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Euro area shadow banking activities in a low-interest-rate environment: a flow-of-funds perspective

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Euro area shadow banking activities in a low-interest-rate environment: a flow-of-funds perspective[*]

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Abstract

Very low policy rates as well as the substantial redesign of rules and supervisory institutions have changed background conditions for the Euro Area's financial intermediary sector substantially. Both policy initiatives have been targeted at improving societal welfare. And their potential side effects (or costs) have been discussed intensively, in academic as well as policy circles. Very low policy rates (and correspondingly low market rates) are likely to whet investors' risk taking incentives. Concurrently, the tightened regulatory framework, in particular for banks, increases the comparative attractiveness of the less regulated, so-called shadow banking sector. Employing flow-of-funds data for the Euro Area's non-bank banking sector we take stock of recent developments in this part of the financial sector. In addition, we examine to which extent low interest rates have had an impact on investment behavior. Our results reveal a declining role of banks (and, simultaneously, an increase in non-bank banking). Overall intermediation activity, hence, has remained roughly at the same level. Moreover, our findings also suggest that non-bank banks have tended to take positions in riskier assets (particularly in equities). In line with this observation, balance-sheet based risk measures indicate a rise in sector-specific risks in the non-bank banking sector (when narrowly defined).

<u>Keywords</u>: Non-bank financial intermediation, shadow banking, financial stability, systemic risk, financial regulation, low interest rate environment.

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1 European finance's new regulatory landscape

Faced with the threat of a literally imploding financial sector, major central banks embarked in the fall of 2008 on a highly expansionary monetary policy course. Initially, this meant strong and swift reductions in their policy rates. But subsequently this course was complemented by using the central bank balance sheet as a stabilization device, through increasing its size, very substantially (quantitative easing), as well as its composition (credit easing).

The ECB, e.g., cut its main refinancing rate from 4.25% in July 2008 to 1% in May 2009 – at the time deemed to be the effective lower bound. After having been forced to come back on two hikes in 2011, the main refinancing rate was subsequently cut to its current level of 0.05%. Meanwhile, in early 2016, the deposit rate is at -0.3%. Concurrently, by means of its "enhanced credit support" policy, substantially more liquidity was provided - against an enlarged pool of collateral with lower credit quality and for markedly longer terms.

These policies were largely about crisis containment. In order to prevent a similar crisis from happening again, in addition, the regulatory landscape has been considerably overhauled. Capital requirements, in terms of quantity and (loss-absorbing) quality have been tightened (relative to risk-weighted assets), liquidity ratios, to control maturity risks, introduced (for a first time), as well as a maximum leverage ratio (relative to unweighted assets) introduced. This was combined with efforts at building a completely new supervisory infrastructure, including a Europeanized supervision of large, important banks, an institution to handle bank restructuring (or, in case this fails) resolution as well as a harmonized deposit insurance scheme. This all came under the heading of "Banking Union" – which ultimately meant a de-nationalization of banking politics.[1]

Understandably, banking – where trouble seemingly emanated – has been given particular attention. Institutions performing similar functions, therefore appropriately called non-bank banks[2], remained – with the exception of insurance companies – largely below the rule-makers' radar screen. As a result, notwithstanding a few

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[1] The European Commission provides a broad overview of all implemented and currently ongoing regulatory efforts on the following website: http://ec.europa.eu/finance/general-policy/policy/map_reform_en.htm.

[2] Conceptually, regulation currently addresses institutions, not functions. Public policy issues – substantial exernalities, calling for remedial collective action – are however caused by inappropriately performed functions. This is why we have a preference for functional regulation, regardless of the institution discharging a particular function (Merton and Bodie (2004)). Related to that is also our preference for the notion of non-bank banks – while coming in different guises, those institutions are performing bank-like functions, banks by another name.

selective regulatory changes, no comprehensive reform-package has been devised for shadow banking.[3]

Evidently, both, central bank as well as financial regulatory policies, are attempts at improving societal welfare. But both, as any policy initiative, inevitably come with side effects, or costs. Given altered background conditions, market participants will respond. They optimize under new constraints. Therefore, banks should become comparatively less attractive. Contemporaneously, non-bank banks should profit. Therefore, it can be expected that the new regulatory landscape will significantly impact activities within the financial-intermediation sector. More specifically, we would expect substitution away from more heavily (banks) towards less or differently regulated entities. As a result, given that non-bank banks discharge (to a large degree) similar functions as banks, and are thus subject to identical risks, but regularly have to adhere to less binding, or different, rules, such a development might actually amount to a challenge for underwriting financial stability.

Moreover, a number of defining features of non-bank banking might, in fact, add to the level of systemic risk.[4] First, non-bank banking, that is, in particular sales and repurchase agreements (or repos) and securitization, provide liquidity and maturity transformation services – without, and this is crucial, recourse to a public backstop facility (deposit insurance, marginal lending facility/discount window – or emergency liquidity assistance). As an upshot, these banks by another name are vulnerable to roll-over risks or runs.[5] This vulnerability is particularly pertinent given that their 'depositors' are mainly institutional investors, providing funds for very short tenors only. Second, non-bank banking is especially about slicing-up the bank value chain.[6] This means, inter alia, substantially longer intermediation chains, typically across numerous institutions (or separate legal entities within bank holding companies). It implies agency problems, frictions and increased default probabilities. Third, and closely related, in times of stress, opacity and complexity of instruments produce "flight-to-quality" phenomena. Fourth, assets, particularly sensitive to high-impact (and apparently low probability) events, are regularly not properly priced. Under

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[3]In September 2013, the European Commission published an overview of measures that had either already been taken or were under review in the context of the regulation and supervision of European shadow banks (see European Commission (2013), for details). This communication is part of a regulatory effort with an eye on setting up a comprehensive framework also for this sector.

[4]See Adrian (2014) for a more detailed exposition of these issues. Other excellent recent academic work include, amongst others, studies by Adrian and Shin (2009b), Gorton and Metrick (2012), Bakk-Simon et al. (2012), Claessens et al. (2012), Gennaioli et al. (2013), Claessens and Ratnovski (2014) and IMF (2014).

[5]Runs must not only arise from bad coordination leading to a bad equilibrium. They might as well be justified in untenable market positions, suddenly exposed (see Gennaioli et al., 2012).

[6]HHK REF 2004

benign circumstances, such risks are neglected (Gennaioli et al., 2013).[7] Fifth, against a background of low volatility – think of the so-called Great Moderation period, abruptly ending in the summer of 2007 – shadow banks (more than anybody else)[8] boost their leverage and vice versa. This is tantamount to pro-cyclicality. Finally, the high degree of connectedness of nonbank banking – its complementarity – with other financial sub-sectors opens the gate to contagion.

While (at least in our view) necessary to prevent the financial implosion and halt a precipitious economic downturn, the policy of "low interest rates for an extended period of time" might have come, inevitably, at the price of inducing (potentially excessive) risk-taking by investors. And - according to IMF (2014, page 31) - in doing so this also might have given a substantial boost to the growth of the non-bank banking sector. From a monetary policy angle, this hints at the so-called risk-taking channel (Borio and Zhu, 2012), having received considerable attention, in particular in the wake of the crisis. This channel (of transmitting monetary impulses) refers to a number of elements: a higher risk-taking capacity of financial intermediaries, a "search/reach for yield" behavior as well as a lower risk aversion associated with low interest rates.[9] The empirical evidence has primarily focused on banking behavior and has generally been supportive of the existence of a risk-taking channel.[10,11]

However, Adrian and Shin (2010) show that the risk-taking channel is, as one would surmise, not constrained to banks but, of course, also holds for "shadow banks". Unlike 'conventional' banks, these non-bank banks fund their activities not by taking deposits but by issuing marketable debt instruments or through repurchase agreements.[12] With fair-value or mark-to-market accounting, monetary policy is hence mediated through these institutions 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., the policy rate is cut, the term spread typically rises, making additional lending

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[7]This is, what Herring (1999) called disaster myopia.

[8]Low volatility translates in value-at-risk models, as typically deployed by financial intermediaries, into an increased distance to default.

[9]See Appendix A and Altunbas et al. (2014) for a more detailed exposition.

[10]See, amongst others, Jimenéz et al. (2014), Ioannidou et al. (2009) or Altunbas et al. (2014) and Appendix A.

[11]In fact, the debate about the Greenspan put, that is, letting good times roll and only intervene in case of trouble (i.e. "mopping-up"), was somehow a precursor to this argument.

[12]Sales and (committed) repurchase agreements are essentially collateralized large-scale deposits. Hence, these repos are inside-money, though created by non-bank banks. Given that, different e.g. from swaps, ownership – right of disposal – is transferred, they allow for re-hypothecation. This makes for a distinct money multiplier; see Gorton and Metrick (2012).

profitable.[13] As a consequence, the net interest rate margin, i.e., the difference between interest income (generated on the asset side of the intermediary's balance sheet) and interest expenses (on the liabilities side of its balance sheet) goes up. This, concurrently, means an increase in the market value of the intermediary's capital. Which, again, boosts its risk-taking capacity. Hence, granting additional loans becomes attractive. Finally, the expansion of the intermediary's lending activities reduces risk premia.

Employing U.S. flow-of-funds data for traditional banks, shadow banks (issuers of asset-backed securities, finance companies and funding corporations) as well as broker-dealers, Adrian and Shin (2010) show that the balance-sheets of the latter two help to explain future real activity better than balance sheet policies of traditional banks. This is not only evidence for distinct roles of different financial intermediaries in the monetary transmission mechanism, but also their comparative importance. Moreover, making use of the time series as well as the cross-section dimension, that is employing a panel regression analysis, they document a negative relationship between the level of the Federal funds rate and the balance-sheet size of intermediaries.

The risk-taking channel is not confined to intermediaries conducting narrowly defined bank-type activities though. Examining, for example, bond investment behavior of insurance companies, Becker and Ivashing (2015) show that these institutions also "reach for yield" in structuring their investment portfolios, or ride the yield curve, somehow unsurprisingly. Similarly, Choi and Kronlund (2015) document reach-yor-yield behavior also for U.S. bond mutual funds.[14]

The primary purpose of this article is to provide a macro-oriented assessment of recent developments in the Euro Area's non-bank banking sector. In doing so, we focus on whether (and how) the protracted low-interest-rate environment shows in the investment decisions in this sector. To address this question, we make use of flow-of-funds data. These include time series which have been collected only recently in an effort also to reduce pre-crisis data gaps, particularly associated with shadow-banking activities.

Whilst we think that taking a macro perspective and employing sector-wide, stock-flow consistent data provides important and useful insights into the functioning of the shadow-banking sector, we are of course aware of shortcomings of this approach. In particular, no price or credit quality information on assets is available.

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[13]The loan rate is fixed but the funding rate variable. Funding short therefore means opening up an interest rate gap and being exposed to a roll-over risk.

[14]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, again, a lowering of the policy rate induces increased risk taking.

Those are aspects which related micro studies employ in assessing whether financial intermediaries tend to grant riskier loans when interest rates are lower. Here, we take an indirect approach. More specifically, we examine whether dynamics observed in aggregate financial data of the non-bank banking sector confirm our hypotheses about investment behavior during a low-interest-rate period.

The questions we in particular examine are (i) whether and if so by how much shadow banking activities have increased in recent years, (ii) whether we can observe a portfolio rebalancing towards relatively more risky assets such as stocks and (iii) whether we can observe an increase in financial risk of the non-bank banking sector employing aggregate measures. To be clear, even if we find evidence supportive of higher risk taking our approach does not allow us to unambiguously trace this back to low interest rates.[15] Nevertheless, it provides interesting insights complementing the micro-data based evidence and serving as useful input for the policy-making process.

In line with previous findings, we document that the non-bank banking sector has increased considerably in the Euro Area ever since the crisis. In particular, investment funds have grown significantly. However, even if one exlcudes mutual funds, the rise in total assets of non-bank banks is still very sizeable. We furthermore find that equities gained in comparative importance. Concurrently, in particular the share of short-term (low yielding) assets has declined. Our balance-sheet based risk measures – capturing distance to default – also indicate somewhat larger exposures.

The rest of this paper is structured as follows. In Section 2, we present and discuss our data. Section 3 provides an overview of recent dynamics in the non-bank banking sector. Section 4 briefly outlines the CCA concept and then provides a risk-based assessment, highlighting implications for financial stability. Section 5 summarizes and concludes.

2 Data – reducing gaps, allowing new perspectives

Following the recommendations given in Financial Stability Board (2011), substantial, globally co-ordinated efforts have been made to reduce gaps in financial data. Within the European Union (EU), the implementation of ESA 2010, i.e., the latest internationally compatible EU accounting framework, implemented in September 2014, allows, inter alia, for a separate consideration of "other" financial intermediaries, including investment funds, in the flow-of-funds data.

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[15]And even if this were unambigously the case, a low-rates policy might of course be justified, nonetheless.

One of the two major data sources of our empirical analysis are the Euro Area's quarterly economic and financial accounts data.[16] More specifically, we primarily employ financial balance-sheet data from the ECB's (and Eurostat's) Euro Area accounts data ("Quarterly Sector Accounts") which offer consistent and comprehensive information on income flows, spending and financing decisions as well as the balance sheets of all sectors in the Euro Area. Financial and non-financial statistics are compiled by national institutions and the Eurosystem. The data is quarterly and available either from 1999 onwards or 2012 onwards (see below).[17]

Data are provided for different domestic sectors as well as a catch-all construct, the rest-of-the-world (ROW) sector. Sectors are defined institutionally, integrating entities with similar (economic) characteristics and behavior. Our focus is on the financial sector. For this sector, data are available in aggregate form (financial corporations, short FC), but also can be further disaggregated into monetary financial institutions (credit institutions and money market funds, MFI, in short), insurance corporations and pension funds (ICPF) as well as other financial institutions (OFI). Since the implementation of ESA 2010, the OFI data can be further distinguished between OFIs with investment funds (other than money market funds) and OFIs without investment funds. These data are available from 2012Q4 onwards.

The Euro Area accounts data are complemented by selected series from the ECB's monetary and financial statistics. More specifically, data are used for credit institutions (CIs), money market funds (MMFs), investment funds (IFs) and financial vehicle corporations (FVCs). Investment funds data are also available in a more disaggregate form according to the type of fund (bond funds, equity funds, mixed funds, real estate funds, hedge funds and other funds). CIs and MMFs form the group of MFIs. All of these series have become available only fairly recently, namely in 2006 (FVCs, CIs, MMFs) or 2008 (IFs).

Financial data per sector and subsector 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 frequency of the data used is quarterly. The start of the sample period

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[16]For a detailed exposition, see in particular de Rougemont and Winkler (2014) on whom we largely rely, see also ECB 2012, MB.

[17]See also ECB and Eurostat (2007) as well as ECB (2012) for further background information on these data.

depends on the data series employed (see above), the sample period ends either in 2015Q1 or 2015Q2 depending on the availability of the data when we downloaded them (November 2015).

To read or interpret the data, we employ a working hypothesis similar to the one used by other authors such as Gray et al. (2007) or Castrén and Kavonius (2009). More specifically, we consider the sectors of the Euro Area economy as capturing the average (mean) behavior of the individual entities comprising the respective sector. This sector perspective deems to us to be a natural aggregation device given, to reiterate, that sectors are defined by entities with similar characteristics and economic behaviors. Financial accounts data of a particular sector, for instance, are hence understood as the balance sheet of a representative agent of this sub-sector.

Building on this approach, we will first provide an assessment of how the Euro Area's non-bank banking system has evolved in recent years. In a second step, we document the dynamics of its (aggregate) portfolio composition. We then provide balance-sheet based statistics (capturing stocks) which are regularly employed to evaluate potential risks emanating from the activities of a given financial entity. Lastly, we will provide an assessment of potential risks emanating in particular from the non-bank banking sector.[18]

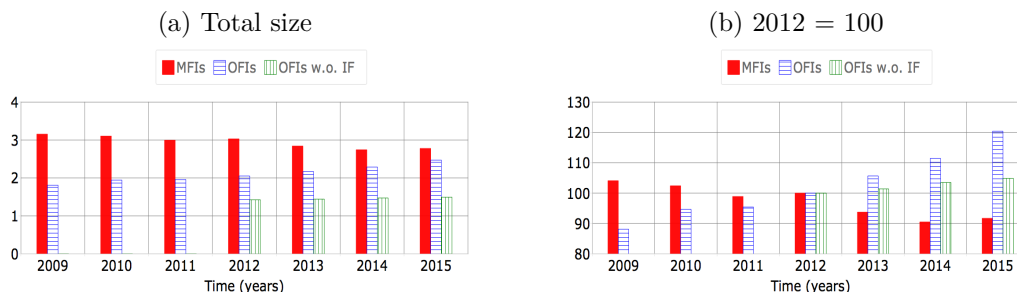# 3 Recent developments in the Euro Area's non-bank banking sector

As a first step, we provide an overview of the overall non-bank banking sector's development as well as selected major entities. We then proceed with taking a closer look at the balance-sheet dynamics of non-bank banks.

3.1 Size – an evolving financial landscape

Figure 1 illustrates that banks (MFIs) are still the dominant financial intermediary sector in the Euro Area: their total assets amounted to slightly less than 3 times Euro Area's GDP in 2015. However, their size has declined by more than 10% since 2012 (when measured in terms of GDP, see right-hand panel). On the other hand, OFIs have experienced a continuous increase in importance since 2009. In terms of

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[18]Of course, we are aware of shortcomings in using flow-of-funds data for the purpose of our analysis. An obvious issue is that aggregated data mask potentially significant vulnerabilities at the sub-sector level, arising from heterogeneity of entities over which aggregates are construed (think of risks in the higher quintiles, for example). Another shortcoming is that no price information on assets is available which is crucial for our risk analysis.

Figure 1: Development of total assets: banks and non-bank banks

(a) Total size

(b) 2012 = 100

Notes: Figure 1 plots total assets of banks (monetary financial institutions, MFIs, minus total assets of the eurosystem) and non-bank banks (other financial intermediaries plus money-market funds including (OFIs) and excluding (OFIs w.o. IF) investment funds). In the left-hand panel, total assets are mapped relative to Euro Area's GDP. In the right-hand panel, data are normalized such that 2012 values correspond to 100. Annual data are obtained from averaging quarterly balance-sheet data. Data sources: ECB, Euro area accounts, monetary financial statistics (eurosystem and money-market funds data).

Euro Area's GDP, total assets of OFIs including investment funds corresponded to around 2.4 in 2015, the corresponding figure for OFIs without investment funds is 1.4. Since 2009, OFIs have increased by more than 30%, when measured relative to GDP.
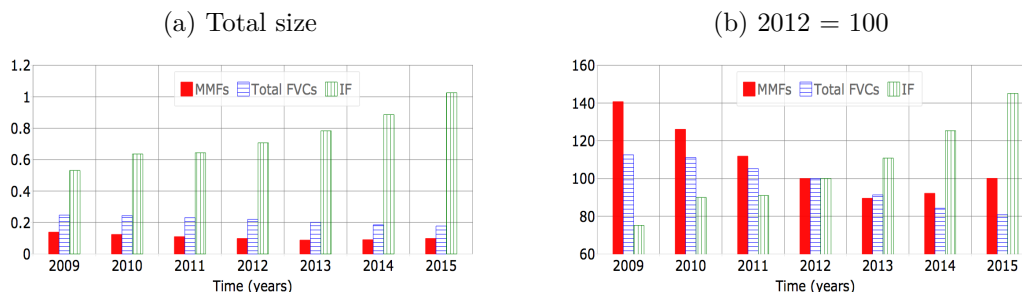
Taking a closer look at the dynamics of three major subsectors of the non-bank banking sector, Figure 2 documents that both money-market funds and financial vehicle corporations are relatively small, having in fact declined since 2009. For money-market funds, which had been under particular pressure during the crisis,[19] this trend has been reversed in 2013, however.[20] At the same time, investment funds (promising higher returns, though with some additional volatility) have exhibited a continuous and very sizeable upward trend since 2009. Their total assets meanwhile amount to one time Euro Area GDP in 2015.

Considering the distribution of non-bank banking activities across countries, it is remarkable that most of Euro Area's other financial intermediaries are located in the Netherlands and Luxembourg. In 2015, these two countries were home to more than 50% of all OFIs when investment funds are included and around 70% of OFIs excluding investment funds. An even more striking feature concerns the growth of the OFI sector (both types) in Luxembourg: since 2009 total assets have in both

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[19]In Europe, there was no official backstop. In the U.S., the Fed came to rescue quickly in September 2008.

[20]Money market funds are functional substitutes to bank deposits – slightly higher remunerated but without a nominal value guaranteeing backstop. They can break the buck.

Figure 2: Money market funds, financial vehicle corporations and investment funds

(a) Total size

(b) 2012 = 100

Notes: Figure 2 depicts total assets of major non-bank banking sectors. In the left-hand panel total assets are plotted relative to Euro Area's GDP. In the right-hand panel, data are normalized such that 2012 values correspond to 100. Annual data are obtained from averaging quarterly balance-sheet data. Data sources: ECB, Monetary and financial statistics (monetary statistics, financial vehicle corporations, investment funds).

cases more than doubled whereas growth rates have been fairly moderate in most other countries. The exception is Ireland where the OFI sector including investment funds has grown (given a considerably lower initial level) by around 70% (!) since 2012.
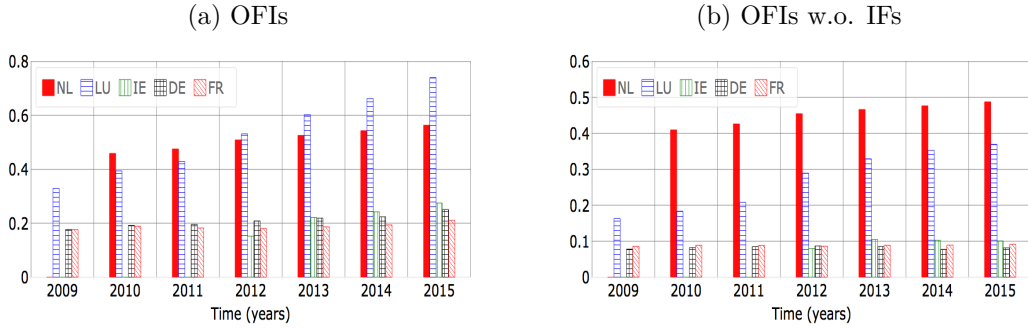
Figure 4 reveals that equity, bond and mixed funds cover more than 80% of total assets of all investment funds. During the sample period their shares have remained relatively constant. Dynamics, however, have been interesting: while the relative importance of equity funds has declined between 2009 and 2012, the period of declining interest rates, the opposite was true of bond funds. Since 2012, i.e. the period of stable policy rates (at the zero-lower bound, also in expectation) the opposite has occurred. Given that investments in stocks come with higher variance than exposures to fixed-income claims, this observation is in line with the hypothesis that low interest rates induce investment in riskier assets.[21]

3.2 Balance-sheet dynamics – establishing the facts

The investment portfolio of the OFI sector has undergone some noteworthy changes. As the upper panel of Figure 5 shows, the share of currency and deposits – cash, for short – in OFI portfolio has steadily declined (from around 12.4% in 2009 to 9.5% in 2015) whereas stocks have become relatively more important (increase from around 43.6% to 46.2%). Moreover, OFIs hold slightly more debt securities (19.6%

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[21]To a degree, central banks of course tried to induce a less risk-averse behavior in order to support capital expenditures.

Figure 3: Non-bank banks by country
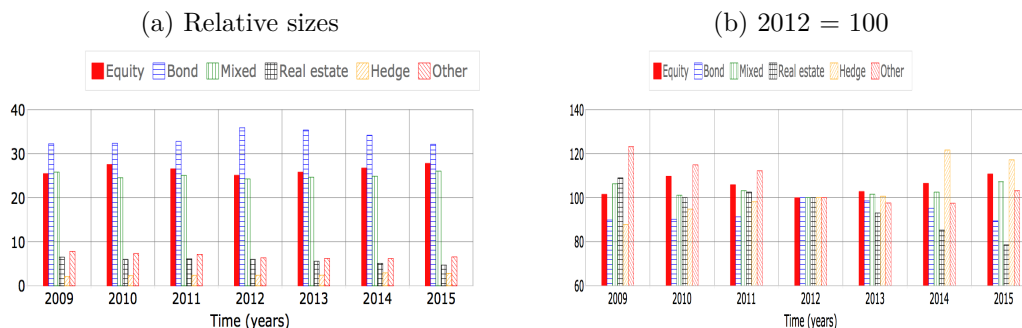
(a) OFIs

(b) OFIs w.o. IFs

Notes: Figure 3 charts total assets of major "other" financial intermediaries including (OFIs) and excluding (OFIs w.o. IF) investment funds by the five countries with the largest sectors (as of 2015). Data are normalized by Euro Area's GDP. Annual data are obtained from averaging quarterly balance-sheet data. In some cases, data became available only after 2009. Data sources: ECB, Euro area accounts.

compared to 18.1%) whereas the portion of loans (20.3% in 2015, 21.2% in 2009) and in particular currency and deposits has declined (from 12.4% to 9.5%). Within the equity position, a strong rebalancing has taken place away from unlisted to listed (i.e. tradable) and investment fund shares. Moreover, OFIs have rebalanced their portfolios somewhat from short- to long-term debt, to capture the term premium.

Considering the OFI sector's asset portfolio dynamics after excluding investment funds (lower panel of Figure 5) we again observe a significant decline in currency and deposits (from around 15.9% in 2012 to around 11.6% in 2015) whereas the relative size of stocks has increased markedly (from 42.6% to 45.4%). Loans have barely moved (33.6% in 2015, 32.7% in 2012) as did other asset positions. Within the equities position we again detect a shift towards listed shares and a reduction in unlisted shares.

Figure 4: Investment funds by type

(a) Relative sizes

(b) 2012 = 100

Notes: Figure 4 plots total assets of investment funds by types. In the left-hand panel, relative shares of each type are given. In the right-hand panel, data are normalized such that investment type shares in 2012 are equal to 100. Annual data are obtained from averaging quarterly balance-sheet data. Data sources: ECB, Monetary financial statistics.

4 Sectoral balance-sheet risk measures

The balance sheet data just sketched, can be read through a risk assessment lens.[22] To do this reading, we use the lens of contingent credit analysis. CCA represents a generalization of option pricing theory, as pioneered by Black and Scholes (1973) and Merton (1973). It has been used comprehensively to value contingent claims, i.e., financial assets whose payoff depends on the future value of other assets. CCA rests on Robert Merton's ingenious insight that the position of stock owners can be understood as holding a call option on the firm which they will only exercise (i.e. buy back the firm from its creditors) is larger than its debt. The required debt payment is effectively the strike price of this call. In a similar, actually exactly corresponding vein, bondholders have written a put. And rational stockholders default whenever the value of assets falls below a well-defined barrier (Merton, 1974), at least in theory.[23]
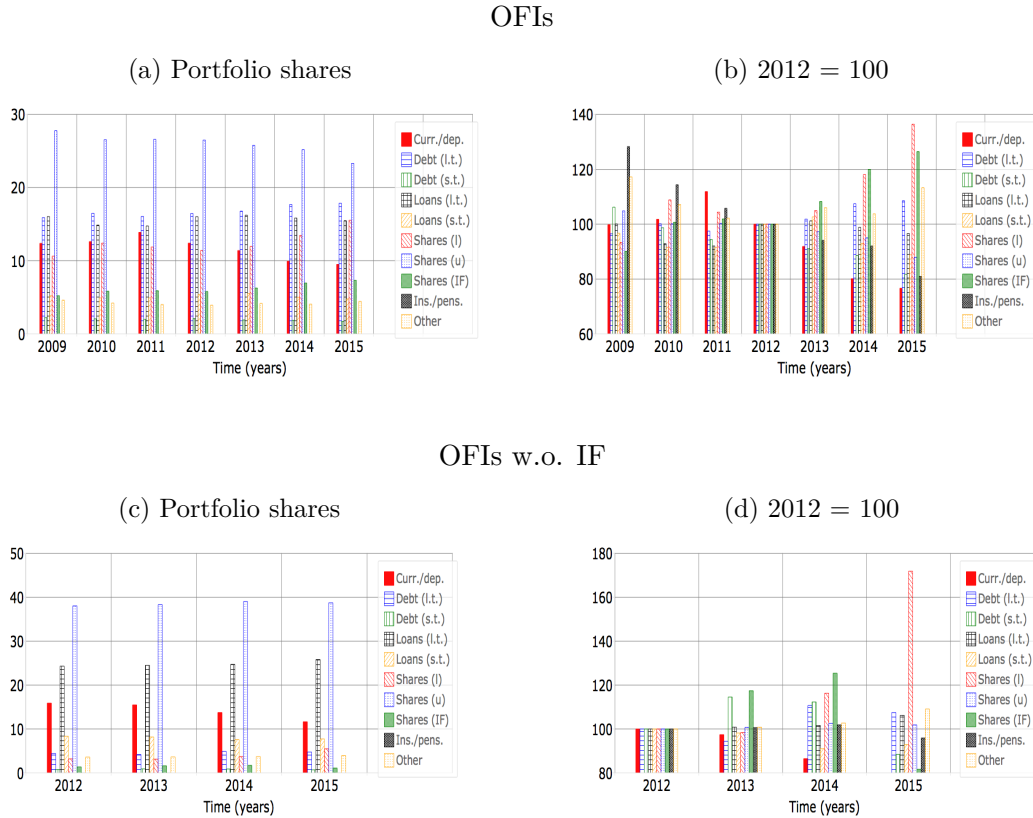
Here, we report results for the overall OFI sector since 2009, for the OFI sector without investment funds the sample period starts in 2012Q4. As we will argue

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[22]Measures provided are similar to those of IMF (2014). However, the latter report focusses selectively on two periods whereas we consider an extended sample period.

[23]For excellent expositions, see Hull (2012) or Saunders and Allen (2010) To be more precise, ours assessment of sectoral risks is based on the "book values" of assets. However, as Gray et al. (2007) convincingly argue, such an approach is only sensible in a deterministic world. To address this issue, we employ CCA at an economic sector level and combine the balance-sheet information of the flow-of-funds data with proxies for the respective sectors' equity volatility. Thus, we replace each sector's "traditional accounting balance sheet" (Jobst and Gray, 2013) by a "risk-adjusted (CCA) balance sheet." For more details see Beck et al 2015, SAFE WP.

below, this allows us to obtain an idea of the indicator qualities of each measure. To benchmark developments in the OFI sector (our stand-in for non-bank banks), we also document results for MFIs.

Figure 5: Assets non-bank banks

OFIs

(a) Portfolio shares

(b) 2012 = 100

OFIs w.o. IF
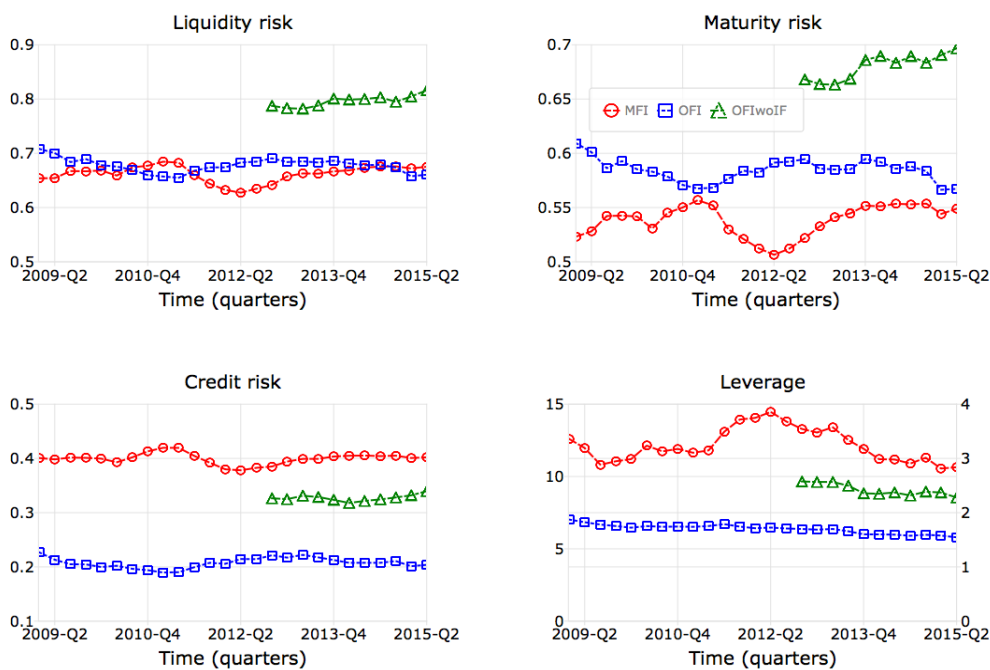

(c) Portfolio shares

(d) 2012 = 100

Notes: Figure 5 charts asset balance-sheet positions of other financial intermediaries (with and without investment funds). In the left-hand panel, relative shares of each asset class are given. In the right-hand panel, the data are normalized such that asset class shares in 2012 are equal to 100. Annual data are obtained from averaging quarterly balance-sheet data.Data sources: ECB, Euro area accounts.

The measures which we employ comprise information about (i) liquidity risk, (ii) asset maturity risk, (iii) credit risk and (iv) a simple leverage measure, results being presented in Figure 6. Liquidity risk is measured as one minus the ratio of currency and deposits, short-term debt, listed shares, investment fund shares and financial derivatives to total assets. While this measure has remained fairly stable for both MFIs and OFIs including investment funds it indicates a slight, but steady increase of risk for OFIs excluding investment funds over the reference period. And, obviously,

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this is in line with our hypothesis of investment behavior in a low-rate context.

Figure 6: Balance-sheet risks of financial intermediaries

Notes: Figure 6 plots various risk measures of activities of monetary financial institutions (MFI) and other financial intermediaries including (OFI) and excluding (OFIwoIF) investment funds employing sectoral balance-sheet data. Asset liquidity risk corresponds to one minus the ratio of currency and deposits, short-term debt, listed shares, investment fund shares and financial derivatives to total assets. Asset maturity risk is computed as the ratio of long-term debt securities, long-term loans, unlisted shares and insurance and pension guarantee schemes to total assets. Credit risk reflects the ratio of loans to total assets. Leverage is computed as the ratio of total assets to shares and other equity (the left-hand y axis indicates the numbers for the MFI sector, whereas the right-hand y axis those for the other sectors). Data sources: ECB, Euro area accounts.

For the latter sector, our measure of asset maturity risk, computed as the ratio of long-term assets over total assets, provides a similar picture as for liquidity risk. Again, we observe a mild, but steady increase since 2012Q4 when data became available. For OFIs including investment funds, an increase between 2011 and 2014 can be observed. Since then, eposure to maturity risk has declined though.

Concerning credit risk, approximated by the ratio of loans to total assets, again a somewhat heterogeneous picture emerges. While numbers have slightly declined for the OFI sector including investment funds a relatively clear upward trend can be observed when we exclude investment funds. For the MFI sector, we detect a similar pattern as for the previous measures: there is a drop between 2011 and 2012Q2

followed by a slight increase which appears to have faded out in recent quarters.

The measure for leverage (constructed as the ratio of total assets to equity and shares) shows similarities in the dynamics, but differences in levels across the OFI and the MFI sectors. Not surprisingly, leverage for OFIs including investment funds is considerably smaller than excluding them. Whilst the former is more or less constant throughout our sample period the latter shows a mild upward tendency. Leverage in the MFI sector is highest in absolute values but has declined considerably in recent years.

In sum, statistics presented in this section provide suggestive evidence in favor of an increase in riskiness in the OFI sector excluding investment funds. This is compatible with the claim that low interest rates induce intermediaries to take more risk.

5 Summary and conclusions

The historically low-interest-rate environment together with the substantial overhaul of the regulatory and supervisory landscape have posed enormous challenges for Euro Area's financial intermediaries. Focussing on non-bank banks, often also called shadow banks, the purpose of this study was to provide an assessment of recent trends in activities of nonbank financial intermediaries within the Euro Area in this environment.

Our main findings are as follows. We can confirm previously made propositions, showing flow-of-funds based evidence of a strong increase in activities of non-bank banks as indicated in particular by data on the OFI sector (both including and excluding investment funds). While regulatory changes certainly play an important role for this shift in relative importance of financial intermediary activities, the low-interest environment may have also contributed to it.

In line with the hypothesis that low-interest rates induce more risk taking on the side of investors we document an increase in the relative proportion of shares in OFIs portfolios.

Secondly, sectoral balance-sheet risk measures indicate increased values of liquidity, maturity and credit risk for the narrowly defined OFI sector where these values for the more widely defined sectors have remained stable or have even slightly decreased.

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A   The risk taking channel of monetary policy - Short literature review

The risk-taking channel of monetary policy has received considerable attention in recent years. According to Altunbas et al. (2014), there are several mechanisms which could give rise to such a risk-taking channel of monetary policy. Firstly, the increase in the value of assets, collateral, income and cash-flows which is very often associated with a reduction in the policy rate can reduce banks' estimates of default probabilities and volatilities in loan portfolios. As a consequence, their risk tolerance and thus risk-taking may increase, with the consequence that loans are extended to borrowers who had not been considered before due to a perceived too-high default risk.[24] Ruckes (2004) and Dell' Ariccia and Marquez (2006) argue that lower policy rates may reduce the incentives of banks to screen their borrowers. Since 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 lead to what Rajan (2005) labelled as a "search for yield" on the side of financial intermediaries. According to this line of argument, asset managers take on more risks in an environment of low (nominal) interest rates which is associated with relatively lower (nominal) returns on investments. Rajan (2005) ascribes this search for yield to behavioral, contractual and/or institutional reasons which are broadly related to the market structure in banking sector (degree of competition), to the design of remuneration system for loan officer and management as well as to shortcomings and deficiency in banking supervision and regulation.

Campbell and Cochrane (1999) argue that the impact of monetary policy on risk-taking behavior might result from investors' habit formation. They show that risk aversion declines in periods of relatively high consumption. Given that low interest rates boost the economy and - as a consequence - lead to relatively high consumption the degree of investors' risk aversion may lower in response to monetary easing and thus may translate into increased risk-taking.

Another approach to explain the existence of a risk-taking channel relates to the conduct of monetary policy and the communication policies of a central bank. Diamond and Rajan (2009), e.g., suggest a possible insurance effect of monetary policy for the case that monetary policy decisions become more predictable and that agents expect that the central bank will ease monetary policy in the event of bad economic outcomes. As a result, incentives are provided to banks to increase their

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[24]For further references on this point, also see Adrian and Shin (2009a) and Borio and Zhu (2012).

risk-taking behavior.

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 that contains comprehensive information on both loan demand by firms as well as loan supply by banks over the period 1984-2006. Their findings suggest that, in the short term, a reduction of the policy rate is followed by a decrease in the default probability on outstanding loans (at variable interest rate) since borrowers' interest burdens are reduced. In the medium-term, however, banks tend to grant more risky loans in response to a monetary ease as lending standards soften due to a search for yields and improved values of collaterals. In total, the empirical evidence in Jimenéz et al. (2014) on the Spanish banking market provide evidence of 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 loose monetary policy on the quantity of new loans (increase) and on the interest rate charged for these new loans (relative reduction). They again find evidence in favor of the theoretical considerations outlined above.

Altunbas et al. (2014) analyze banks' balance sheet information across 16 countries over the period 1998-2008. Employing different measures of 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 translates 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 so-called "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 issuing marketable debt instruments. In the presence of mark-to-market accounting, the monetary policy transmission via these institutions is according to Adrian and Shin (2010) then 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., the interest rate decreases, the term spread increases making additional lending profitable. As a consequence, the net interest rate margin, i.e., the difference between the total interest income on the asset side of the intermediary and the interest expense on the liabilities sides of its balance sheet raises inducing an increase in the forward looking value of its capital. The higher capital base increases the risk-taking capacity of the intermediary and induces it to extend 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) show that the balance-sheets of the latter two help to explain future real activity better than fluctuations of traditional banks, indicating 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 the intermediaries.

In another interesting, very 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) increase it. The authors denote this phenomenon as "waterbed effect" and explain it with an increased securitization activity by shadow banks after an increase in the interest rate.

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. Similarly, Choi and Kronlund (2015) document reach-yor-yield behavior also for U.S. bond mutual funds.[25]

B   Contingent-claims analysis

CCA represents a generalization of the option pricing theory pioneered by Black and Scholes (1973) and Merton (1973). It has been used comprehensively to value contingent claims, i.e., financial assets whose payoff depends on the future value of other assets. CCA rests on Robert Merton's ingenious insight that the position of stock owners can be understood as holding a call option on the firm which they will only exercise (i.e. buy back the firm from its creditors) is larger than its debt. The required debt payment is effectively the strike price of this call. In a similar, actually exactly corresponding vein, bondholders have written a put. And rational stockholders default whenever the value of assets falls below a well-defined barrier

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[25]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.

(Merton, 1974), at least in theory.[26]

The intuition underlying this idea can be illustrated using **??** which is taken from Gray et al. (2007, Figure 1a). On the y axis, the value of a firm's total assets, denoted by A_t, is plotted. Returns are assumed to follow a stochastic process given by:

$$\frac{dA}{A} = \mu_A dt + \sigma_A \varepsilon \sqrt{t}, \tag{1}$$

where μ_A denotes the drift rate, σ_A represents the standard deviation of the asset returns and ε is an i.i.d. normally distributed increment with mean zero and unit variance. Promised payments of the firm correspond to the face value of its debt. For a given initial asset value, A_0, a certain probability distribution of the values of A in period T arises, reflecting uncertainty about that period's realization of A. As can be seen in the graph, with a certain probability, denoted as "actual probability of default", the firm will not be able to fully serve its debt obligations because the realized asset value A_T is smaller than B, the promised payments. Given the assumption of normally distributed increments, the probability that this occurs is given by:

$$P\left(A_T \leq B\right) = P\left(A_0 \exp\left[\left(\mu_A - \sigma_A^2/2\right)T + \sigma_A \varepsilon \sqrt{T}\right] \leq B\right) = P\left(\varepsilon \leq -d_{2,\mu}\right) = N\left(-d_{2,\mu}\right),$$

with

$$d_{2,\mu} = \frac{\ln\left(A_0/B\right) + \left(\mu_A - \sigma_A^2/2\right)T}{\sigma_A\sqrt{T}}$$

and $N\left(\cdot\right)$ representing the cumulative normal distribution. This shows the probability of debt repayment depending on the value of the firm's assets at T. It is risky due to the volatility in the prices of the firm's assets.

To price the value of the debt, CCA assumes that there exists a (European) put option on the firm's assets with a strike price equal to the face value of the debt at maturity T. Given that this put option can be employed to serve as a guarantee against default, in the absence of arbitrage opportunities the value of the debt plus the value of the guarantee, i.e., the price of the put option, is equal to the value of the default-free value of the debt. Considering on the other hand the situation of equity holders it is clear that the value of equity also depends on the value of the total assets at period T: it corresponds to the difference between the value of total

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[26]For excellent expositions, see Hull (2012) or Saunders and Allen (2010).

assets and the face value of debt if the former is larger and is zero otherwise. In other words, equity has the same payoff as an implicit call option on the firm's total assets with strike price equal to the face value of debt and maturity T.

Following Gray et al. (2007), we make use of this perspective in evaluating liabilities of economic sectors which we consider to represent either a portfolio of individual entities or one large entity. Liabilities, equity and total assets are then related to the aggregate balance sheet of this sector and are approximated as described below.

In the following, a more formal exposition of the approach will be given.[27] Denoting a sector's total assets in a particular period by A, its junior claims (equity) by J and the value of its risky debt by D, we have[28]

$$A = J + D. \tag{2}$$

As outlined above, the junior claims of a sector are interpreted as an implicit call option on the assets, with an exercise price equal to the promised payments, B, maturing in T periods. The risky debt, D, is equivalent in value to default-free debt minus a guarantee against default. This guarantee is calculated as the value of a put on the assets with an exercise price equal to B as follows:

$$D = Be^{-rT} - P, \tag{3}$$

where P denotes the put price. The value of the junior claims is then computed using the Black-Scholes-Merton formula for the value of a call and is given by:

$$J = AN\left(d_1\right) - Be^{-rT}N\left(d_2\right), \tag{4}$$

with

$$d_1 = \frac{\ln\left(\frac{A}{B}\right) + \left(\mu_A + \frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}} \tag{5}$$

$$d_2 = d_1 - \sigma_A\sqrt{T}, \tag{6}$$

where σ_A denotes the implicit volatility of a sector's assets. Following Castrén and Kavonius (2009) and Gray et al. (2007), the real drift of the asset, μ_A, is related to the risk-neutral asset drift, r, by $\mu_A = r + \lambda\sigma_A$, where λ denotes the market price of

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[27]This exposition closely follows Gray et al. (2007).

[28]For notational ease, we have dropped time indices. The current time period, t, is set equal to 0.

risk.[29] To obtain – back out – the unknown implicit values of a sector's assets, A, and its assets' volatility, σ_A, we additionally use

$$\sigma_J J = N(d_1) A \sigma_A \tag{7}$$

and solve Equations (4) and (7) for A and σ_A using a standard nonlinear optimization routine.

B.1 Evidence on sector-level default risk indicators

The assessment of sectoral risks in the previous section was based on the "book values" of assets. However, as Gray et al. (2007) convincingly argue, such an approach is only sensible in a deterministic, however not a stochastic world. In the following, we address this issue and employ contingent-claims analysis (CCA) at an economic sector level and combine the balance-sheet information of the flow-of-funds data with proxies for the respective sectors' equity volatility. Thus, we replace each sector's "traditional accounting balance sheet" (Jobst and Gray, 2013) by a "risk-adjusted (CCA) balance sheet."

Employing data on the volume of a sector's equity (junior claims), J, their volatility, σ_J, and the value of the sector's debt level (default barrier, B) the option-pricing based contingent claims analysis allows us to compute a measure for the riskiness of the entire sector. The values we use for this purpose correspond to the ones employed by Castrén and Kavonius (2009) who for their part essentially follow MKMV (2003) and Gray et al. (2007).[30]The values for the junior claims (i.e. equity, that is, claims on residual income) and the default barrier are obtained from the flow-of-funds data. Junior claims are defined as the sum of equity and net financial wealth (defined as a sector's total assets minus total liabilities).

The default barrier, B, is computed as the sum of a sector's short-term liabilities plus one half of its long-term liabilities where short-term liabilities are given by currency and deposits, short-term loans and debt securities, derivatives instruments and other accounts and receivables and long-term liabilities include long-term debt securities and loans, mutual fund shares.
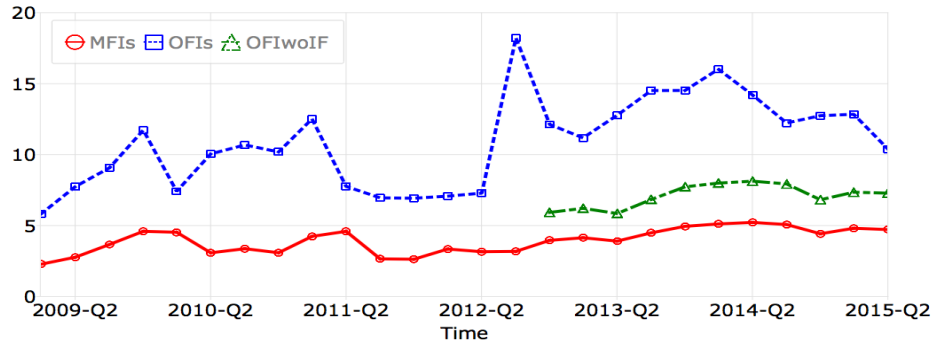
The volatilities of junior claims, σ_J is given by the implied volatilities of the sector-level stock indices for banks. Finally, we adopt the convention that λ, i.e. the market price of risk, is fixed at 0.45, corresponding to the global long-term average

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[29]See Gray et al. (2007, Annex: Extensions of the Merton Model) for more details on the derivation of this relationship.

[30]We have also conducted some sensitivity analyses, available upon request.

value as calculated by Moody's KMV.[31]

Figure 7: Distance to distress

Notes: Figure 7 plots the distance-to-distress measures ($d2$) for monetary financial institutions, insurance companies and pension funds and other financial institutions.
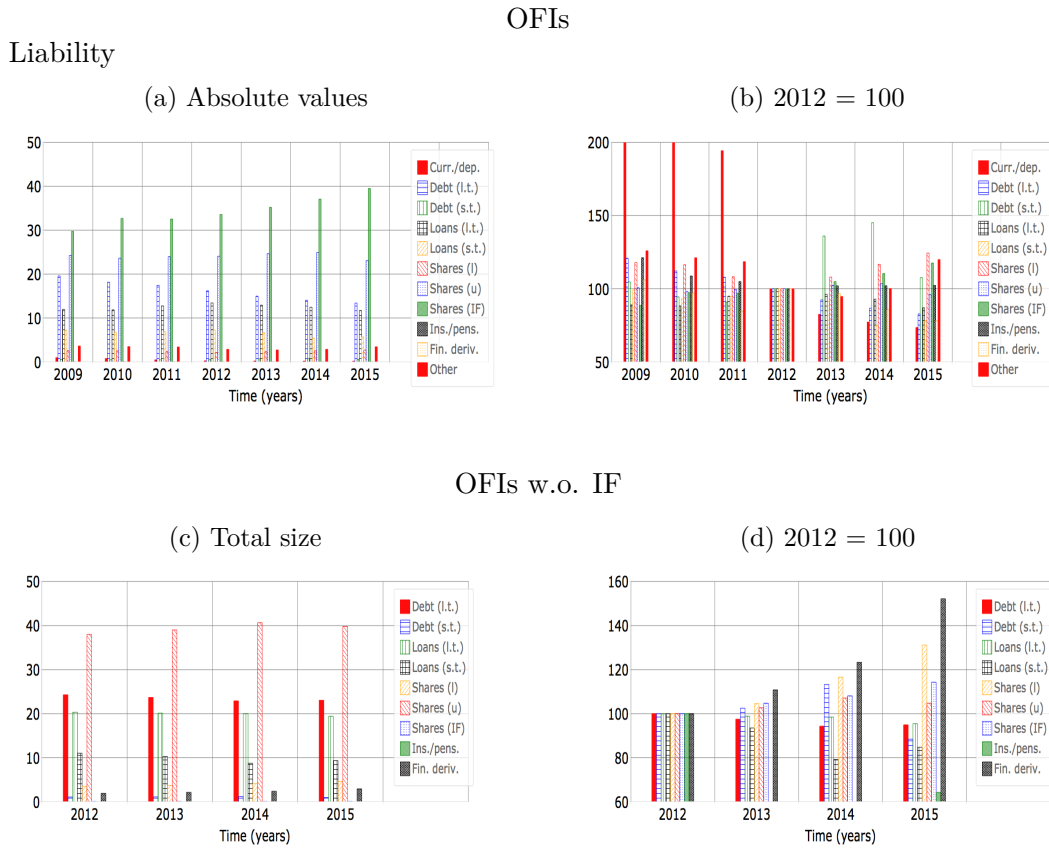
The distance-to-distress measures ($d2$), presented in Figure 7, exhibit at least three noteworthy features: first, values for all three sectors move remarkably in parallel. They exhibit a continuous downward trend from 2004 until the end of 2008 when they reach their respective global minima in the considered sample period, reaching from 2 for the MFI and ICPF sectors to around 3 for the OFI sector. From the beginning of 2009 onwards until around the mid of 2011, values increase but decline again afterwards. Since the third quarter of 2012, they experience a considerable upward trend with a small decline in all sectors in the last period covered. Secondly, and most interestingly, default probability in the OFI sector has always been lowest throughout the sample period and almost always highest for the MFI sector (apart from some phases at the beginning of the sample period). Thirdly, variations in default probabilities are much more pronounced in the OFI sector than in the other two sectors.

Overall, the findings obtained from the CCA provide instructive insights. All movements in the computed risk indicators can be intuitively traced back to developments in the Euro Area which can account for these changes both qualitatively and quantitatively. Most interestingly, problematic events are not only indicated "ex post", but tendencies towards a deteriorating situation can regularly be detected already some time in advance. In this respect, the observable drop in distance-to-distress values which occurred in the last two sample periods merits careful monitoring.

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[31]Results turn out not to be very sensitive to smaller changes in this value.
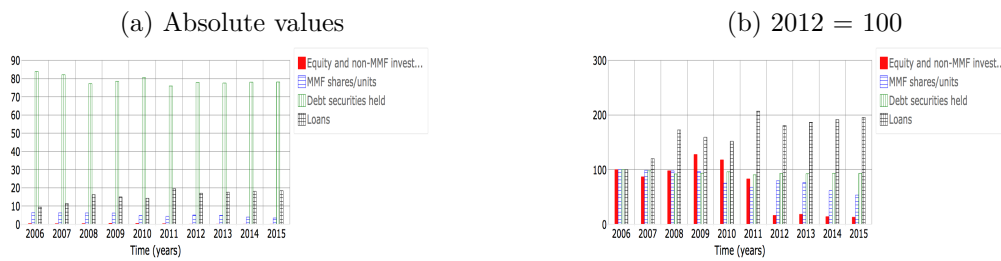
C   Appendix - Additional figures

Figure 8: Liability balance-sheet positions of non-bank banks

OFIs

Liability

(a) Absolute values

(b) 2012 = 100

OFIs w.o. IF
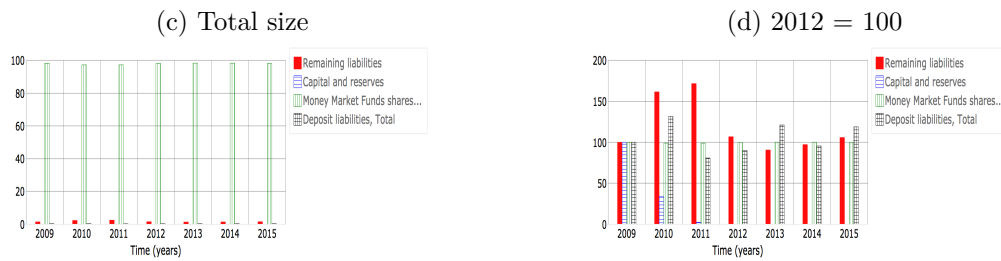
(c) Total size

(d) 2012 = 100

Notes: Figure 8 plots liability balance-sheet positions of other financial intermediaries (with and without investment funds). Data sources: ECB, Euro area accounts.

Figure 9: Assets and liabilities of money market funds (MMFs)

Assets

(a) Absolute values

(b) 2012 = 100

Liabilities

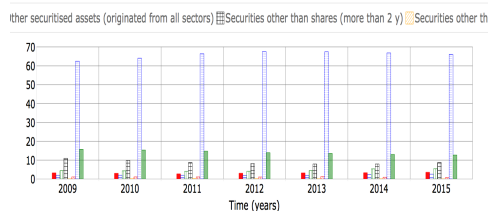(c) Total size

(d) 2012 = 100

Notes: Figure 10 plots balance-sheet positions of money market funds. Data sources: ECB, Monetary and financial statistics.
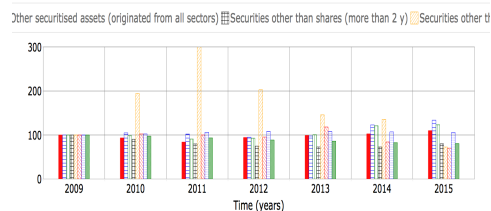
28

Figure 10: Assets and liabilities of financial vehicle corporations (FVCs)

Assets

(a) Absolute values

(b) 2012 = 100

Liabilities

(c) Total size

(d) 2012 = 100

Notes: Figure 10 plots balance-sheet positions of financial vehicle corporations. Data sources: ECB, Monetary and financial statistics.

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