3. INTERCONNECTEDNESS BETWEEN BANKS AND MARKET-BASED FINANCING ENTITIES IN LUXEMBOURG

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ABSTRACT

This study focuses on the interconnectedness between banks and market-based financing entities in Luxembourg. The market-based financing entities group within this study includes other investment funds (OIFs), money market funds (MMFs) and securitisation vehicles. Although some domestic banks have notable exposures toward the OIF sector, the network analysis demonstrates that overall the domestic banking sector's exposure to market-based financing entities is rather limited. On the liability side, domestic OIFs account for a significant share of banks' liabilities. OIFs mostly provide banks with short-term liquid funding which is more susceptible to withdrawals and seem to have contributed more to the variations of banks' liabilities since the collapse of Lehman Brothers. Most banks showing high levels of OIF funding are either foreign branches or relatively small banks, while domestically oriented banks appear to have a very low level of funding stemming from market-based entities. However, for banks more considerably reliant on OIF funding a thorough assessment is warranted in order to determine whether they maintain adequate levels of liquidity buffers as regards the potential withdrawal of funding from the OIFs.

1. INTRODUCTION

Close ties between different components of the financial sector have the potential to generate systemic risk. Modern financial markets have become more complex and involve a collection of interconnected institutions which are increasingly interdependent. Shocks impacting one sector can spill over to other sectors and provoke illiquidity, losses and insolvency. The interconnectedness between the domestic banking sector and *market-based financing entities*[16] – the group consistent of other investment funds (OIFs), money market funds (MMFs) and securitisation vehicles – is important for regulators given that shocks impacting the market-based financing entities could potentially affect the funding of the real economy.

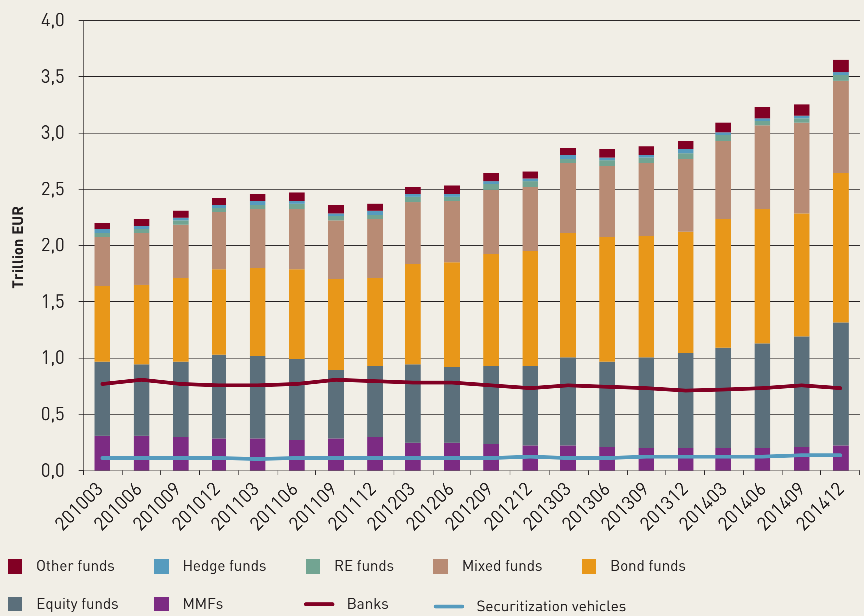
The banking sector is directly connected to market-based financing entities through two channels. Firstly, banks are exposed to the market-based financing entities through various kinds of assets with specific characteristics implying different risks. Consequently, if negative shocks occur in the market-based financing entities, banks may encounter losses. Secondly, banks receive funding from the market-based financing entities. The liabilities can take different forms and the more liquid they are, the faster they can be withdrawn in case funds would need them to absorb any negative shocks. Luxembourg domestic banks' asset exposure toward market-based financing entities have remained contained in the past few years while, at the same time, the share of banks' obligations toward the market-based financing entities has increased. Therefore, it is crucial to analyse the nature and the extent of domestic banking sector asset and liability exposures to market-based financing entities.

The note builds upon the network of domestic banking sector and market-based financing entities in order to interpret the network structure and observe the channels potentially propagating shocks. Then, we analyse the exposures to market-based entities through the asset and the liability sides of bank

15 Financial Stability Department, *Banque centrale du Luxembourg.*
16 *More commonly referred to also as the shadow banking system entities.*

Chart 1

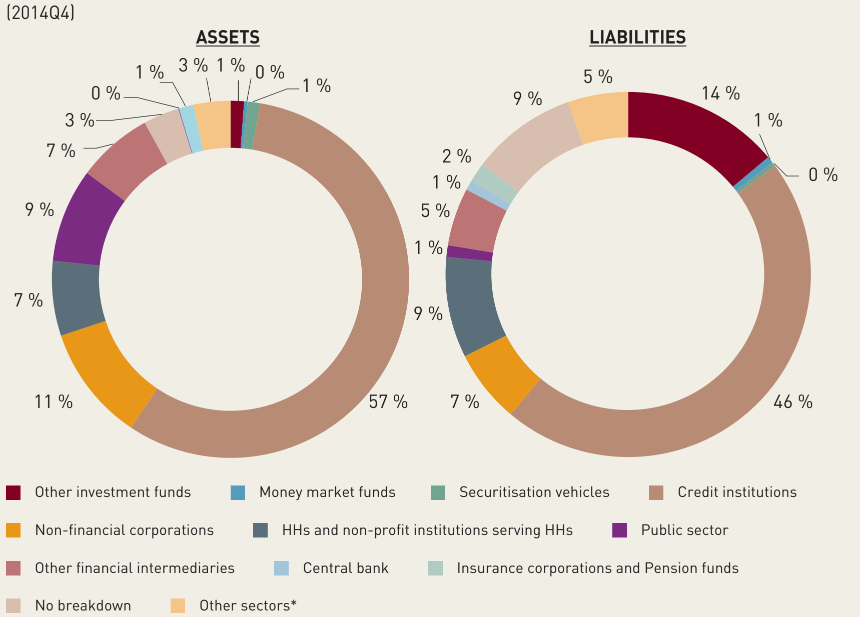
Total assets for Luxembourg banking sector and market-based financing entities total assets (2010Q1 to 2014Q4)



Source: BCL

Chart 2

Sector distribution of Luxembourg banks assets and liabilities (2014Q4)



Source: BCL

**Note: Other sectors include International institutions except the ECB, Financial auxiliaries, Securitisation institutions, Central counterparties, and Other MFIs.*

balance sheets. Subsequently, we study the interconnectedness between banks and investment funds from a fund's perspective. Finally, we develop an indicator framework to evaluate the level of credit and funding risks throughout the domestic financial sector.

2. GENERAL OVERVIEW OF THE DOMESTIC BANKING SECTOR AND THE MARKET-BASED FINANCING ENTITIES WITHIN LUXEMBOURG

The fund industry has grown by 66% in the past four years, as observed in Chart 1. The most significant increases in the value of assets under management have been reported by the funds specialising in bond investments, as well as mixed funds. In the observed period, assets under management for bond funds have doubled in size, whereas the mixed funds recorded growth of 85%. Equity funds grew by about 67%, while hedge funds shrunk their total assets under management by about 4%.

The balance sheets of the domestic banking sector and MMFs declined in the observed period. The assets of banks went down by about 5%. The MMF industry recorded a drop in assets under management of 28%, which is most likely related to the protracted low yield environment at the short end of the yield curve. Finally, we observe that total assets reported by securitisation vehicles have increased by approximately 20% since year 2010, although they remain relatively modest.

Panels (a) and (b) of chart 2 display the asset and the liability exposures (as a proportion of total assets and liabilities respectively) of the Luxembourg banking industry to various sectors for assets and liabilities. In 2014Q4, funding from OIFs accounts for approximately 14% of Luxembourg banking industry's total liabilities, whereas the share of funding from MMFs accounted for merely 0.6% of total liabilities. The contribution of securitisation vehicles amounted to only about 0.4% of total domestic banking sector liabilities in 2014Q4.

Domestic banks' have less exposure to the OIFs on the asset side. Investments in OIFs and securitization vehicles each represented about 1% of total domestic banking sector exposures. The MMF exposure corresponded to a mere 0.3% of aggregate domestic bank balance sheet size.

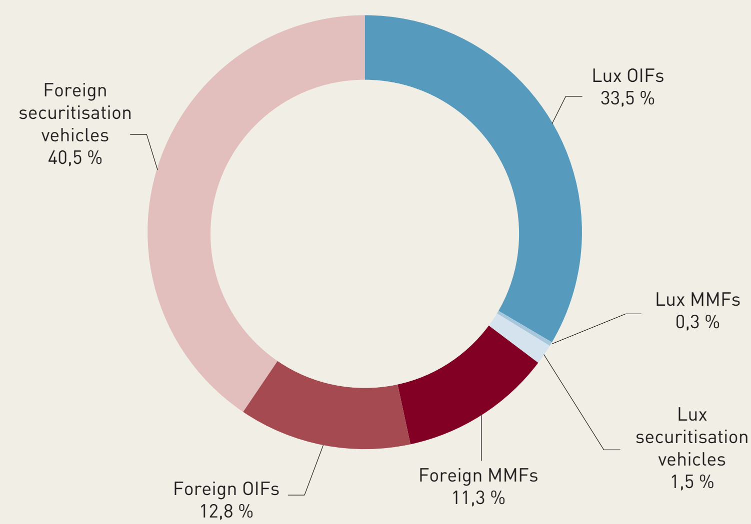
3. NETWORK ANALYSIS

The aim of the section is twofold. First, we want to provide a visual representation of the interconnectedness between the domestic banking industry and the market-based financing entities domiciled in Luxembourg and abroad. An additional objective is to address the proportion of exposures of domestic market-based financing entities to domestic/foreign banking sector.

3.1 Share of domestic bank investments in domestic/foreign market-based financing entities

- **Predominately foreign exposure**

Chart 3
Domestic bank investments in domestic and foreign market-based financing entities
(of total exposure, 2014Q4)



Source: BCL

Domestic banks are inclined to invest in foreign market-based financing entities. The share of domestic market-based financing entities was about 35% in 2014Q4. Nevertheless, when the domestic banking sector exposures toward market-based financing entities are decomposed into separate subsectors, an uneven geographical distribution appears. In terms of MMF and securitisation vehicle exposures, Luxembourg banks tend to invest abroad (about 97% of total MMF investments and about 96% of total securitisation vehicle exposures), whereas a larger proportion of investments in OIFs are invested domestically (about 72% of total other investment fund exposures).

3.2 Network of domestic banking sector exposures to domestic/foreign market-based financing entities

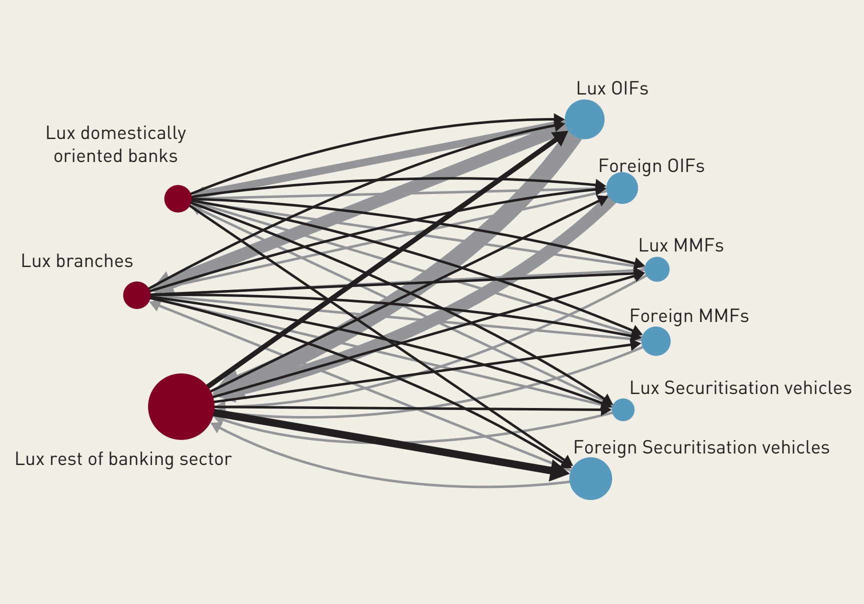
The directed networks displayed in Charts 4 and 5 are a visual representation of aggregate nominal exposures of the Luxembourg banking sector vis-à-vis domestic/foreign market-based financing entities in 2014Q4. The arrows in black indicate the part of the network under review. The *thickness* of the lines connecting the vertices reflect the proportion of nominal vertex exposure vs. aggregate nominal value of exchanged funds (low: thin, high: thick) within the network.

The market-based financing entities are represented by the light blue vertices. The sizes of vertices are determined by the proportion of the funds provided (in the case of the banking sector in Chart 4) or the received funds (in the case of market-based financing entities in Chart 4) to the total volume of transactions within the observed network.

Luxembourg credit institutions, represented by dark blue vertices, are split into three clusters: (i) *domestically oriented banks* – this cluster is composed of 7 credit institutions that form a group of entities which are closely intertwined with the real economy in Luxembourg, (ii) *foreign branches* – this cluster is composed of 9 credit institutions which are significant due to their low levels of equity and significant degree of parent bank involvement at different levels, as opposed to managing subsidiaries, which are considered to be separate entities from their parent banks with regulatory required minimum capital levels; and (iii) *rest of the banking sector entities* – the cluster counts 59 credit institutions, which do not qualify as any of the two groups previously specified (e.g. domestic banks or subsidiaries of foreign banking groups which do not have extensive links with the domestic real economy).

Splitting the vertices into clusters, based on the level of interconnectedness, provides a clearer view on the potential spill-over effects to the real economy in case vulnerabilities developed in any of the nodes representing the market-based financing entities. For example, the domestic real economy is much more reliant on credit issued by domestically oriented banks than by branches and other credit institutions located in Luxembourg. Therefore, a shock originating from market-based financing entities could be managed and contained if the group of domestically oriented banks was not significantly exposed.

Chart 4
Network of Luxembourg bank investments toward foreign and domestic market-based financial entities (2014Q4)



Source: BCL

- **Gravitating toward domestic OIFs and foreign securitisation vehicles**

The combined Luxembourg banking sector exposure to market-based financing entities, and hence also the network size, is about 18 billion euros. The proportions of domestic banking exposures to market-based financing entities are exhibited by the sizes of nodes representing each cluster of credit institutions: (i) *domestically oriented banks* have an 8% share, (ii) *foreign branches* have a 6% share, and *rest of the domestic banking sector* has an 86% share.

The majority of the domestic bank investments are concentrated in domestic OIFs and foreign securitisation vehicles, the two clusters account for about 74% of total domestic bank investments in market-based financing entities.

From Chart 4 it can be observed that *Luxembourg foreign branches* have no significant exposure to domestic MMFs. The MMF sector in general exhibits the smallest degree of exposure, representing about 11% of total domestic banking sector exposures. The bulk of this exposure arises from a single bank within the cluster denoted by *rest of banking sector*, which accounts for about 95% of total MMF exposures. One additional significant single-bank exposure within the cluster of *rest of banking sector* is an exposure of about 4 billion euros toward the foreign securitisation vehicles cluster, which at the same time is the largest single exposure in the entire network, itself representing about 22% of the network size.

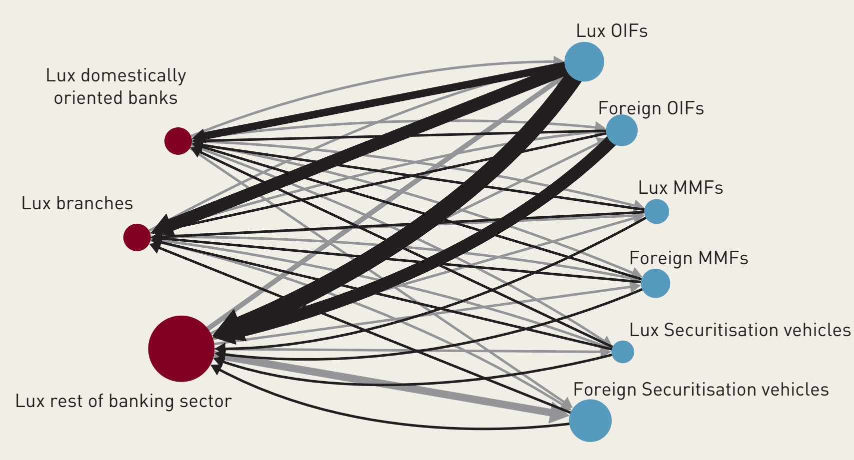
- **Domestic OIFs represent the most significant source of funds among market-based financing entities**

The network in Chart 5 displays the liability exposures of banks to domestic/foreign market-based financing entities. Banking sector nodes dimensions are determined by the proportion of total borrowed funds (cluster borrowed funds vs. total borrowed funds), while the market-based financing entities node sizes are determined by the proportion of transferred funds to total transferred funds. The total size of the network in Chart 5 was about 104 billion euros, which is almost 6 times larger than the network discussed in Chart 4.

The group of banks within the cluster representing *rest of domestic banking sector* have been the receivers of the largest share of funds in 2014Q4, accounting for about 81% of total borrowed funds from the market-based financing entities. Main providers of funds were the domestic OIFs; contributing about 75% of total market-based financing entities funds. The total OIF sector (domestic and foreign OIFs combined) accounted for about 93% of the network size. As a share of total borrowed

Chart 5

Network of Luxembourg bank funds received from foreign and domestic market-based financing entities (2014Q4)



Source: BCL

funds from market-based financing entities, the allocation of OIF sector funds across banking sector clusters is the following: (i) *domestically oriented banks:* 82%, (ii*) foreign branches*: 86%, (iii) *rest of the banking sector*: 95%.

3.3 Network of domestic market-based financing entities exposures to domestic/foreign banking sectors

The network analysis of aggregated sectors is a good starting point to develop a broad understanding of the degree and magnitude of links between different counterparties' components of the financial sector network. However, the next step is to disaggregate[17] the "*Lux OIF*" node into the individual components constituting this vertex, namely all the various types of funds. A more granular perspective of the network provides a more detailed view and a clearer perception of potential risks originating within the domestic fund industry. The network in Chart 6 and Chart 7 also includes the foreign banking sector dimension, which has not been included in the analysis so far. Similarly to the directed network above in Chart 4 and Chart 5, the arrows in black should indicate which entity is investing in the other.

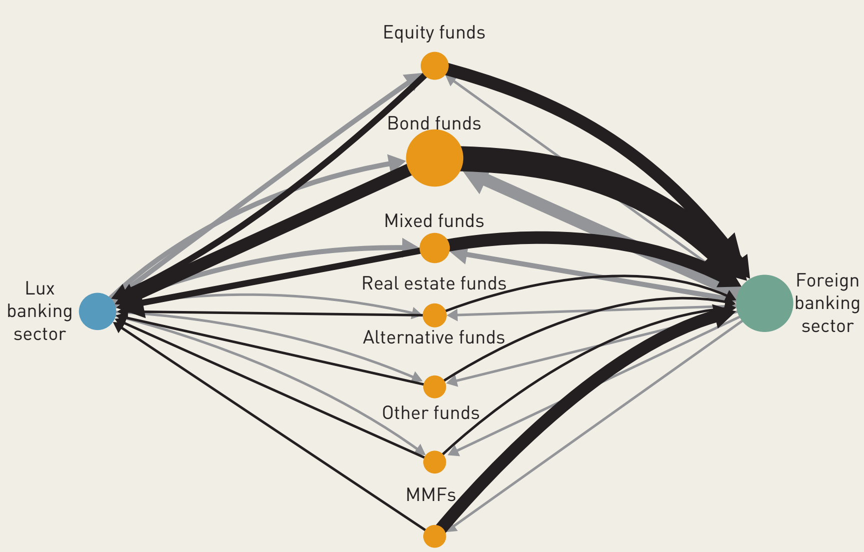
- **The big bond funds**

With the foreign banking sector component included in the interconnectivity analysis, the nominal value of flows[18] within the network becomes much larger. The exposure of the domestic fund industry toward the banking sector network (foreign bank exposures included) has nominal flows of 831 billion euros versus 96 billion euros (excluding the securitised vehicles exposures) in the previous network. Therefore, about 13% of the fund transactions conducted by the domestic fund industry is with the domestic banks.

Bond funds are the most exposed component of the domestic fund industry to the banking sector, with the vast majority of exposures toward foreign bank entities (about 35% of the entire network). The largest exposure within the fund industry to the domestic banking sector is held by bond funds and amounts to 36% of combined domestic bank exposures. The second largest exposure of 31% is held by mixed funds.

Chart 6

Domestic market-based financing entities exposures toward domestic/foreign banking sector by fund type (2014Q4)



Source: BCL

17 *In order to perform a more detailed analysis, the existing reporting framework was not sufficient due to limited granularity options. An additional reporting source had to be included to perform a more granular analysis of fund industry exposures. For the same reason, the more granular fund industry network analysis does not include securitised vehicles exposures within the network. Therefore the main focus of the network analysis below is the fund industry as opposed to all market-based financing entities.*

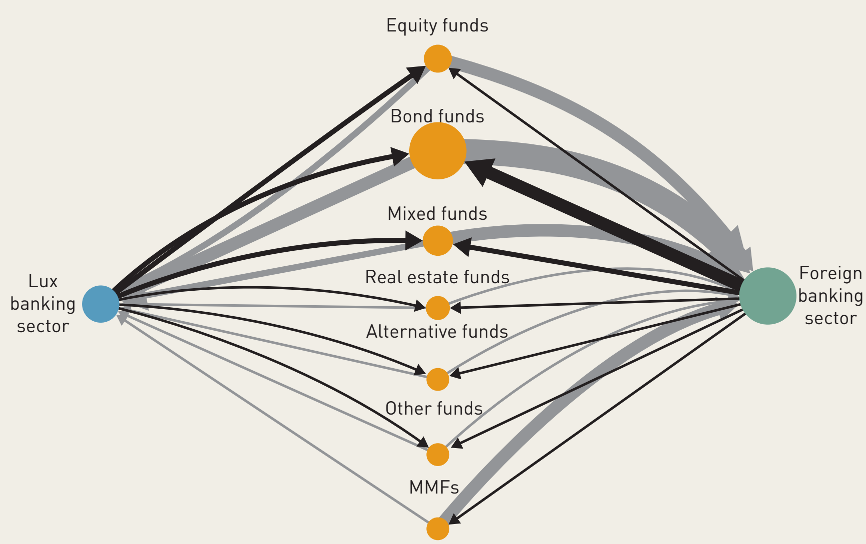
18 *The domestic fund industry exposures to the banking sector include nominal values of derivatives.*

3.4 Bank exposures toward OPC sector by fund type

The network of bank exposures vis-à-vis the fund sector is much smaller in terms of aggregate flow of funds than the network of fund sector exposures toward banks. In total, bank exposures to the fund industry add up to 223 billion euros, with the domestic banking sector exposures representing about 8% of the total. The most significant exposure of the domestic banking sector is bond funds, which account for roughly 44% of the total domestic banking sector exposures versus 30% for mixed funds and 17% for equity funds.

On the other hand, foreign banks invest predominately in bond funds (76% of total foreign bank investments) and mixed funds (12% of total foreign bank investments) funds.

Chart 7
Domestic/foreign banking sector investments toward domestic market-based financing entities by fund type
(2014Q4)



Source: BCL

4. DOMESTIC BANKING SECTOR INVESTMENTS TOWARD MARKET-BASED FINANCING ENTITIES

This section provides a detailed analysis of domestic bank exposures to market-based financing entities. Luxembourg bank exposures toward market-based financing entities are first examined by asset type. Then the market-based financing entities' investments are split into three parts: (i) OIFs, (ii) MMFs, and (iii) securitisation vehicles exposures. Furthermore, the three segments of market-based financing entities are examined through: (i) historical observation of domestic and foreign investment flows, (ii) individual bank exposures to each of the constituents of the market-based financing entities group, and (iii) geographical breakdown of domestic banking sector investments in market-based financing entities.

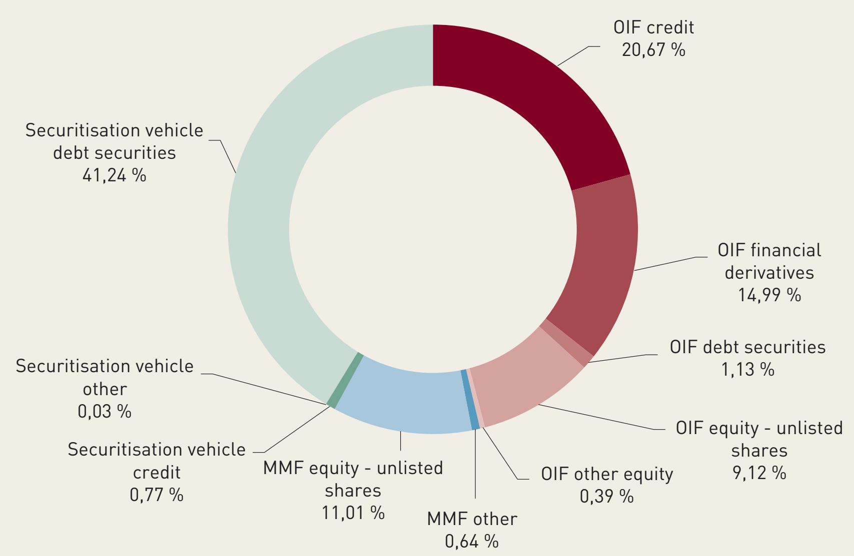
4.1 Bank investments in OPC sector by asset types

- **Buying securitised bonds and lending to OIFs**

Within the Luxembourg banking sector, investments in securitised debt are the most common type of exposure to the market-based financing entities, as displayed in Chart 8. Furthermore, credit to OIF entities accounts for about 21% of total exposures. Holdings of unlisted MMF and OIF shares are also commonly reported investments among domestic banks. In addition, domestic banks quite frequently act as counterparties in various financial derivatives transactions with OIFs.

Chart 8

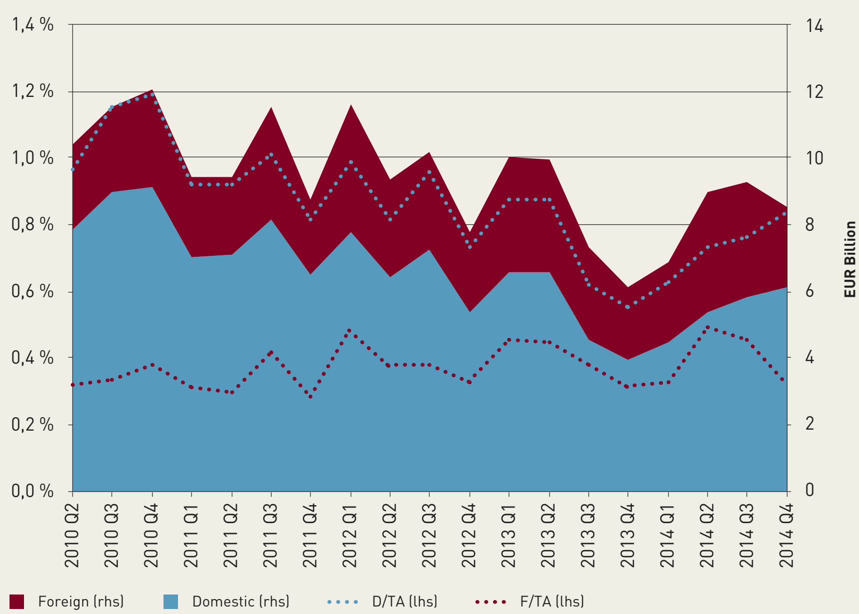
Luxembourg bank exposures to OPC and market-based financing entities by asset types (2014Q4)



Source: BCL

Chart 9

Ratio of bank investments in OIFs to Luxembourg banking assets



Source: BCL

4.2 Banking sector investments in OIFs

- **Trending down, but strong increase in 2014**

Luxembourg bank investments in OIFs account for a considerable share of total market-based financing entities investments (approximately 46%). A closer look at historical developments reveals a declining trend of domestic bank exposures toward OIFs – total exposure toward the OIF sector has diminished from 10.4 billion euros in 2010Q2 to 8.5 billion euros in 2014Q4. However, the exposures to domestic OIFs have marked an increase in most recent quarters, as observed on Chart 9, whereas exposures toward foreign OIFs decreased to a certain extent (demonstrated by dashed lines in Chart 9 – signifying the ratio: *total domestic/foreign exposures to OIFs vs. total domestic banking sector assets*).

Charts 10 and 11 display the exposures of individual banks to OIFs, relative to (i) total assets and (ii) total equity[19]. The exposures to the OIF industry are not highly concentrated. Banks display

19 *Total equity reference stands for total own funds, but is considered to be an accounting item rather than a regulatory item. This approach was adopted in order to include branches in the analysis when individual bank exposure to market-based financing entity is measured up against its total equity. Namely, branches are not bound to report their regulatory capital; hence some of the banks would have been left out of the analysis if the regulatory own funds definition would have been applied. However, Chart 18 includes also the CET 1 in addition to total equity and total assets as a measure of risk when considering individual bank exposures to market-based financing entities.*

relatively modest investments to the OIF industry in terms of the proportions of their total asset size. Approximately half of banks within the domestic banking system had exposures toward the OIF industry, but only 12 banks surpassed the threshold of 5% in total OIF exposures to total balance sheet size.

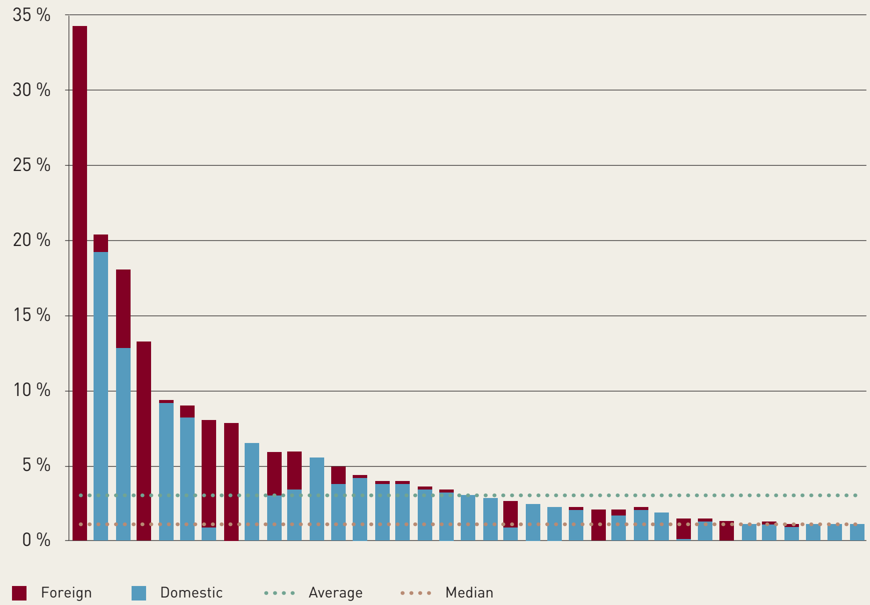
Eighteen banks have exposures to OIFs greater than 50% of their total equity; half of those banks have exposures to OIFs which surpassed their total equity. The average and median values of the distribution are 41% and 12%, respectively.

4.3 Banking sector investments in MMFs

- **Insignificant except for one bank**

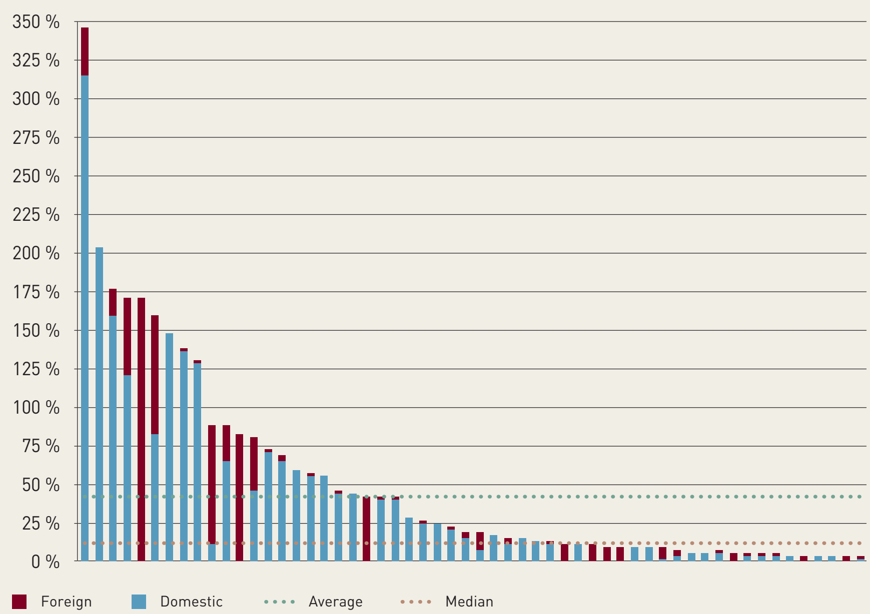
Similar to the domestic banking sector investments in the OIFs, the investments in MMFs share a longer-term declining trend. However, similar to OIFs, there was a significant increase in exposures in 2014Q4. As opposed to the latest increase in OIF exposures, which were mainly from domestic OIFs, domestic banks have increased their exposures to MMFs based abroad. Nevertheless, exposures to MMFs tend to be rather marginal, especially after subtracting the exceptionally large exposure of a single bank (2.0 billion euros investment in foreign MMF quoted shares) from the existing composition of domestic banking sector MMF exposures. The investments in MMFs make up about 0.3% of domestic

Chart 10
Luxembourg bank investments in OIFs
(% of total assets, 2014Q4)



Source: BCL

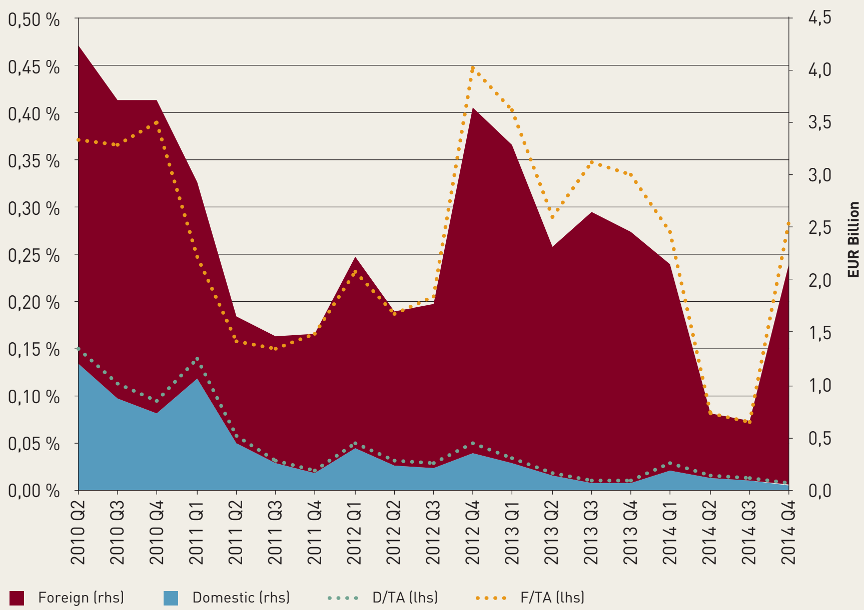
Chart 11
Luxembourg bank investments in OIFs (% of total equity, 2014Q4)
(% of total equity, 2014Q4)



Source: BCL

Chart 12

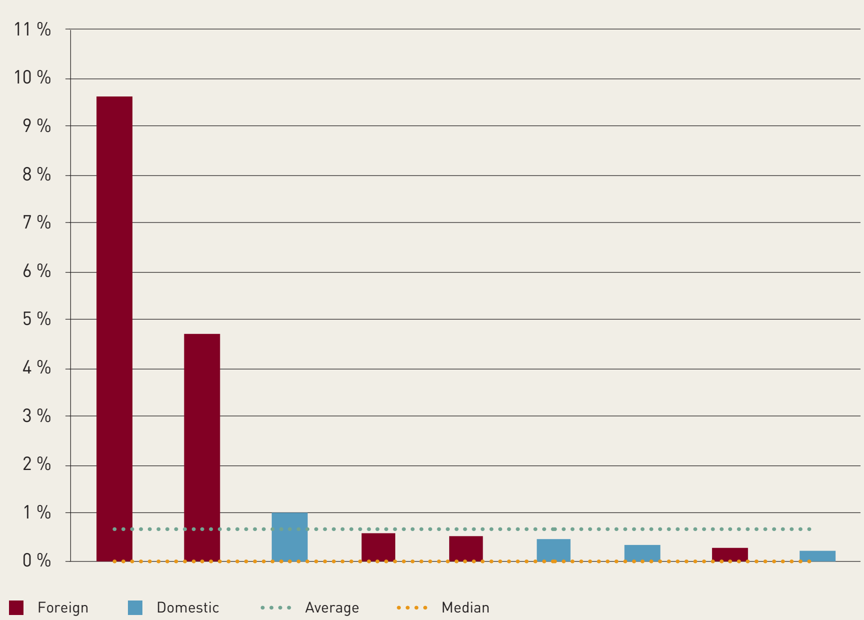
Ratio of bank investments in MMFs to Luxembourg banking assets



Source: BCL

Chart 13

Luxembourg bank investments in MMFs (% of total assets, 2014Q4)



Source: BCL

banking sector balance sheets, which amounted to 2.1 billion euros in 2014Q4 (2010Q2: about 4 billion euros).

The exposures to MMFs do not reach the levels observed with bank exposures to the OIFs, as compared to the total balance sheet size of individual banks. Only one bank is exposed to MMFs above the 5% threshold of its total balance sheet size. The majority of the largest five banks' exposures toward MMFs are to a foreign entity.

Two banks have exposures to the MMF industry which are greater than 50% of their total equity. The divergence of the four banks´ exposures to MMFs, as compared to the rest of the banks within the group, is also emphasised by the average and median values of the distribution. Namely, the median value (0.1%) is much lower than the average value (12%), implying that a few outliers drive the mean value up from an overall low level of exposures vis-à-vis the MMF sector.

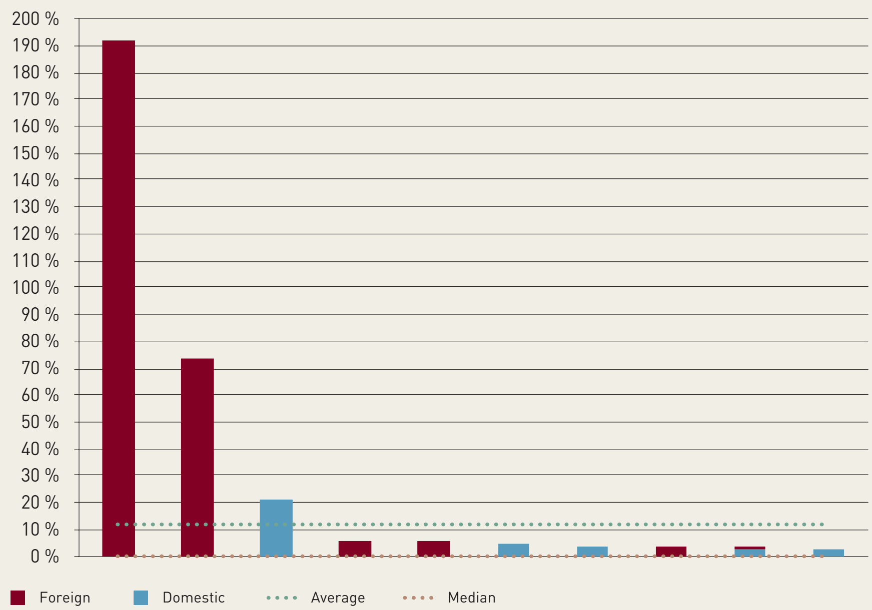
4.4 Banking sector investments in securitisation vehicles

From looking at Chart 15, the first impression might be that exposures to securitisation vehicles have taken a substantial upswing since 2014 Q3. However, this might only partially be the case. A bank specialised in securitised investments was introduced in the reporting framework in 2014 Q3, which significantly changed the landscape in Chart 15. With the exception of this significant bank, exposures to securitised vehicles remained relatively stable even in the last quarter of 2014. The significant bank contributed to about 53% of total securitisation investments by the domestic banking sector. Total asset exposure to securitised vehicles accounted for approximately 1% of total domestic banking sector assets.

The distribution of Luxembourg banking sector investments in securitisation vehicles varies substantially – Chart 16 displays a specialised bank with investments in securitised assets representing slightly above 80% of its total assets. The rest of the domestic banking system has only marginal exposures to securitisation vehicles – about 18% of domestic credit institutions invested in securitised assets in 2014Q4.

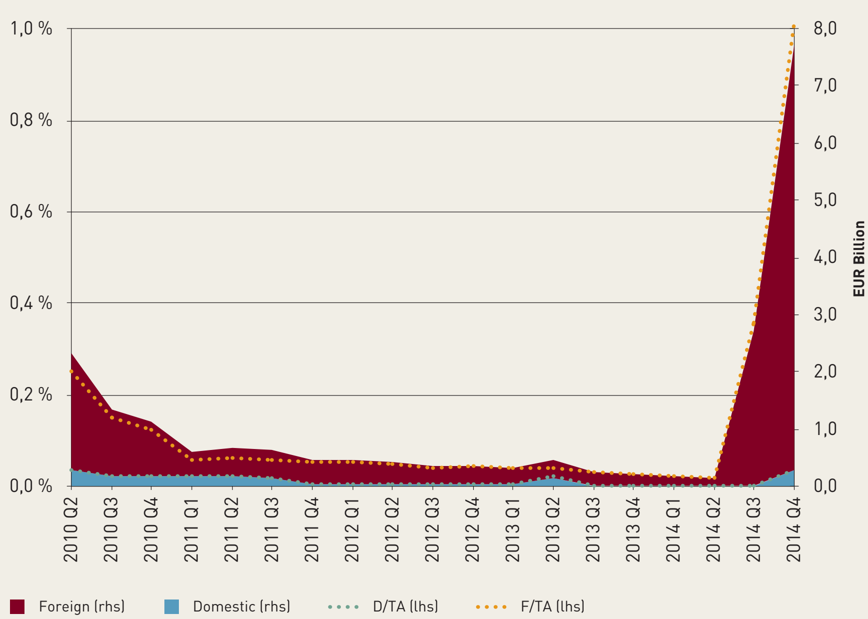
Five domestic banks had exposures to securitisation vehicles which surpassed their total equity

Chart 14
Luxembourg bank investments in MMFs
(% of total equity, 2014Q4)



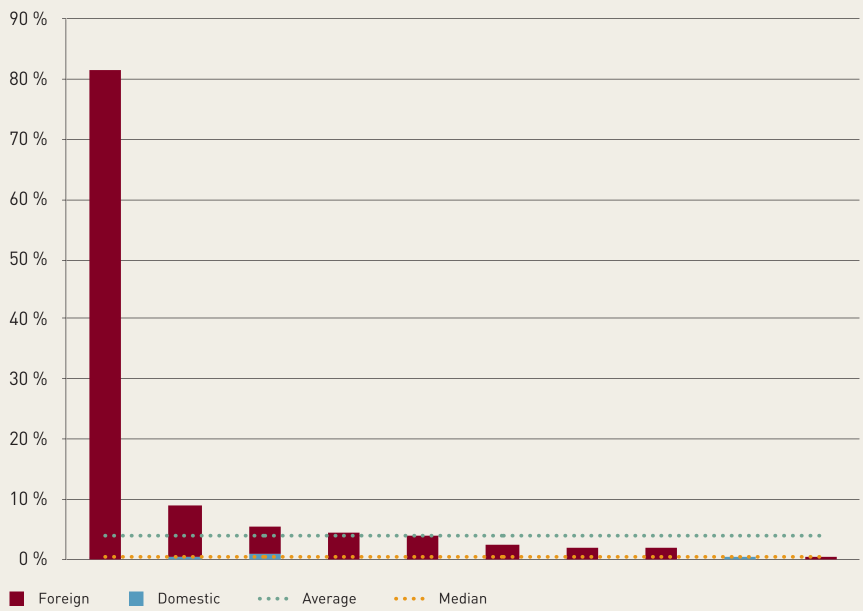
Source: BCL

Chart 15
Ratio of bank investments in securitisation vehicles to Luxembourg banking assets



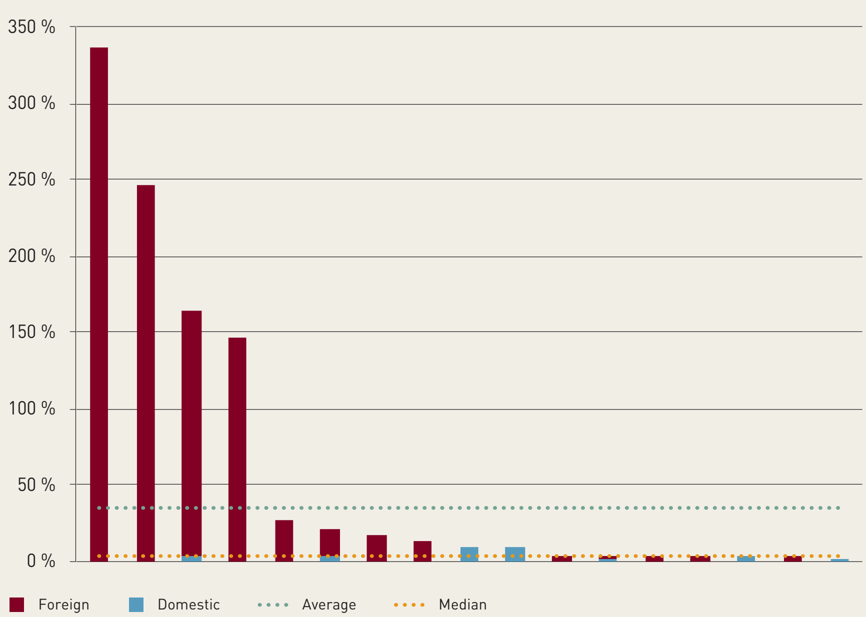
Source: BCL

Chart 16
Luxembourg bank investments in securitisation vehicles
(% of total assets, 2014Q4)



Source: BCL

Chart 17
Luxembourg bank investments in securitisation vehicles
(% of total equity, 2014Q4)



Source: BCL

levels in 2014Q4[20]. The banks with significant exposures to securitisation vehicles, displayed in Chart 17, are either branches or credit institutions with specialised business models that significantly differ from the business strategies of commercial banks.

4.5 Combined banking sector exposures to market-based financing entities

The charts in Section 4 above display a rather limited view of the concentration of potential risks stemming from the exposure to market-based financing entities. This is because the charts in Section 4 show individual bank exposures to OIFs, MMF, and securitisation vehicles separately, whereas Chart 18 considers them together. In addition, we include *common equity tier 1 (CET 1)* as an additional element to the already existing measures of risk[21] to provide a more comprehensive risk perspective.

Chart 18 below includes three graphs based on clusters from the network analysis in Charts 4 and 5: (a) domestically oriented banks, (b) foreign branches, and (c) the rest of the domestic banking sector.[22] The y-axis on the graphs in Chart 18 represents the ratio of investments in market-based financing entities to

20 *One bank is not included in the graph because its securitisation vehicle exposure to total equity ratio amounted to 37,660%, which would have distorted the graph below.*
21 *Total assets and total equity.*
22 *The aforementioned bank is not included in the graph to avoid distorting the graph below.*

total equity of the bank. The x-axis represents the ratio of investments in market-based financing entities to their total assets. The volume of a bubble represents the CET 1 ratio[23] of a bank. The banks which exceeded the thresholds of (i) 100% for total market-based financing entities exposure to bank total equity and (ii) 10% for total market-based financing entities exposure to bank total assets are considered to exhibit more risk and are highlighted in orange.

The observations from Chart 18 lead us to conclude that (i) banks with exposures to market-based financing entities are generally well capitalised, (ii) domestically oriented banks are exposed to market-based financing entities only to a limited extent compared to branches and the rest of the domestic banking sector, and (iii) some of the outliers – with substantial exposures to market-based financing entities and relatively low CET 1 ratio levels – within the group of banks representing the rest of the domestic banking sector warrant closer monitoring.

4.6 Geographical breakdown of banking sector investments

The subsection below displays a precise geographical allocation of Luxembourg banking sector funds toward the market-based financing entities.

23 *The bubbles within the graph representing domestically oriented banks include the CET 1 ratio values for each domestically oriented bank displayed in the graph.*

Chart 18
Luxembourg banking sector exposure to total market-based financing entities
(2014Q4)

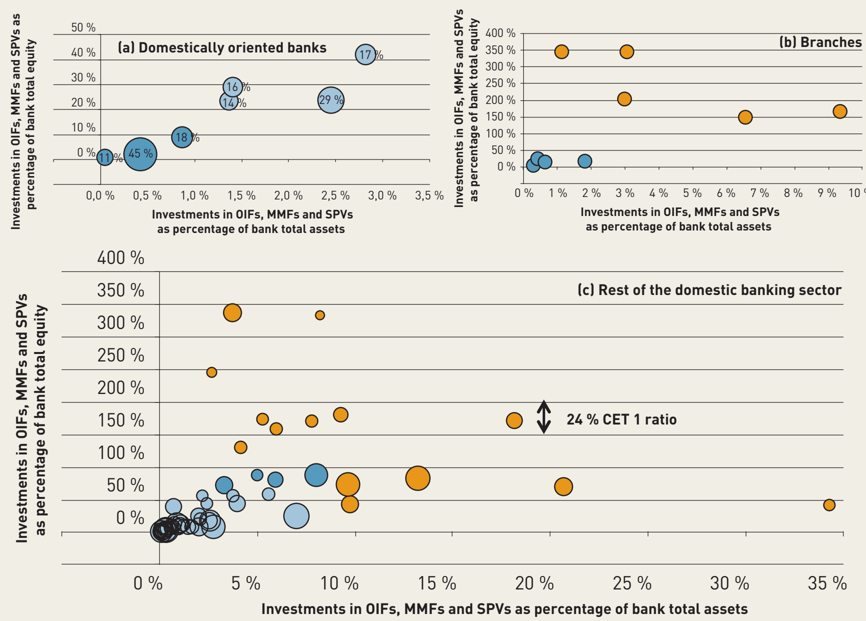
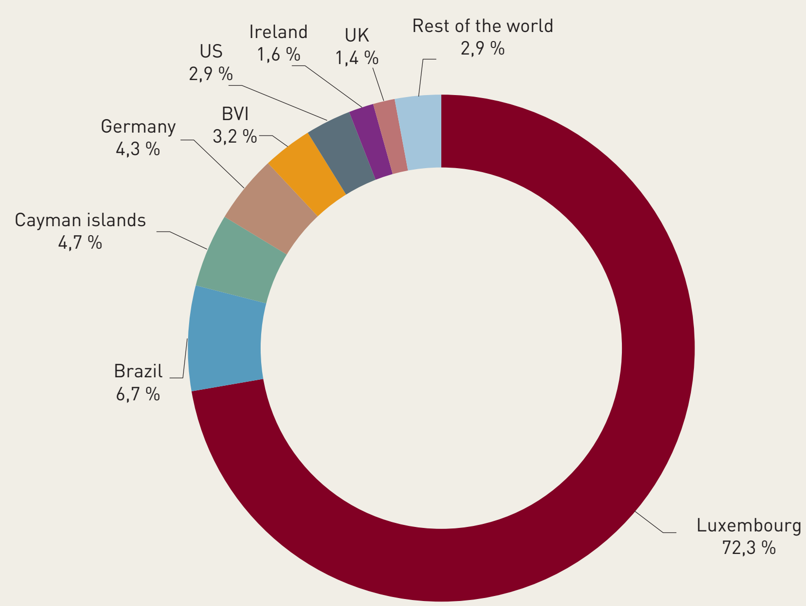
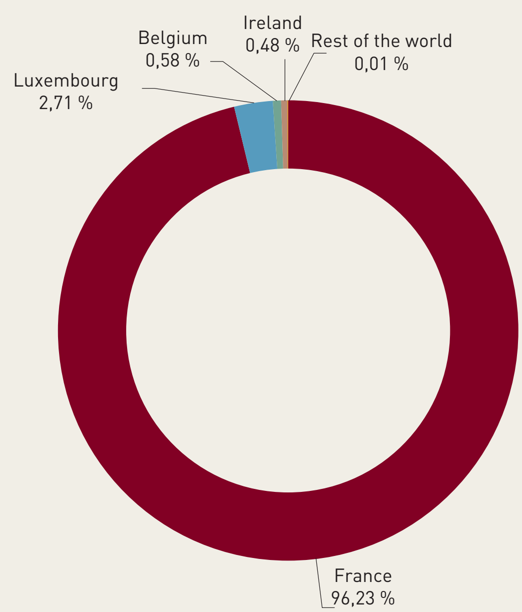


Chart 19
Geographical distribution of domestic banking sector exposures to OIFs
(2014Q4)



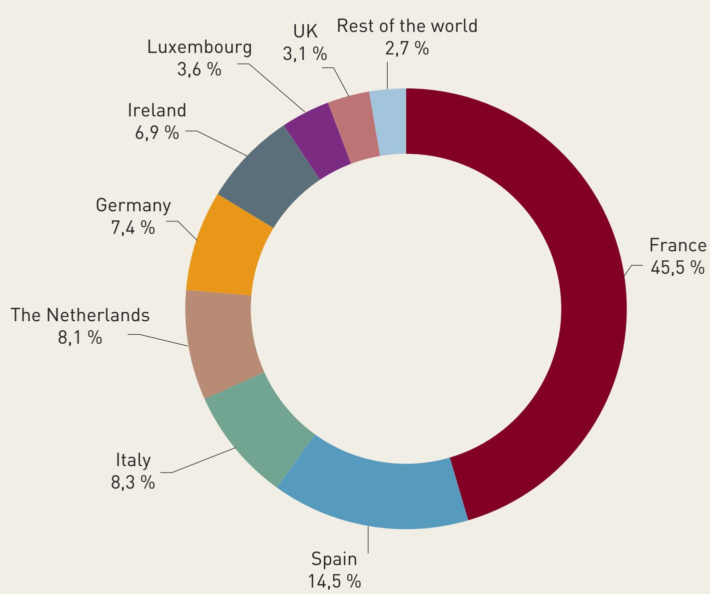
Source: BCL

Chart 20
Geographical distribution of domestic banking sector exposures to MMFs
(2014Q4)



Source: BCL

Chart 21
Geographical distribution of domestic banking sector exposures to securitization vehicles
(2014Q4)



Source: BCL

- **OIFs' home bias with some exotic preferences**

Investments in domestic OIF entities prevail and EU exposure constitutes slightly above 80% of total investments in OIFs. The most prevalent overseas exposures are Brazil (about 7%), Cayman Islands (about 5%), British Virgin Islands (BVI) and US (about 3% each).

- **The MMF path leads to France**

The Luxembourg banking sector investments in MMFs do not share the same home bias tendency as observed previously with the investments toward OIFs. Domestic MMFs hold a mere 3% share of the total MMF fund distribution. The major MMF investment destination is France, notably due to an already mentioned significant exposure of a single Luxembourg bank.

- **The EU preference of securitisation vehicles**

Similarly to Luxembourg banking sector fund distribution to MMFs, France is a major investment destination toward securitization vehicle entities as well. As demonstrated in Chart 16, a single bank exposure signifies a large proportion of the combined exposure to France. Approximately 90% of Luxembourg banking sector investments in securitised debt instruments are issued by entities based within the boundaries of continental Europe.

5. FUNDING FROM THE MARKET-BASED FINANCING ENTITIES

Given the importance of funding sources for the domestic banks and potential risks originating from emerging market economies, this section focuses on the funding of the domestic banking sector stemming from OIF, MMF and securitisation vehicles sectors. For each of them, we analyse the distribution within the banking sector, the geographical origins, the types of liabilities and the maturities.

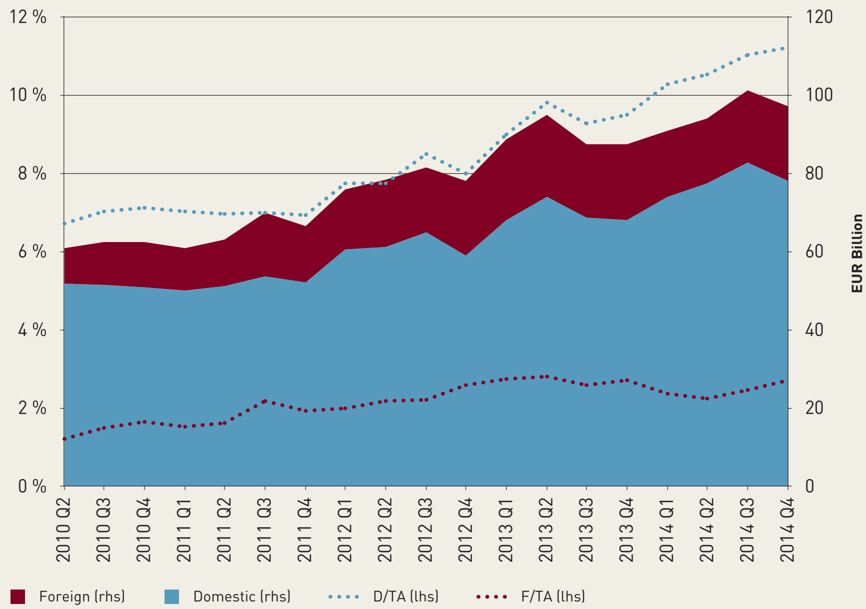
5.1 Funding from other investment funds

5.1.1 The growing importance of funding from OIFs

Although the share of OIFs is still relatively small compared to the share of other banking institutions in total funding, the OIFs have increased their contribution in the past few years from 8% in June 2010 to 14% in December 2014. It has to be noted that most of the increase results from domestic funds. This suggests a growing reliance of Luxembourg banks on funding provided by those institutions.

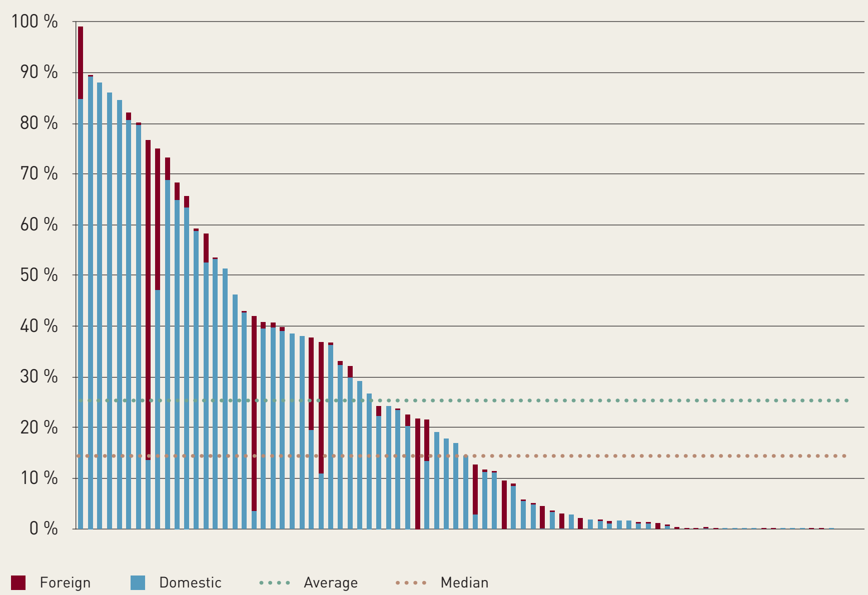
At the individual level, 81 banks (out of 148 banks within the domestic banking system) report liabilities vis-à-vis OIFs. Many of them are predominantly reliant on OIF funding. In the majority of cases domestic OIFs represent most of the total OIF funding. Nevertheless, some banks still exhibit a high level of liabilities

Chart 22
Evolution of the share of OIFs in Luxembourg banks' liabilities
(% of total liabilities)



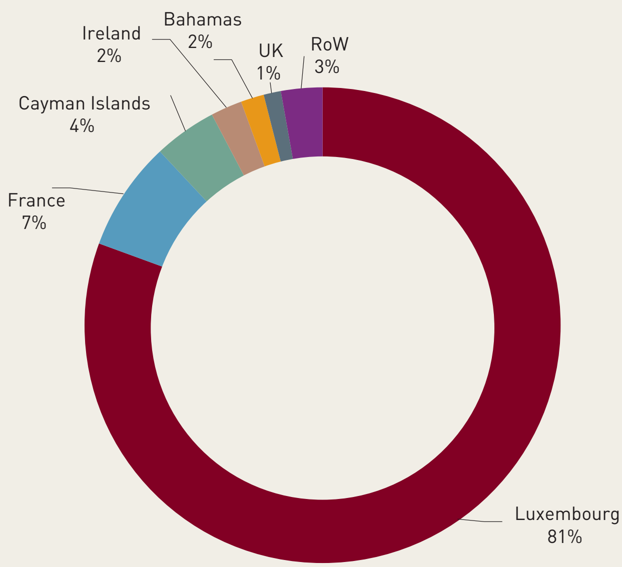
Source: BCL

Chart 23
Adjusted debt of Luxembourg banks vis-à-vis investment funds
(% of total adjusted debt, 2014Q4)



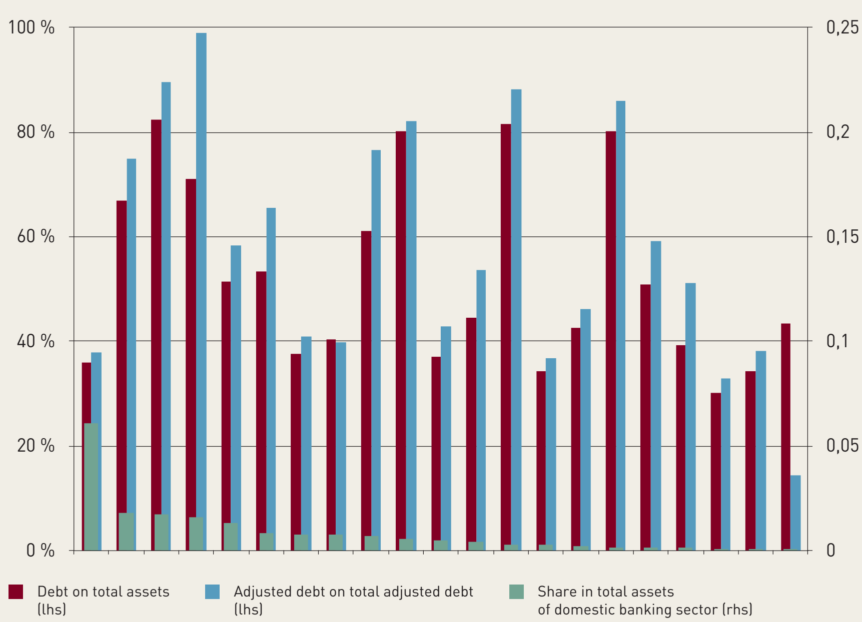
Source: BCL
Note: Adjusted debt is the difference between total debt and deposits received from affiliates.

Chart 24
Geographical distribution of domestic banking sector's debt vis-à-vis OIFs
(2014Q1)



Source: BCL

Chart 25
Debt of Luxembourg banks (non-branches) vis-à-vis investment funds
(2014Q1)



Source: BCL

vis-à-vis foreign funds. The geographical distribution of foreign bank liabilities is studied in more detail subsequently. Out of the 81 banks receiving funds from the OIF sector, there are 33 banks which report marginal OIF funding below 5% of total adjusted external funding. For banks with a ratio above 30%, a more detailed analysis is provided below.

5.1.2 The predominance of domestic OIFs

The Chart below illustrates the predominance of domestic OIFs which represent 81% of total OIF funding. In addition, many French funds (7% of total debt) invest in the Luxembourg banking sector, followed by entities from Cayman Islands and Ireland (respectively 4% and 2%). The funding from other parts of the world accounts for only 6% of the total debt of banks.

5.1.3 Identifying banks highly reliant upon the OIFs funding

There are 28 banks receiving more than 30% of their funding from OIFs. Those banks account for 21% of total assets of domestic banking sector. Seven of them are branches of foreign banks and represent about 3% of total assets of all banks. Among banks which are not classified as branches, eleven banks account for more than 0.5% of total assets of the domestic banking sector, including one accounting for more than 5% of total domestic assets of Luxembourg banks.

5.1.4 High liquidity of deposits

Long-term funding from OIFs appears to be very limited. The liabilities reported under "no breakdown" are almost exclusively *Overnight deposits* (see Table below).[24] Indeed, the share of *Short sale of securities* is extremely marginal. The affiliates tend to provide more stable funding. However, deposits received from related entities are consolidated to determine the adjusted debt. The table below shows that most of the funding stemming from OIFs is highly liquid and could be withdrawn fast in case OIFs would need them.

Table 1:

Types of liabilities vis-à-vis investment funds by maturities (2014Q4)

	OVERNIGHT DEPOSITS	DEPOSITS WITH AGREED MATURITY	DEPOSITS REDEEMABLE AT NOTICE	SALE AND REPURCHASE AGREEMENTS	SHORT SALE OF SECURITIES	TOTAL DEBT	DEPOSITS RECEIVED FROM AFFILIATES	TOTAL ADJUSTED DEBT
No breakdown	100%				0%	82 837	1%	82 221
Up to 1 year		16%	6%	27%		12 065	1%	11 713
[1 year; 2 years]		40%	10%			4	16%	2
[2 years; 5 years]		50%	0%			81		81
Over 5 years		50%				22		22
Total	**82 836**	**4 086**	**1 479**	**6 605**	**0**	**95 007**	**969**	**94 038**

Source: BCL

Note: Values are either expressed as percentages of total debt for a given maturity or in million euros.

5.2 Funding from money market funds

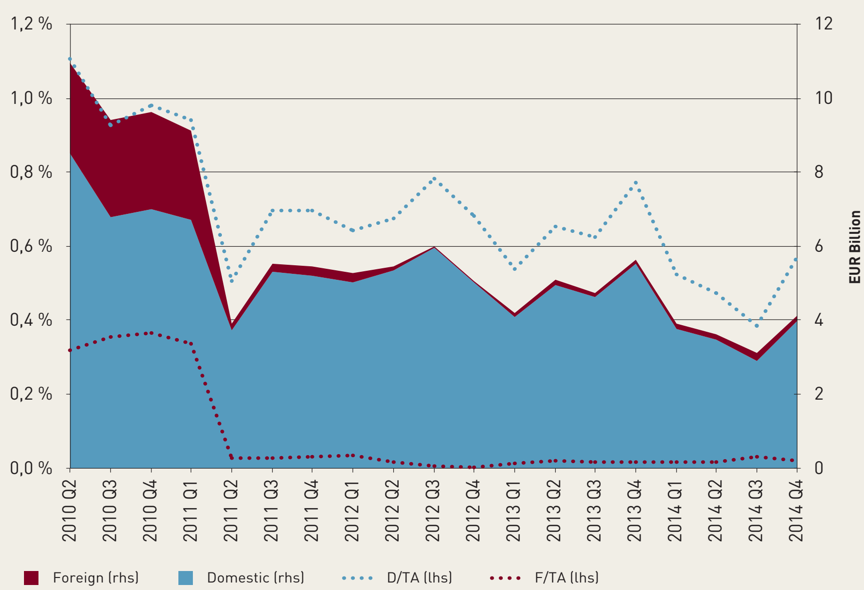
Money market funds have not contributed substantially to the funding of Luxembourg banks in the past few years. In fact, the share of their contribution has even decreased somewhat since 2011. Concomitantly, we notice that foreign MMF funding has almost disappeared from banks' liabilities. Overall, the contribution of MMFs to domestic bank funding seems to be marginal as it represents less than 0.6% of total bank liabilities.

The figures at the individual bank level show that only a few banks rely on MMF funding and in only one case their shares outweigh

Chart 26

Evolution of the share of MMFs in Luxembourg banks' liabilities

(% of total liabilities)



Source: BCL

24 *Overnight deposits are convertible into currency and/or transferable on demand by cheque, banker's order, debit entry or similar means, without significant delay, restriction or penalty.*

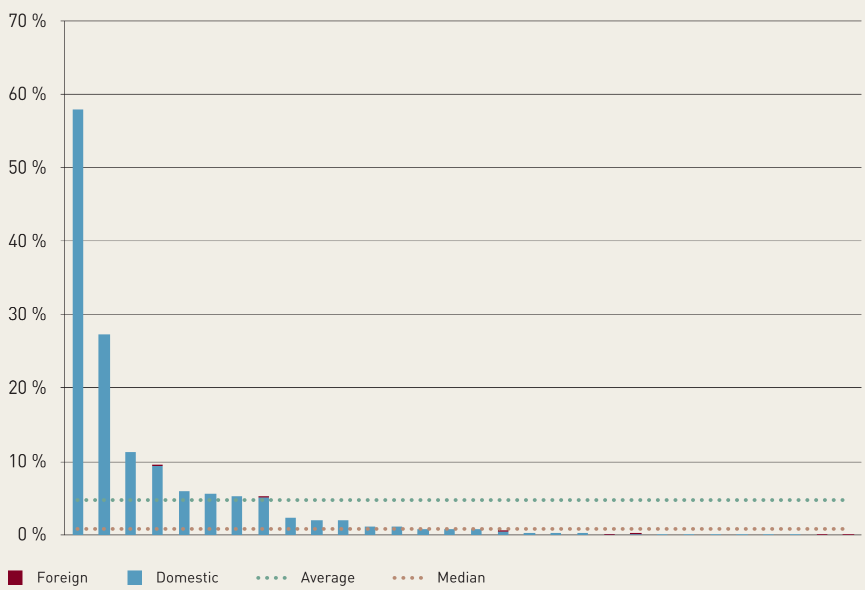


Chart 27
Adjusted debt of Luxembourg banks vis-à-vis MMFs
(% of total adjusted debt, 2014Q4)

Source: BCL
Note: Adjusted debt is the difference between total debt and deposits received from affiliates.

30% of total external adjusted debt. Individual figures confirm the aggregated numbers as marginal foreign MMF contribution can be observed. Most of foreign MMF funding is of Irish origin and directed at one domestic bank.

Similarly to the case of OIFs, liabilities with no breakdown are almost exclusively overnight deposits. Total debt reported vis-à-vis MMFs essentially takes the form of short-term debt or overnight deposits. It has to be noted that deposits received from affiliates result only from funds provided by domestic MMFs to two banks.

Table 2:
Types of liabilities vis-à-vis MMFs by maturities (2014Q4)

	OVERNIGHT DEPOSITS	DEPOSITS WITH AGREED MATURITY	DEPOSITS REDEEMABLE AT NOTICE	SALE AND REPURCHASE AGREEMENTS	SHORT SALE OF SECURITIES	TOTAL DEBT	DEPOSITS RECEIVED FROM AFFILIATES	TOTAL ADJUSTED DEBT
No breakdown	100%				0%	3 347	6%	3 149
Up to 1 year		100%				584		584
]1 year; 2 years]		100%				1		1
]2 years; 5 years]						0		0
Over 5 years		100%				128		128
Total	**3 347**	**713**				**4 061**	**198**	**3 862**

Source: BCL
Note: Values are either expressed as percentages of total debt for a given maturity or in millions of Euros.

5.3 Funding from securitisation vehicles

From Chart 28, we can observe that funding of banks by securitisation vehicles has decreased since 2010 and accounted for around 0.4% of their total liabilities in 2014Q4. Recently, foreign counterparties have played a growing role in bank funding and domestic and foreign securitisation vehicles now bring the same amount of funding to domestic bank (1.3 billion euros).

After the adjustment for deposits received from affiliates, individual debts exhibit low levels that do not outweigh 10% of total adjusted debt. Therefore, funding risk stemming from securitisation vehicles can be regarded as relatively marginal for Luxembourg banks.

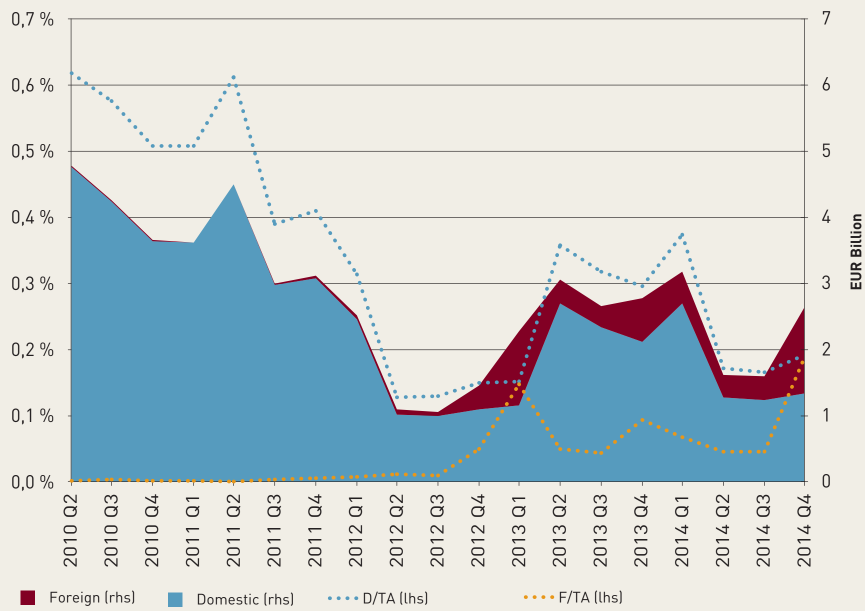
6. EXPOSURE OF LUXEMBOURG FUND INDUSTRY TOWARD BANKS

In this section we analyse the interconnectedness between banks and OIFs from a fund's perspective and evaluate any potential funding or credit risks for the domestic fund industry. In particular, spillover risks from banks to the investment fund sector are examined. Subsequently, we observe whether variations in OIFs' total assets impact their bank deposits.

6.1 MFIs as a major counterpart for MMFs on the asset side when foreign entities are included

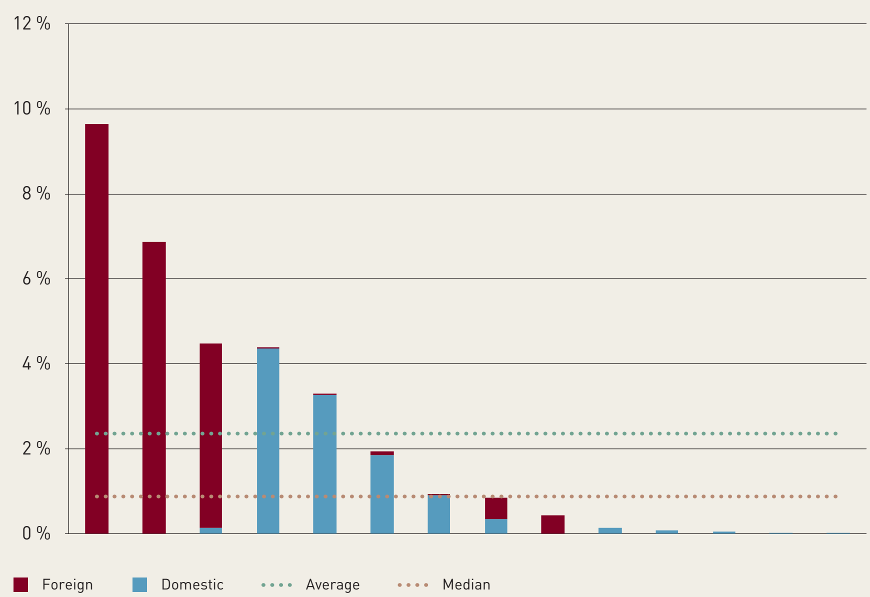
The bank funding liquidity problems have the potential to propagate quickly to the rest of the financial sector. Indeed, when banks struggle with funding, it becomes difficult to issue loans. Therefore, other financial institutions that rely heavily on bank funding may face funding risk when banks encounter such difficulties in the first place. In order to determine whether bank funding difficulties could spread to the fund industry, we analyse the evolution of the shares of banks in total liabilities of funds. The level

Chart 28
Evolution of the share of securitisation vehicles in Luxembourg banks' liabilities
(% of total liabilities)



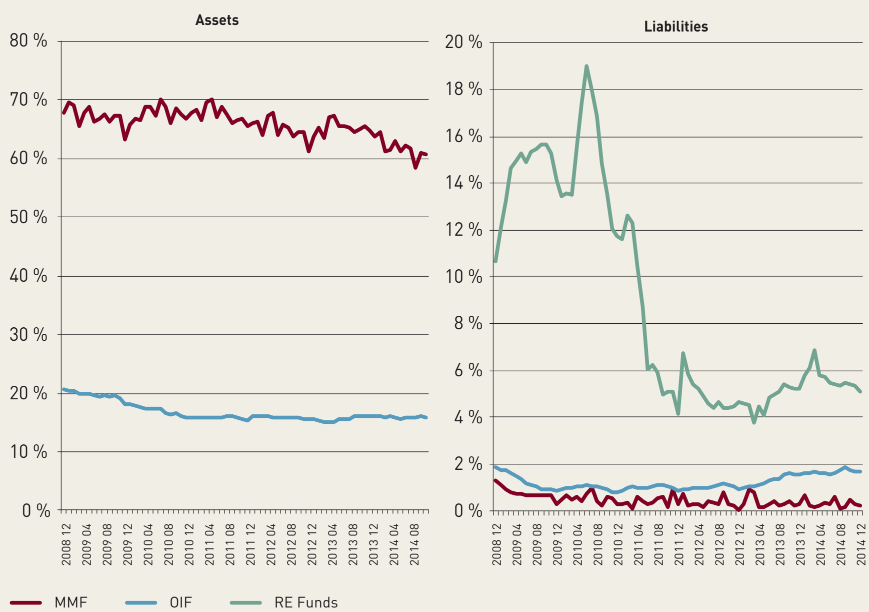
Source: BCL

Chart 29
Adjusted debt of Luxembourg banks vis-à-vis securitisation vehicles
(% of total adjusted debt, 2014Q4)



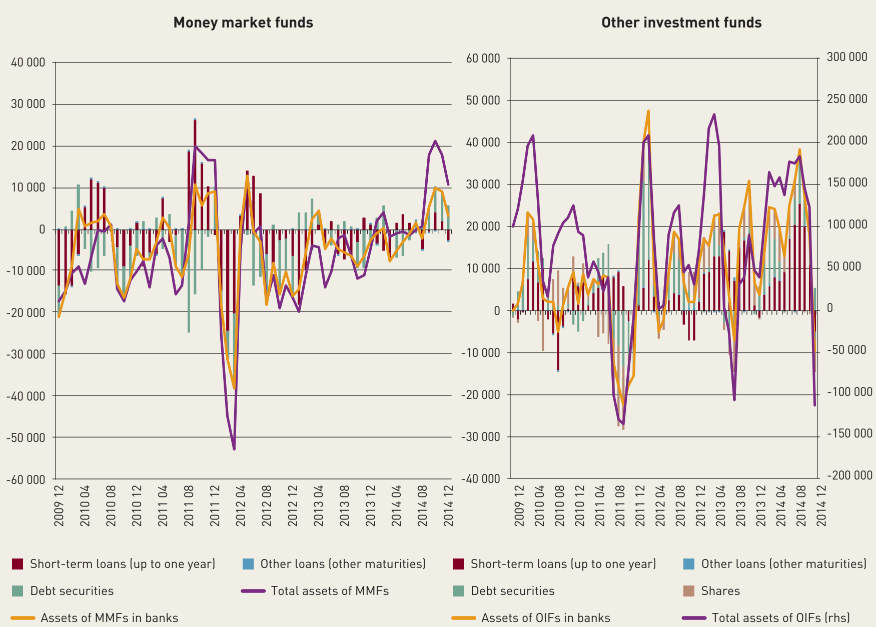
Source: BCL
Note: Adjusted debt is the difference between total debt and deposits received from affiliates.

Chart 30
Shares of MFIs in funds total assets and liabilities
(% of total assets/liabilities)



Source: BCL

Chart 31
Variation of Luxembourg investment funds' total assets and variation of assets held in credit institutions
(quarterly change, EUR million)



Source: BCL

of OIFs/MMFs asset exposures to the banking sector is also depicted so as to determine whether the fund industry is exposed to credit risk stemming from banks. In this subsection national statistics on domestic OPCs are used which permits a decomposition of exposures of domestic funds by type of fund vis-à-vis both domestic and foreign credit institutions (ratios for each type of investment fund are reported in the dashboard presented in the next section).

The share of banks in MMFs assets is very high, consistently observed at a level between 57% and 70% of total assets since 2010, but it is gradually decreasing since 2013. OIFs invest less in credit institutions. The shares of banks in OIF total assets range from 8% for hedge funds to 20% for bond funds. Those levels are consistent with the observed euro zone characteristics where the share of MFIs in total funds was slightly higher than 15% in 2014 Q1 while the share of MFIs in MMFs assets evolved between 65% and 75% of total assets over the same period.[25] On the liability side, OIFs/MMFs rely for less than 2% of their funding on MFIs, except for the real estate funds for which the level is higher but also remains rather limited.

From Chart 31, we observe that the net asset variation of MMFs is closely related to the stock of assets held in credit institutions. Most of the MMF asset variation results from exposures to banks

25 *ESMA (21014), Report on Trends, Risks, and Vulnerabilities, No. 2, 2014.*

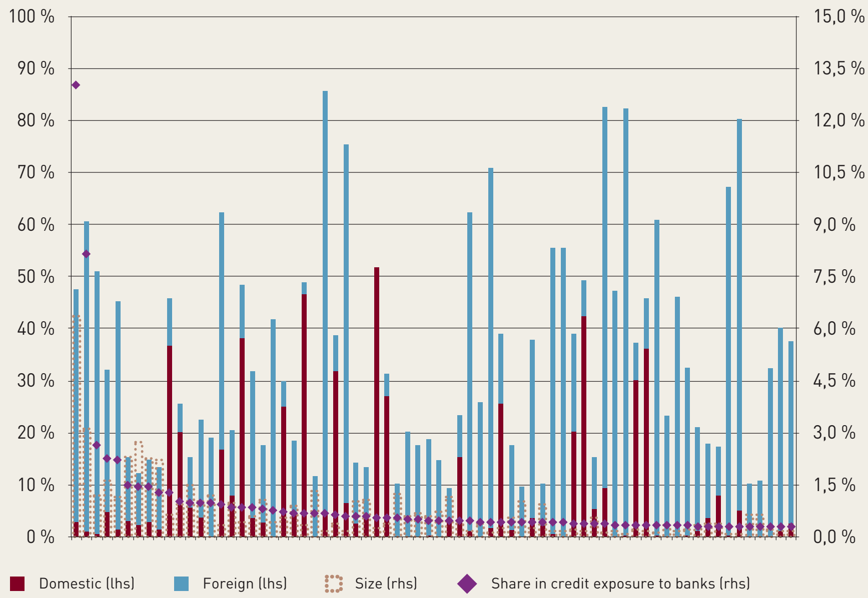
and a large share of it from loans with maturity below one year. As regards the OIFs, exposures to banks contribute to a much lesser extent to total assets fluctuations. However, short-term loans appear to play a leading role in variations of OIFs' exposures to banks. In particular, we observe that OIFs have significantly increased their short-term loans to banks in 2013 and 2014.

6.2 Individual fund exposures to the banking sector

In this subsection we study the exposures of OIFs/MMFs to banks at the individual level using a database of more than 3650 funds and 13200 fund units which hold total assets of more than 3 trillion euros. The analysis focuses on the top 70 exposures of domestic funds to the banking sector both on the liability and asset sides. Exposures are deemed to be *"high"* when the ratio outweighs the level of 25% for a fund representing more than 0.5% of total assets of domestic fund industry and more than 0.5% of total exposures to banks.

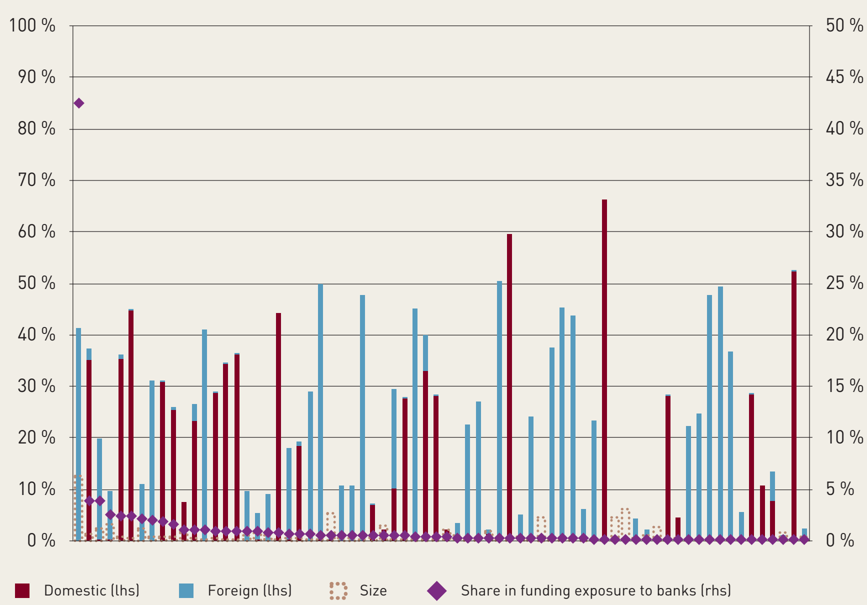
The 70 funds with the largest credit exposures to banks account for 66% of assets held by OIFs/MMFs in banks. Funds having a credit risk exposure above 25% represent 64% of the fund industry. However, most of them are small funds – only 9 funds which represent a 16% share of the industry – are regarded as having *"high"* exposures to banks. The exposures to domestic banks remain generally low for individual funds shown in Chart 32, except for 11 banks.

Chart 32
70 largest exposures of individual funds to banks on the asset side
(% of total assets)



Source: BCL
Note: this figure includes exposures in financial derivatives.

Chart 33
70 largest exposures of individual funds to banks on the liability side
(% of total assets)



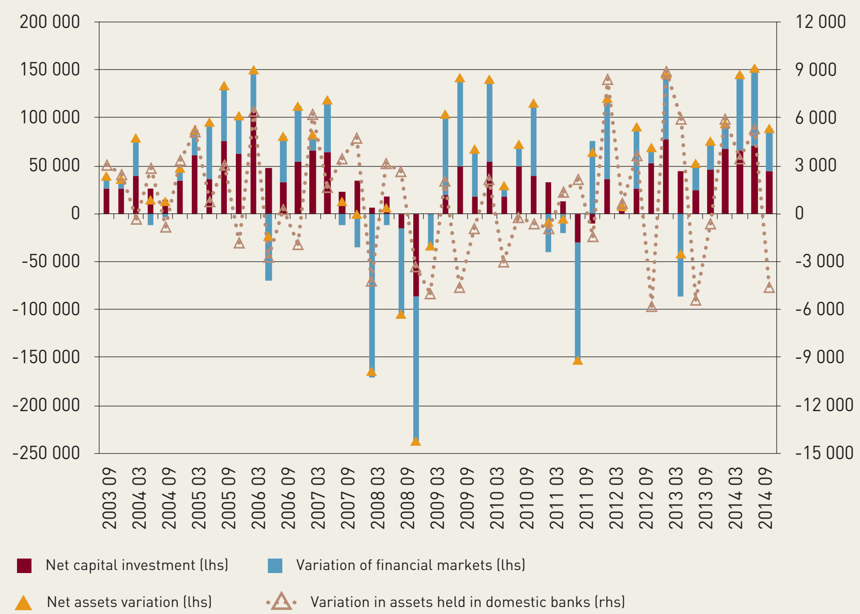
Source: BCL
Note: this figure includes exposures in financial derivatives.

The fund industry is less exposed to the banking sector on the liability side. The 70 largest bank-linked exposures cover 91% of all OIFs/MMFs' exposures to banks. Funding risk is considered to be high – above 25% of total assets – for 112 funds, but only 2 of them are bigger than 0.5% of the fund sector's total asset. In 17 cases, the funding ratio vis-à-vis domestic banks is higher than 25%, though none of those exposures is considered to be *"high"* according to the criteria stated above.

6.3 The sharp reduction in OIF total assets in 2008 was followed by a decrease in OIF deposits in domestic banks

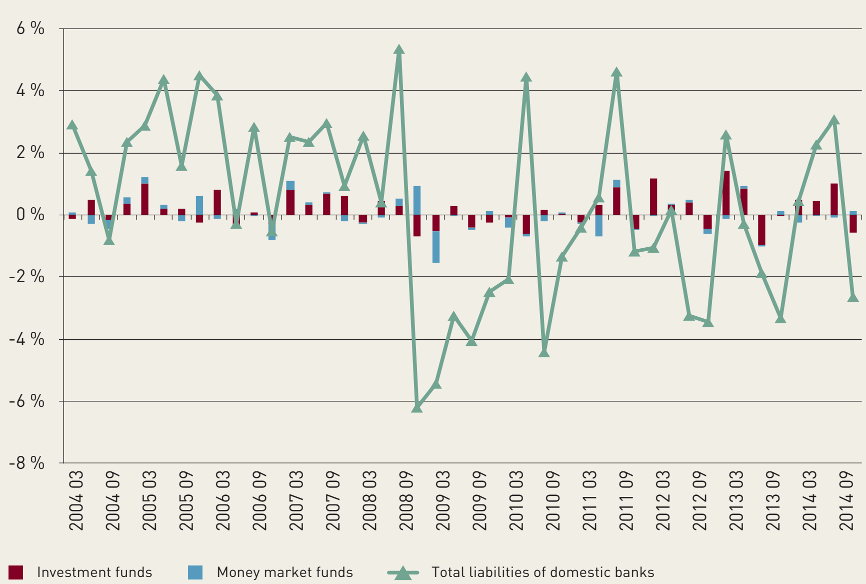
Chart 34 below displays the variations of OIF (i) net assets and (ii) assets in domestic banks. We observe that following the crisis in 2008, domestic OIFs withdrew deposits from Luxembourg banks. However, the scale of deposits in domestic banks was not sufficient to cover losses associated with the financial downturn. On the bank side, such an outflow of OIF deposits only contributed to reducing the aggregated balance sheet of domestic banks by 1.3% between September 2008 and September 2010 compared to a total reduction of 21.5% over the period. Although at the aggregated level, the withdrawal of OIFs from domestic banks does not seem to have impacted bank funding by much, OIF runs have the potential to affect individual banks which substantially rely on OIF short-term funding, although the risk for Luxembourg remains low.

Chart 34
Variation of Luxembourg OIFs' total assets and variation of assets held in domestic banks
(quarterly change, EUR million)



Source: BCL

Chart 35
Contribution of Investment funds and Money market funds to the variation of domestic banks' total liabilities
(% of total liabilities variation)



Source: BCL

6.4 Since the collapse of Lehman Brothers OIFs contribute more to the variations of banks' liabilities

OIFs and MMFs may contribute significantly to the variation of banks' total liabilities. The correlation coefficients of OIFs with domestic banks' total liabilities and MMFs with domestic banks' total liabilities were at 0.27 and 0.64, respectively (see chart below). By contrast, the correlation with the contribution of OIFs has become much stronger (0.52) after 2008, while MMFs are now negatively correlated with the growth rate of domestic banks' total liabilities. Therefore, OIFs are now playing a stronger role in funding domestic banks. On the one hand, the share of OIFs in bank funding has increased over the past few years, while on the other hand, the OIFs have contributed more to the variations of banks' liabilities since the 2008 crisis.

7. INDICATOR FRAMEWORK FOR MONITORING INTERCONNECTEDNESS

Activity and connections established between the banks and OIFs/MMFs require constant monitoring in order to follow their evolution over time and to detect any potential emergence of risk in the early stages. Such a monitoring approach is a key aspect of macro-prudential policy which is to reinforce the resilience of the financial system overall so as to support the provision of long-term stable funding to the real economy. The development of indicators is essential to guide the use of macro-prudential policy and take decisions as regards the activation/de-activation and the calibration of possible macro-prudential instruments.

The interconnectedness between banks and OIFs/MMFs can be measured using a wide range of indicators. Following the work carried out by the Financial Stability Board (FSB)[26], interconnectedness between banks and OIFs/MMFs can be measured by a credit risk indicator and a funding risk indicator. First, credit risk is measured by the ratio of assets of *i* to *j* on total asset of *i*:

$$CR_{i,j} = \frac{A_{i,j}}{TA_i}$$

where *i* and *j* are either banks or investment funds, $CR_{i,j}$ stands for credit risk for *i* vis-à-vis *j*, $A_{i,y}$ is the assets of *i* to *j*, and TA_i is the total assets of *i*. This indicator allows determining the extent of potential losses stemming from failures in one sector. Alternatively, we substitute total equity (TE) to total assets (TA) to evaluate the exposure in the light of the capacity of banks to cover potential losses resulting from a particular sector with their own funds.

Second, the funding risk is the ratio of total liabilities of *i* to *j* on the total assets of *i*:

$$FR_{i,j} = \frac{L_{i,j}}{Ta_i}$$

Where *i* and *j* are either banks or investment funds; $FR_{i,j}$ stands for funding risk for *i* vis-à-vis *j*; $L_{x,y}$ is the liabilities of *i* to *j*; and TA_i is the total assets of *i*. A similar indicator is also calculated using only short-term liabilities (overnight deposits or deposits with a maturity of less than one year) so as to determine whether liabilities can be withdrawn quickly, if needed. The higher the ratio, the more an institution is susceptible to liquidity shortages.

26 *FSB (2014), « Global Shadow Banking Monitoring Report 2013 », 14 November 2014.*

Finally, the size of a group of institutions is determined as follows:

$$Size_i = \frac{TA_i}{\sum_j^N TA_j}$$

In the assessment of interconnectedness risk between banks and OIFs/MMFs, we distinguish two set of indicators. The first group of indicators aims to capture interconnectedness from the domestic banks' point of view whereas the second one describes the exposures of domestic OIFs/MMFs to banks. The banking sector is decomposed into domestic banks, foreign subsidiaries and foreign branches in order to distinguish banks which follow under national regulation from those outside its scope. Finally, we show indicators for the group of 9 banks whose activities are domestically oriented. The objective is to determine the extent to which banks contributing to the funding of the real economy could be affected by negative shocks in the OIFs/MMFs sector.

Table 3:

Indicators on exposures of domestic banks to OIFs

	CREDIT RISK TA	CREDIT RISK TE	FUNDING RISK TA	SHORT TERM FUNDING RISK TA	SIZE (% OF TA)
All banks	**1%**	**15%**	**14%**	**14%**	**17%**
Domestic banks	1%	7%	4%	4%	2%
Foreign subsidiaries	2%	18%	16%	16%	12%
Foreign branches	0%	11%	15%	15%	2%
Domestically oriented	***0%***	***2%***	***2%***	***2%***	***2%***
	100%	**100%**	**100%**	**100%**	**100%**

Table 4:

Indicators on exposures of domestic banks to MMFs

	CREDIT RISK TA	CREDIT RISK TE	FUNDING RISK TA	SHORT TERM FUNDING RISK TA	SIZE (% OF TA)
All banks	**0%**	**4%**	**1%**	**1%**	**17%**
Domestic banks	0%	1%	0%	0%	2%
Foreign subsidiaries	0%	5%	1%	0%	12%
Foreign branches	0%	0%	2%	2%	2%
Domestically oriented	***0%***	***0%***	***0%***	***0%***	***2%***
	100%	**100%**	**100%**	**100%**	**100%**

Table 5:

Indicators on exposures of domestic banks to securitisation vehicles

	CREDIT RISK TA	CREDIT RISK TE	FUNDING RISK TA	SHORT TERM FUNDING RISK TA	SIZE (% OF TA)
All banks	**1%**	**14%**	**0%**	**0%**	**17%**
Domestic banks	0%	3%	0%	0%	2%
Foreign subsidiaries	1%	15%	0%	0%	12%
Foreign branches	1%	45%	1%	1%	2%
Domestically oriented	***0%***	***3%***	***0%***	***0%***	***2%***
	100%	**100%**	**100%**	**100%**	**100%**

Table 6:

Indicators on exposures of IFs and MMFs to banks

	ALL BANKS		DOMESTIC BANKS		SIZE (% OF TA)
	CREDIT RISK TA	FUNDING RISK TA	CREDIT RISK TA	FUNDING RISK TA	
All funds	**19%**	**2%**	**4%**	**0%**	**80%**
Equity funds	12%	1%	3%	0%	24%
Bond funds	20%	2%	3%	0%	27%
Mixed funds	16%	2%	5%	1%	19%
RE funds	10%	5%	10%	2%	1%
Hedge funds	8%	2%	4%	1%	1%
Other funds	17%	4%	6%	1%	2%
MMFs	57%	0%	4%	0%	5%
	100%	**100%**	**100%**	**100%**	**100%**

8. CONCLUSIONS

In this work we have analysed the interconnections between the domestic banking sector and market-based financing entities in Luxembourg.

The network analysis demonstrates that the exposure of domestically oriented banks toward the market-based financing entities within Luxembourg and abroad is rather limited. On the other hand, the analysis also reveals that domestic market-based financing entities are substantially more interconnected with the foreign banking sector than with domestic banks, suggesting that they remain susceptible to risks originating outside the Luxembourg banking sector.

As consistently emphasised throughout the analysis, domestic bank exposures to market-based financing entities are rather low in terms of proportion to the domestic banking sector's total assets. The exposures to OIFs seem to be on a declining trend; however we could observe a rise in activity in 2014Q4, especially in terms of exposures to domestic OIFs. Moreover, several domestic banks have considerable exposures toward the OIF sector, measured in relative terms vs. total assets or vs. total equity. In particular, the domestic banking sector has most significant ties with the bond funds as shown by the network analysis.

The exposure to bond funds in a current protracted low interest rate environment can be concerning to some extent given the rising macro risks on the back of increasing divergences between international monetary policy stances. This upward shift in interest rates could have an impact on the fund industry, in particular the bond funds, since bonds carry the highest price sensitivity to the expected yield curve swings in the current environment. Therefore, bond funds could be exposed to some risks in the event of sudden asset price shocks. The network analysis in Section 3 shows that the domestic bond and mixed funds are primarily exposed to the foreign banking sector on both sides of the balance sheet. Nevertheless, bond/mixed funds exposures toward the domestic banking sector are not negligible. Therefore, a more granular analysis on individual bond/mixed fund connections with the bank entities is warranted.

The asset exposures of the domestic banking sector to MMFs and securitisation vehicles remain relatively marginal with the exception of one bank in each of the above mentioned market-based financing entities' exposures. There is a single bank which has substantial exposure to either MMFs or securitisation vehicles. Nevertheless, neither of the two banks pose any systemic risk to the domestic banking industry given their exclusive ties to the foreign banking sector.

On the liability side, the share of OIFs in total funding of domestic banks has increased by more than 75% since 2010. The share of MMFs has declined over the same period and is now rather marginal. Domestic OIFs account for a predominant part of bank liabilities vis-à-vis OIFs (81%) and the main foreign counterpart is France (7%). OIFs mostly provide banks with short-term liquid funding which may be more susceptible to withdrawals. In the event of a large redemption of shares, managers would tend to close the most liquid position first in order to cover liquidity shortages. From that point of view, the holding of liquid assets by OIFs can be beneficial in terms of stability since it improves their ability to absorb shocks. The withdrawal of OIF funding in banks can also result from a loss of confidence in banks or if funds have to liquidate their assets in order to recover losses in case of market distress. For Luxembourg, we noted above that domestic OIFs reduced their deposits in banks following the 2008 crisis and that net capital investment had a limited impact on the stock of assets held in domestic banks.

The 28 banks receiving more than 30% of their funding from OIFs, including 7 branches, account for 21% of total assets of domestic banking sector. Among the banks not classified as branches, which are regulated by Luxembourg authorities, only 11 banks account for more than 0.5% of total assets of the domestic banking sector.

Liquidity is a central issue for the resilience of financial institutions in times of stress and for the provision of long-term stable funding to support the real economy. Although not suggested by the analysis here, there might be potential systemic consequences for the stability of the financial system in case banks' normal funding and refinancing channels fail. In such a case, macro-prudential measures may be implemented in order to prevent liquidity stress. In particular, Article 105 of the CRD IV foresees that authorities can impose specific requirements to mitigate the liquidity risk to which an institution can be exposed.

In the case of banks relying on OIF funding, a more thorough assessment should be carried out in order to determine whether these institutions maintain adequate levels of liquidity buffers as regards the potential withdrawal of funding stemming from OIFs. For instance, the behaviour of liquidity ratios of domestic banks in a scenario of a run on the bank from the OIFs should be further analysed so as to determine if individual banks may face a sudden withdrawal of a substantial amount of OIFs' deposits.