the monetary policy rate.

## 4 Empirical evidence

### 4.1 Baseline VAR model

To select the lag order of the VAR, we make use of four standard selection criteria: the Akaike Information Criterion (AIC), the Hannan Information Criterion (HIC), the Schwarz Information Criterion (SIC) and the Akaike final prediction error (FPE). Three of these criteria (AIC, HIC, FPE) suggest two lags, whereas the fourth criterion (SIC) suggests a one lag specification (see upper panel of Table 1). Based on these results, we decided to include two lags in all of our specifications. As the lower panel of Table 1 shows, for this lag specification the null hypotheses of no serial correlation and normality are not rejected employing standard specification tests.

Figure 6 plots the impulse response functions of our base VAR model for output ( $y$ ), consumer prices ( $p$ ), world commodity prices ( $pcom$ ) and the policy rate ( $i$ ) to a one-standard deviation monetary policy shock. In line with our intuition, we observe a drop in output, consumer prices and world commodity prices in response to a contractionary shock. Our impulse-responses resemble those of Bonci (2012) who uses a similar setup to ours but a shorter sample period.

The estimated structural monetary policy shocks associated with the base VAR model are depicted in Figure 7. The pattern suggested by this graph is essentially in line with widely held views on the conduct of monetary policy in the EA over the sample period. According to our estimates, monetary policy was fairly accommodative

in the years following the burst of the dot.com bubble (2002 - 2005) and became contractionary afterwards, until the outbreak of the GFC in 2007. While initially hesitant with regard to the policy rate (but not the provision of additional liquidity) the monetary policy response became very strong in the fall of 2008. Subsequently, except for a brief attempt at “exciting” (from unconventional, nonstandard policies) in 2012, monetary policy was accommodative. The identified switch to a more contractionary stance at the end of 2012 reflects the hike in the policy rate during this period (see also panel 4 of Figure 5). Moreover, it is interesting to note that tightening of policy rates occurred against a background of overall weak economic perspectives. Summarizing, we can say, that both the statistical properties of the estimated base VAR model as well as the economic conclusions implied suggest that this model specification represents a well-suited starting point for our further analysis.<sup>19</sup>

## 4.2 Zooming in on the financial intermediary sector

We start our analysis of financial variables’ dynamics after a monetary policy decision with studying the behavior of the balance-sheet positions of the overall financial intermediary sector. Figure 8 shows that net funds raised in the financial sector decline for two periods in response to a one-standard deviation increase in the policy rate. Subsequently, they gradually return to their initial level. This is exactly what our above discussion of the various monetary-policy transmission channels would suggest to happen. The effect is significant and exhibits some persistence. It is not possible though to tell whether the observed decline in net funds raised is due to demand or supply side factors. Unfortunately, a similar reservation applies to the consideration of the individual balance-sheet positions of both the sector in the aggregate as well as subsectors presented in the following.

Taking a more detailed look at the various asset-side positions of the overall financial sector, we can see from Figure 9 that the response of most variables on impact is fairly symmetric: in line with theoretical considerations, except for currency and deposits and short-term loans, all decline immediately after the shock. After the impact period, the dynamics of the various asset positions becomes distinctly more asymmetric, though. While currency and deposits, short- and long-term loans

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<sup>19</sup>To examine whether our results are sensitive to the inclusion of an extended period characterized by very low short-term interest rates, we have also considered a shorter sample period. The results did not change noticeably, though. The same is true for considering alternative specifications of the base VAR model replacing, e.g., the world commodity price index by the exchange rate or adding money supply as an additional variable.

and equity and shares decline for some periods, debt recovers very quickly and even “over-shoots” slightly. Interestingly, the response of loans is particularly significant and fairly long-lasting. In contrast, the response of debt securities is, as expected, negative, but only slightly significant, “overshooting” as just mentioned somewhat in the periods after the shocks and then returning to zero very quickly.

A potential explanation for the at first glance counterintuitive behavior of short-term loans is provided by Christiano et al. (1996). Finding a similar response for the U.S., these authors argue that firms cannot adjust their long-term planned expenditure quickly enough to a negative monetary policy innovation. Firms hence have to fall back on short-term financing – distressed borrowing – in the presence of a deterioration in firms revenues, associated with negative economic developments and a consequent fall internally generated funds.

As we will see from the analysis of the asset positions of the individual subsectors below, the dynamics of the debt securities can be largely understood as a response of OFIs’ investment behavior. It might reflect what Nelson et al. (2015) call a “waterbed effect”.

As panel 7 of Figure 10 shows, the evolution of currency and deposits on the asset side is mirrored by that on the liability side. The initial increase in currency and deposits which are predominantly used by MFIs for funding (see Figure 3 and Figure 4) might reflect the fact that households and firms rebalance their portfolios from long- to short-term, e.g., by not re-investing investments due but keeping them in very liquid form, understandable given uncertainties and dim economic prospects.

Concerning the behavior of the other positions on the liability side, two interesting observations emerge. Firstly, the response of debt is fairly mitigated and statistically not significant at any time horizon. Secondly, while overall loans in line with our intuition decline after the shock and remain negative for some periods, the immediate responses of short- and long-term assets are asymmetric: in the period after the shock, contrary to our intuition, long-term loans tend to increase while short-term loans move in line with our priors. Again, the somewhat counterintuitive reaction of long-term loans reflects the behavior of OFIs as will become clear below.

Overall, analyzing the responses of major asset classes of the financial intermediary sector yields findings which largely corroborate our intuition. However, there are a few somewhat counterintuitive results, calling for further investigation. As we will see below, a disaggregated view, examining the three financial intermediary subsectors separately, allows for useful insights into these issues.

### 4.3 Drilling deeper: results for the MFI, OFI and ICPF subsectors

The responses of major balance-sheet positions of the three subsectors comprising the financial corporation sector - shown in Figures 11 and 12 - exhibit a large degree of commonality. This is not surprising, given that all three fulfill the same function, namely channeling funds from savers to borrowers. There exist some notable differences in some positions across financial intermediaries, though. In the following, the major insights from considering first the asset sides and then the liability sides of the financial intermediaries' balance sheets are presented.

As panel (a) of Figure 11 shows, the responses of the asset positions of MFIs to a contractionary monetary policy shock largely mirror those of the overall financial sector, qualitatively and (with some interesting exceptions discussed below) quantitatively. A comparison of the scales on the y-axis between the subsectors and the overall FC sector reveals that this reflects the fact that absolute responses of the MFI sector are in general much larger than those of the other financial intermediaries. This implies that the response of the overall sector is dominated by the former. Of course, a factor which plays a crucial role in this context concerns the still large size differences across subsectors discussed above.

There are three noteworthy differences in the dynamics of individual asset positions between MFIs and the overall financial sector, though. As a comparison of panels (a) and (b) of Figure 11 reveals, these discrepancies mostly reflect asymmetries in the response of MFIs and OFIs to the monetary policy shock. First, while short-term loans (counterintuitively) increase significantly after a rise in the interest rate, they decline in line with our intuition at OFIs. Given the almost negligible move of this variable at ICPFs, for the overall sector then a relatively moderate and insignificant immediate effect of short-term loans results – a sort of washing out happens. After some 2 quarters, the amount of short-term loans issued by MFIs turns negative, again in accordance with our a priori conjecture. Thus, the counterintuitive increase in short-term loans of the financial corporation sectors, which was explained by Christiano et al. (1996) with short-term financing needs by firms, is a phenomenon which primarily concerns banks.

A second major difference between MFIs and OFIs consists of an uneven dynamics of their issuance of long-term debt: while long-term debt, in line with our intuition, decreases on impact at MFIs, it rises at OFIs. Given the relative sizes of the responses of short- and long-term debt, these discrepancies for long-term debt are reflected in the behavior of overall debt origination by the two sectors. To interpret this finding, a reference to recent work by Nelson et al. (2015) appears to be helpful: these

authors show that shadow banks tend to expand asset growth after a contractionary monetary policy shock to meet creditor (and investor) demand no longer satisfied by banks because they cut back their lending. To achieve this, securitisation activities rise. Given that securitization companies are an integral part of OFIs, our finding of an increase in the holdings of long-term debt securities in response to a negative monetary policy shock might therefore likewise be seen as evidence of a “waterbed effect”.

The third asset position whose behavior markedly differs across MFIs and OFIs concerns the amounts of equity held: whereas MFIs tend to increase their investments in shares after a negative monetary policy shock, OFIs significantly decrease their holdings.

In addition to the just discussed asymmetries in the behavior of some asset positions between MFIs and OFIs, a final noteworthy observation concerning the asset side of financial intermediaries relates to the behavior of ICPFs. The responses of almost all balance-sheet positions are not only statistically insignificant but also - as the scales of the y axis indicate - economically. Considering the generally long-term orientation of this subsector’s investments, this finding is not surprising.<sup>20</sup>

Turning to a detailed analysis of the liability-side, Figures 10 and 12 reveal that the behavior of the time series in the overall financial sector is now (apart from currency and deposits) no longer predominantly shaped by that of MFIs but equally strongly by OFIs’ behavior. Considering the former, we can see that they tend to reduce their non-deposit financing on impact while the level of currency and deposits rises (probably due to increased demand for deposits private households and firm customers). Over time, currency and deposits drop significantly, also reflecting the decreased creation of inside money in response to weaker economic conditions. Most other liability positions of MFIs react only fairly weakly to monetary policy innovations with observed impulses being not significant, not even in most periods close to the shock.

This is different in the case of OFIs. On impact, we can observe a tendency to switch funding from medium-/long-term to short-term: both short-term loans and debt increase while long-term loans and debt and equity/shares decrease. However, the response of short-term securities is not significant. Over time, short-term funding turns significantly negative (in all cases) and returns to the pre-shock level afterwards. In contrast, long-term, non-equity financing first increases and then decreases, before dying out after around eight quarters. Unlike for MFIs, the short-run responses of

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<sup>20</sup>This might change with Solvency II which calls for more capital to protect against potential problems from longer maturity positions.

OFIs to the monetary contraction are significant. Given the again mostly muted responses of the ICPFs, this explains the fact that the response of most security positions of the aggregated financial sector reflects largely the investment decisions of OFIs. This is true even for non-loans positions for which no series for MFIs are available.

As in the case of the asset side, the liability positions of ICPFs respond only very moderately to a monetary impulse. Panel (c) of Figure 12 indicates some adjustment of funding (across short- and long-term loans and between short- and long-term debt). However, taking into account volumes – i.e. the scales of figures on the y axes – only very small responses occur.

## 5 Summary and conclusions

Woodford (2010) emphasizes that the GFC has made patently obvious that financial intermediaries play a crucial role in the allocation of resources even in advanced economies, a fact that had been largely ignored in most leading macro models existing at that time. One consequence of the renewed interest in the role of financial intermediaries in the context of the monetary transmission mechanism has been that the credit channel of monetary policy has regained considerable attention in recent years. This channel is generally associated with banks and attributes them an important role in the monetary transmission process. However, in light of two trends which have occurred in the financial intermediary sector over the recent decades this channel might have become of less relevance in modern economies. The first of these trends consists of a substantial decline in the importance of traditional on-balance sheet banking, relative to off-balance or below-balance sheet as well as non-bank banking by financial intermediaries such as insurance companies, pension funds and asset managers, i.e. shadow banks, to be brief. Moreover, and directly related, there has been a salient tendency away from (retail-) deposit-based financing towards ‘bought’ deposits (wholesale-banking) and other forms of ‘market’-based financing of intermediary activities. This is also true for traditional banks. Empirically, these developments have been particularly pronounced for the U.S. whereas the evidence presented in this paper suggests that the EA is lagging in this dimension.

To better understand the role of financial intermediaries in the wake of the GFC, the importance of an alternative monetary transmission mechanism has been emphasized. According to the so-called risk-taking channel of monetary policy, financial intermediaries increase their risk taking in response to a monetary expansion

and thus issue riskier loans or buy riskier securities as a consequence. Overall, a lowering of interest therefore typically leads to increased financing of real activities by financial intermediaries. Interestingly, this channel not only works via banks but also non-bank financial intermediaries (such as insurance companies, pension funds, securitization vehicles etc.). The evidence discussed in Section 2 provides ample support in favor of a risk-taking channel.

Whilst this channel (and the other propagation mechanisms) of monetary policy discussed in Section 2 work - where applicable - symmetrically across intermediaries, recent work by Nelson et al. (2015) for the U.S. shows that shadow banking activities might counteract intended effects of a monetary policy decision usually observed at other financial intermediaries. According to these authors, a monetary contraction in the U.S. is accompanied by a surge in securitization activities, implying an increase rather than a decrease in funds issued by shadow banks in this policy scenario. Besides providing an overview of the literature concerning the role of financial intermediaries in the monetary transmission mechanism, the second aim of this paper was to assess the degree to which conventional on-balance sheet banking and non-bank financial intermediation behavior in the EA respond symmetrically (or otherwise) to a monetary policy impulse.

In accordance with conventional views, we find that the financial-intermediation sector as a whole decreases its activities when confronted with a contractionary monetary policy shock. However, we also observe some notable differences in the behavior of MFIs and OFIs after a given monetary policy innovation. More specifically, MFIs tend to reduce long-term lending whereas OFIs tend to build their loan books. In other words, we observe some indications of a “waterbed effect” as documented by Nelson et al. (2015). The sector’s overall reaction is dominated by the behavior of the MFI sector due to its still largely dominating share. In line with our intuition, the long-term oriented ICPF sector only reacts moderately to monetary policy innovations.

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## 6 Tables

Table 1: Specification tests

Lag-order selection					
	AIC	HIC	SIC	FPE	
Lag 1	-18.56	-18.28	-17.85 **	1.03E-13	
Lag 2	-18.84**	-18.34**	-17.56	7.84E-14**	
Lag 3	-18.77	-18.05	-16.93	8.53E-14	
Lag 4	-18.62	-17.68	-16.21	1.03E-13	
Serial correlation tests			Normality tests		
Equation	Q	p value	JB stat	DoF	p value
y	0.79	0.67	0.22	2.00	0.89
p	0.88	0.64	0.00	2.00	1.00
pcom	0.97	0.62	0.60	2.00	0.74
i	0.09	0.96	1.80	2.00	0.41
all			2.63	8.00	0.96

**Notes:**

- 1) Table 1 reports specification tests results for the VAR model, given by Equations (1) and (2).
- 2) In the upper panel the statistics for four different lag-order selection criteria are reported: the Akaike Information Criterion (AIC), the Hannan Information Criterion (HIC), the Schwarz Information Criterion (SIC) and the Akaike final prediction error (FPE). \*\* indicates the lag order suggested by the respective selection criterion.
- 3) In columns 2 and 3 of the lower panel, results for the Ljung-Box Q test for serial correlation are reported (Q statistics and associated p values). In columns 4 to 6 of the lower panel, results for the Jarque-Bera normality test are reported (JB test statistics, degrees of freedom and associated p values).

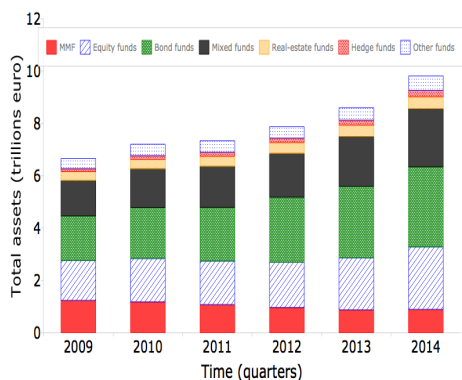
## 7 Figures

Figure 1: Total assets of MFIs, OFIs and ICPFs

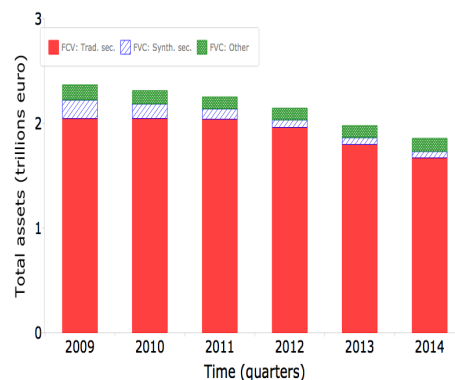


Notes: Panel (a) of Figure 1 plots total assets (divided by GDP) of Euro Area's monetary financial institutions (MFIs), other financial intermediaries (OFIs) and insurance corporations and pension funds (ICPFs). Panel (b) plots the relative sizes of each of these sectors.

Figure 2: Total assets of investment funds and financial vehicle corporations



(a) Investment funds

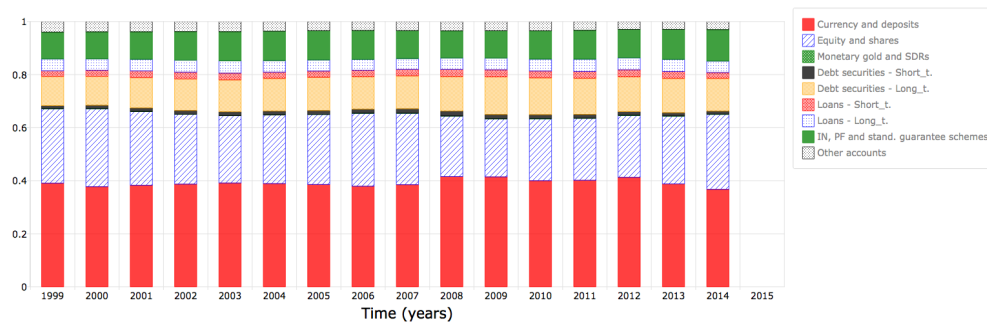


(b) Financial vehicle corporations

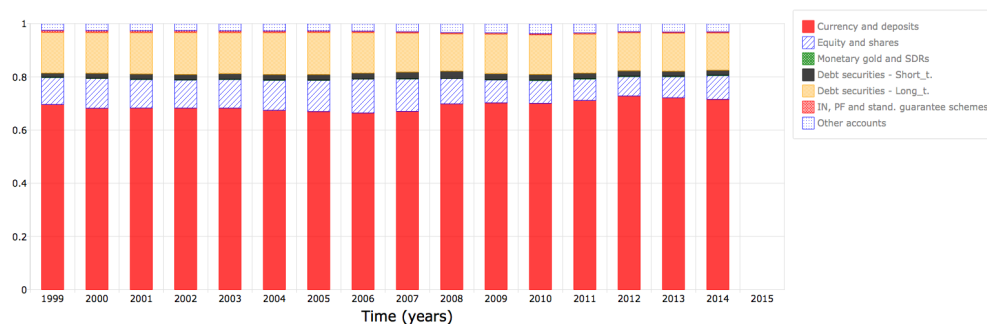
Notes: Panel (a) of Figure 2 plots total assets of Euro Area's investment funds (IF), while panel (b) plots those of financial vehicle corporations (FVCs).

Figure 3: Sources of funds: All financial intermediaries, MFIs, OFIs and ICPFs

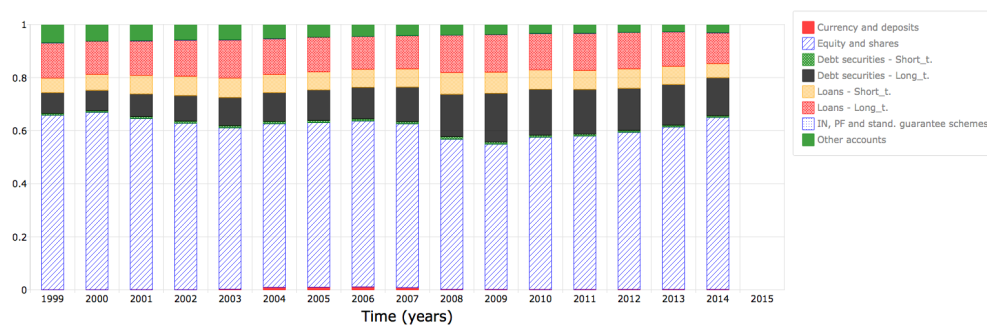
(a) All financial intermediaries



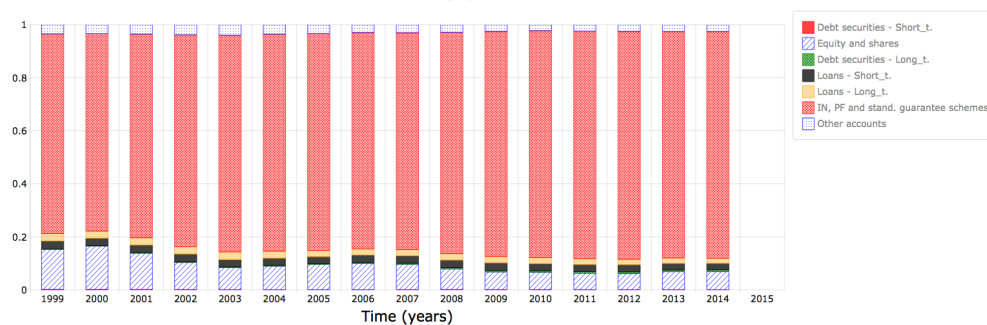
(b) MFIs



(c) OFIs



(d) ICPFs

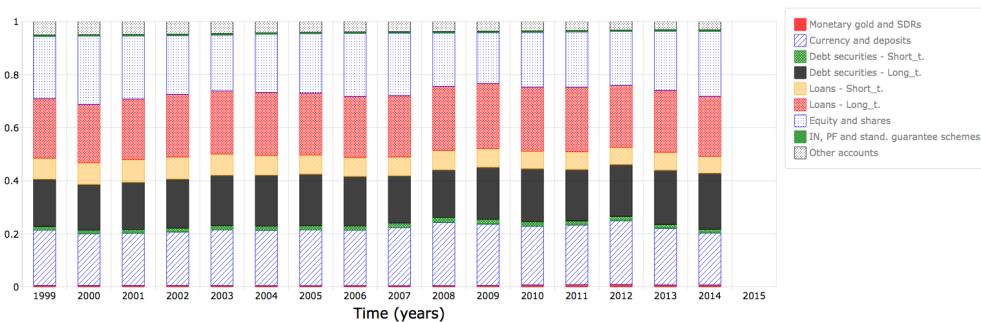


Notes: Panels (a) to (d) of Figure 3 plot the asset positions of the liability side of the balance-sheets of Euro Area's financial intermediary sector (all financial intermediaries), monetary financial institutions (MFIs), other financial intermediaries (OFIs) and insurance corporations and pension funds (ICPFs). All positions are divided by total assets.

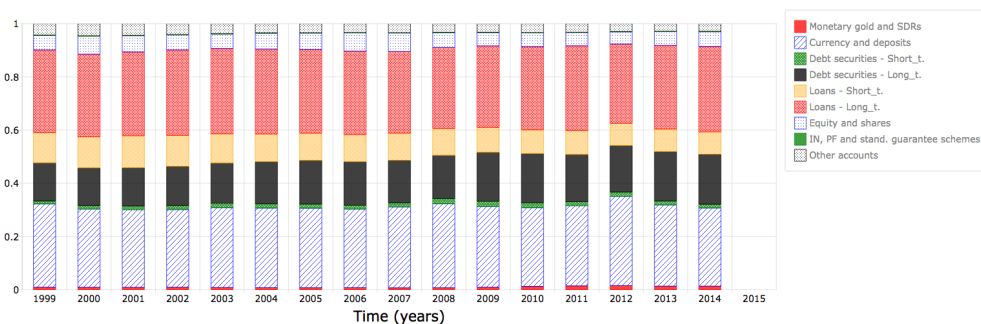


Figure 4: Uses of funds: All financial intermediaries, MFIs, OFIs and ICPFs

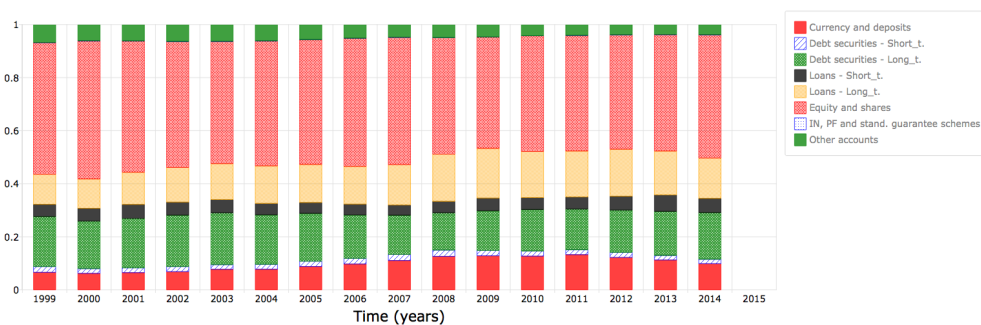
(a) All financial intermediaries



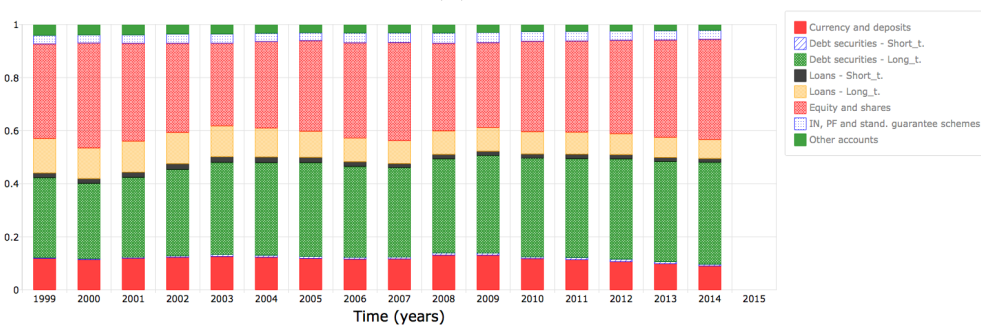
(b) MFIs



(c) OFIs

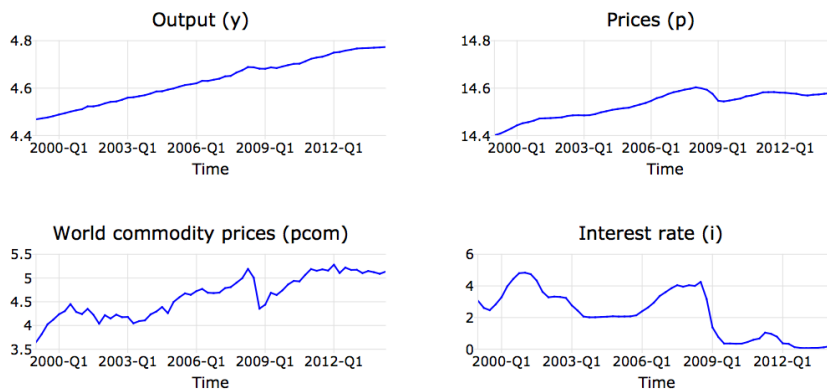


(d) ICPFs



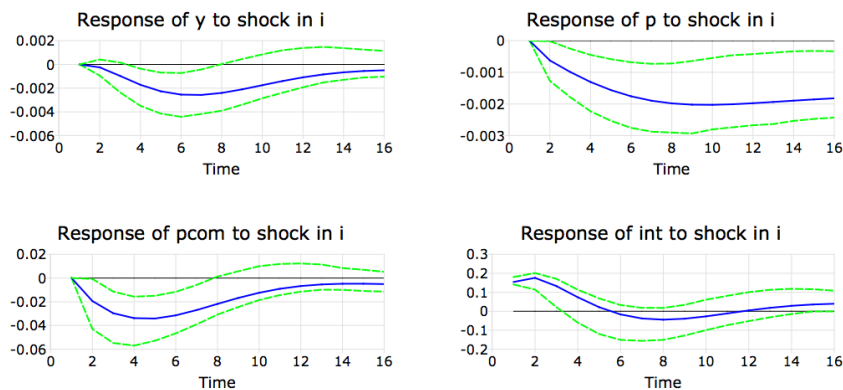
Notes: Panels (a) to (d) of Figure 4 plot the compositions of the asset side of Euro Area's financial intermediary sector (all financial intermediaries), monetary financial institutions (MFIs), other financial intermediaries (OFIs) and insurance corporations and pension funds (ICPFs). All positions are divided by total assets.

Figure 5: Macro data of base VAR model



The four panels of Figure 5 plot the (log of) output ( $y$ , upper left panel), (the log of) consumer prices ( $p$ , upper right panel), (the log of) word commodity prices ( $pcom$ , lower left panel) and the (EONIA) policy rate ( $i$ , lower right panel) employed in our base VAR model.

Figure 6: Impact of a contractionary monetary policy shock on output and prices



The four panels of Figure 6 plot the response of output ( $y$ , upper left panel), consumer prices ( $p$ , upper right panel), word commodity prices ( $pcom$ , lower left panel) and the policy rate ( $i$ , lower right panel) to a one-standard deviation increase in the monetary policy rate. 80% confidence bands are obtained from a bootstrap simulation using 1000 random draws.

Figure 7: Estimated monetary policy shocks

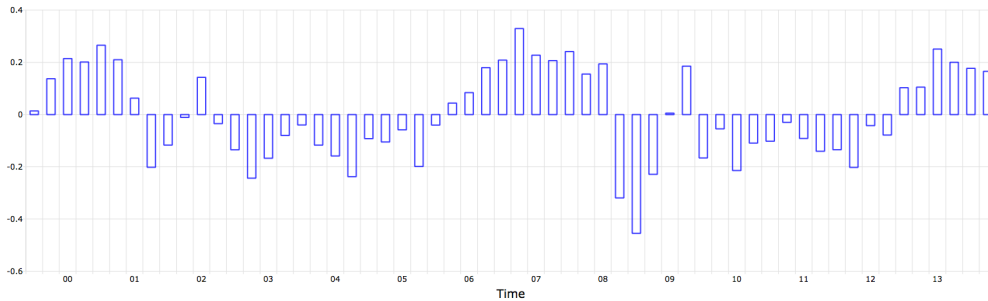
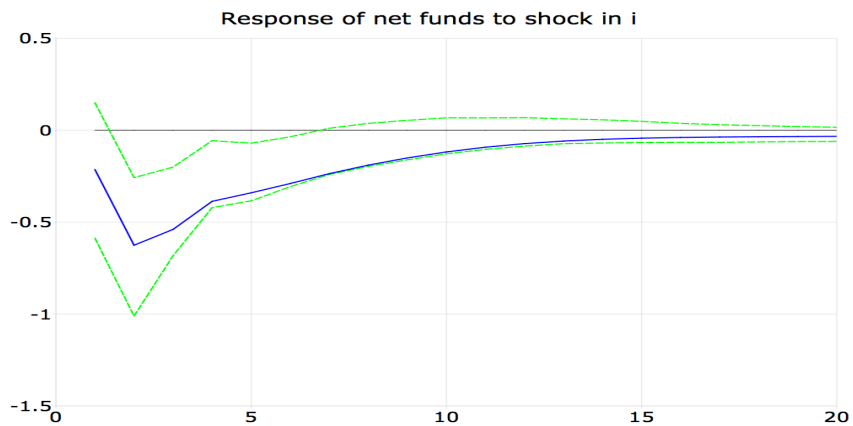


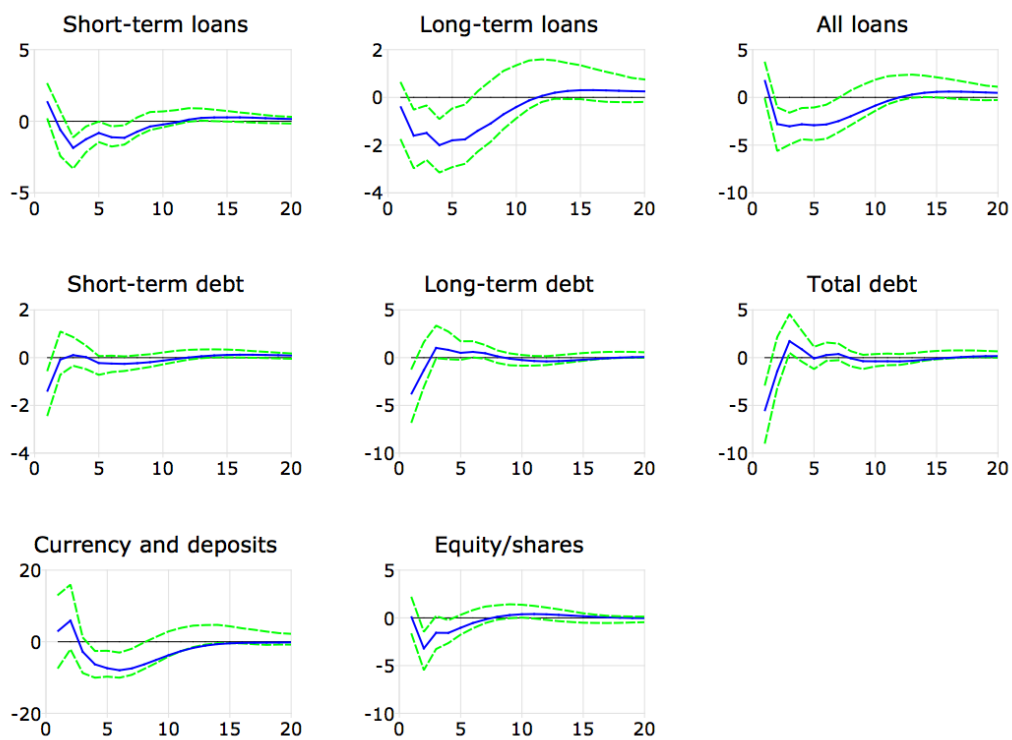
Figure 7 plots the estimated structural monetary policy shocks of the base VAR model which includes output, consumer prices, world commodity prices and the policy rate and which is given by Equation (1). As in Christiano et al. (1996), three-quarter centered moving averages of the shocks are plotted.

Figure 8: Impact of a contractionary monetary policy shock on net funds raised by financial corporations



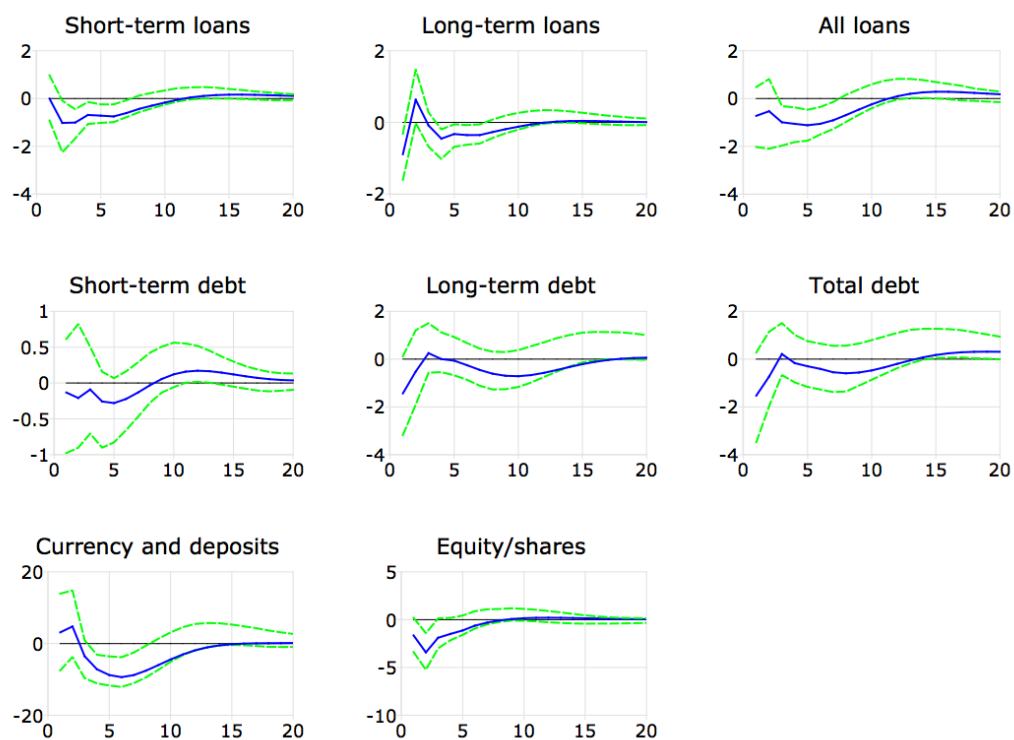
Notes: Figure 8 plots the response of net funds raised by all financial corporations to a one-standard deviation increase in the monetary policy rate. Confidence bands are obtained from a bootstrap simulation using 1000 random draws.

Figure 9: Impact of a contractionary monetary policy shock on the assets of financial corporations



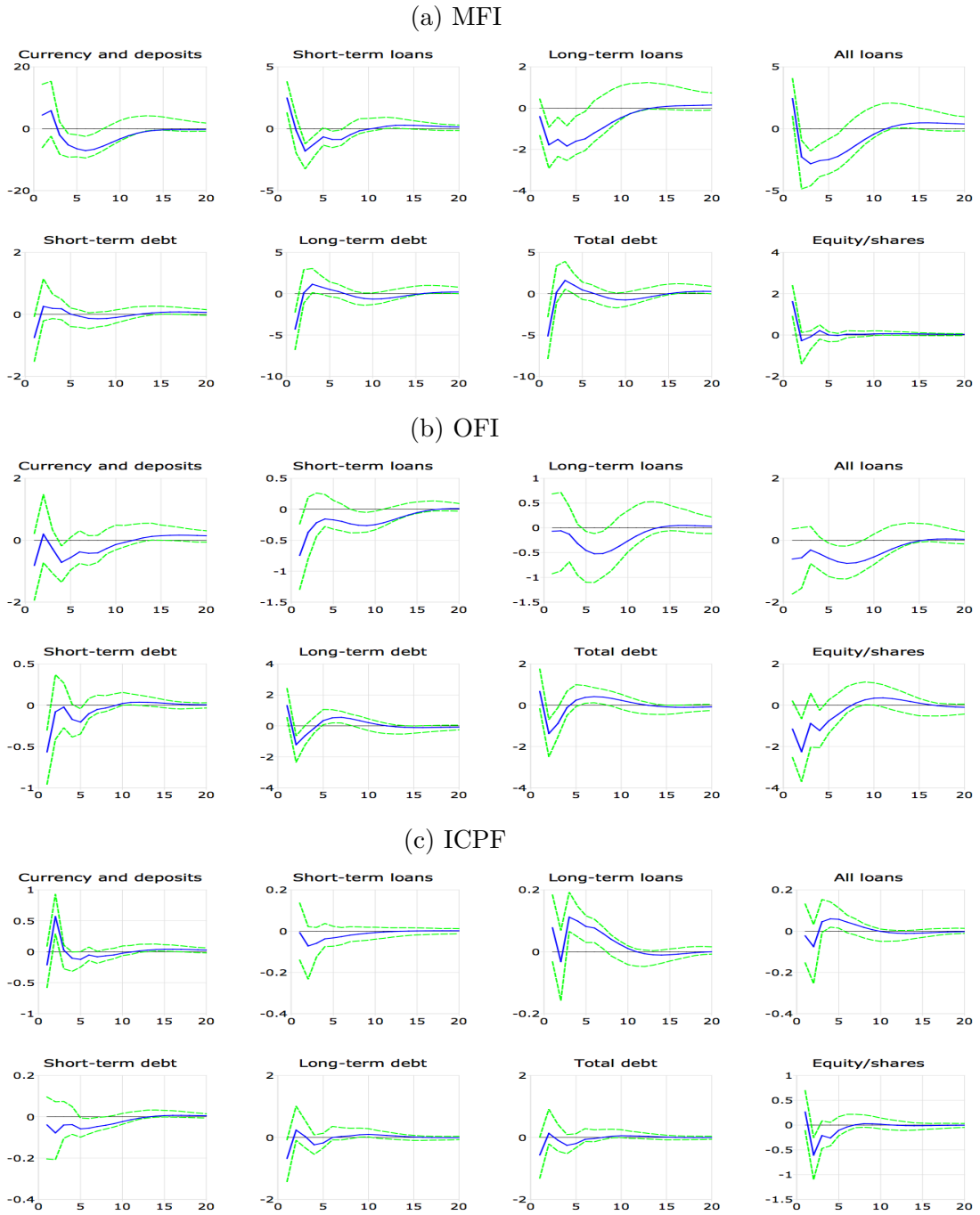
Notes: The panels of Figure 9 plot the responses of the various asset-side balance-sheet positions of all financial corporations (FCs) to a one-standard deviation increase in the monetary policy rate. 80% confidence bands are obtained from a bootstrap simulation using 1000 random draws.

Figure 10: Impact of a contractionary monetary policy shock on the liabilities of financial corporations



Notes: The panels of Figure 10 plot the responses of the various liability-side balance-sheet positions of all financial corporations (FCs) to a one-standard deviation increase in the monetary policy rate. 80% confidence bands are obtained from a bootstrap simulation using 1000 random draws.

Figure 11: Response of assets of MFIs, OFIs and ICPFs



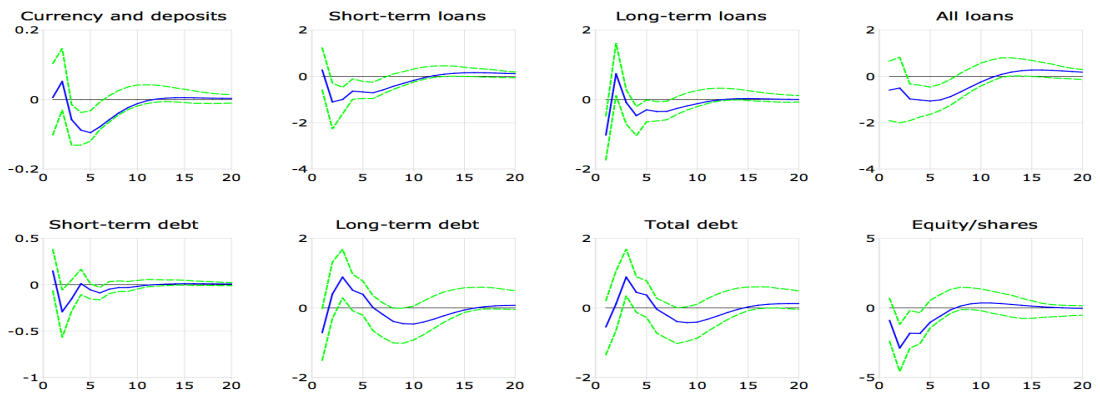
Notes: The panels of Figure 11 plot the responses of major asset positions of the indicated financial intermediaries to a one-standard deviation increase in the monetary policy rate. 80% confidence bands are obtained from a bootstrap simulation using 1000 random draws.

Figure 12: Response of liabilities of MFIs, OFIs and ICPFs

(a) MFI



(b) OFI



(c) ICPF



Notes: The panels of Figure 11 plot the responses of major liability positions of the indicated financial intermediaries to a one-standard deviation increase in the monetary policy rate. 80% confidence bands are obtained from a bootstrap simulation using 1000 random draws.