CAHIER D'ÉTUDES
WORKING PAPER

N° 197

AN ANALYSIS OF THE RELATIONSHIP BETWEEN CAPTIVE FINANCIAL INSTITUTIONS AND EXTERNAL LENDERS

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APRIL 2025

BANQUE CENTRALE DU LUXEMBOURG
EUROSYSTÈME

An Analysis of the Relationship between Captive Financial Institutions and External Lenders

First Version: 24 March 2025

This Version: 23 April 2025

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Abstract

This paper examines the relationship between captive financial institutions (CFIs, sector S127) and external lenders. The paper focuses on CFIs in Luxembourg that are owned by (resident and non-resident) investment funds specialising in private equity or real estate. Within the holding and acquisition structure set up by the fund sponsors, CFIs are mainly linked to other CFIs resulting in intragroup financial linkages in the form of equity holdings and intragroup loans. This is consistent with the relative importance of holding and intragroup lending companies among Luxembourg CFIs. However, certain types of CFIs have links with external lenders. This is particularly the case for conduits, entities with predominantly non-financial assets, mixed structures and extra-group loan origination companies. At the aggregate level, this means that most CFIs have little exposure to external lenders. Only a small proportion of CFIs have a higher credit exposure. The exposure is mainly to banks whose loans issued to CFIs finance mainly real estate investments (particularly commercial real estate such as office buildings and logistics facilities) located in Western Europe (mainly Germany and the United Kingdom). German banks are the main providers of loans for real estate investments, while US banks are the leading finance providers for private equity investments. The latter are broadly diversified across economic activities, with most targets located in Western Europe.

Keywords: Captive financial institutions and money lenders, Sector S127, Investment funds, Private equity, Real estate, Banks, Financial linkages

JEL codes: C80, C81, F23, F30, G23, G32

Contact: gabriele.difilippo@bcl.lu **Disclaimer:** This paper should not be reported as representing the views of the Banque centrale du Luxembourg or the Eurosystem. The views expressed are those of the author and may not be shared by other research staff or policymakers in the Banque centrale du Luxembourg or the Eurosystem. **Acknowledgements:** For their suggestions and comments, the author would like to thank Jean-Pierre Schoder. More importantly, I would like to thank Roland Nockels for his support and assistance, without which this work would not have been possible. Any remaining errors are the sole responsibility of the author.

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Non-Technical Summary

This paper examines the relationship between captive financial institutions (CFIs, sector S127) and external lenders. The paper focuses on Luxembourg-based CFIs owned by resident and non-resident investment funds specialising in private equity or real estate.

Within the holding and acquisition structures set up by fund sponsors, CFIs are primarily linked to other CFIs belonging to their respective fund structures, resulting in internal (or intra-group) financial linkages. The latter often take the form of direct investment positions between Luxembourg-based CFIs in the form of equity holdings and intragroup loans. However, within these respective fund structures, certain CFIs also have links with external lenders, giving rise to external (or extra-group) financial linkages.

At the aggregate level, this means that a significant proportion of CFIs have low exposure to external lenders. In 2022, CFIs with a credit exposure of less than 5% of their liabilities accounted for 60% of all CFIs linked to private equity or real estate investment funds and 63% of total assets. This is consistent with the fact that CFIs in Luxembourg are mainly interconnected with each other, namely in the form of holding companies and intragroup lending companies. While the majority of CFIs have a low credit exposure, some CFIs may have a higher exposure. This is, of course, particularly the case for CFIs that rely on loans as their main source of funding. In 2022, the credit exposure of these CFIs averaged 70% of their liabilities. They represent 15% of all CFIs linked to private equity or real estate funds and have a 10% share of total assets. The links between investment funds and external lenders take the form of indirect links established through certain types of CFIs (in particular conduits, entities with predominantly non-financial assets, mixed structures and extra-group loan origination companies).

CFIs that use loans as their main source of funding absorb 70% of the loans granted to CFIs that are linked to private equity or real estate funds. While banks are the main providers of these loans, other financial institutions such as investment funds, insurance companies and pension funds may also contribute.

In 2022, 60% of the stock of loans granted to CFIs using loans as a primary source of funding was provided for real estate investments, while the remaining 40% was used for private equity investments. German banks predominantly support the financing of real estate investments, while US banks are the leading finance providers for private equity investments. Of the real estate

investments, 52% are in commercial real estate (mainly office buildings), 23% in industrial real estate (mainly logistics facilities) and 16% in residential real estate. These real estate investments are mainly located in Western Europe, with a significant concentration in Germany and the United Kingdom. By comparison, private equity investments are more broadly diversified across economic activities, with most targets located in Western Europe.

The contribution of loan financing to the final investment can vary considerably for CFIs that rely mainly on loans for financing. Nevertheless, the average contribution of loans declines over the decade leading up to 2022. In 2022, CFIs using loans as the main source of funding for private equity acquisitions are, on average, financed 25% by internal funds and 75% by loans. In comparison, CFIs investing in real estate are, on average, financed 35% internally and 65% by loans. As a result, CFIs linked to private equity funds have a slightly higher leverage ratio than CFIs linked to real estate funds.

Between 2014 and 2022, the network of creditors financing CFIs ultimately owned by private equity or real estate investment funds has flourished. Relationships have evolved both in terms of number and volume, with certain lenders being more active than others.

Résumé Non Technique

Cet article examine le lien entre les institutions financières captives (CFI, secteur S127) et les prêteurs externes. L'article se concentre plus précisément sur les CFI basées au Luxembourg, détenues par des fonds d'investissement résidents et non-résidents spécialisés dans le capital-investissement ou l'immobilier.

Au sein des structures de détention et d'acquisition mises en place par les promoteurs de fonds, les CFI sont principalement liées à d'autres CFI appartenant à leurs structures de fonds respectives, ce qui entraîne des liens financiers internes (ou intragroupes). Ces derniers prennent souvent la forme de positions d'investissement directs entre CFI résidentes au Luxembourg sous forme de participations au capital et de prêts intragroupes. Toutefois, au sein de ces structures de fonds respectives, certaines CFI ont également des liens avec des prêteurs externes, ce qui crée des liens financiers externes (ou extra-groupes).

Au niveau agrégé, cela signifie qu'une proportion significative de CFI a une faible exposition aux prêteurs externes. En 2022, les CFI dont l'exposition aux crédits représente moins de 5 % de leur passif représentaient 60 % de l'ensemble des CFI liées à des fonds de capital-investissement ou immobiliers et 63 % du total des actifs. Ceci est cohérent avec le fait que les CFI au Luxembourg sont principalement interconnectées entre elles, notamment sous la forme de sociétés holding et de sociétés de prêt intragroupe. Si la majorité des CFI a une faible exposition aux crédits, certaines peuvent présenter une exposition plus élevée. Cela est particulièrement le cas pour les CFI dont la principale source de financement est constituée par les prêts. En 2022, l'exposition au crédit de ces CFI représentait en moyenne 70 % de leur passif. Elles représentent 15 % de l'ensemble des CFI liées à des fonds de capital-investissement ou immobiliers et 10 % du total des actifs. Les liens entre les fonds d'investissement et les prêteurs externes prennent la forme de liens indirects établis à travers certains types de CFI (notamment les conduits, les entités à prédominance d'actifs non financiers, les structures mixtes et les sociétés d'origination de prêts extra-groupe).

Les CFI utilisant les prêts comme source principale de financement absorbent 70 % des prêts accordés aux CFI liées à des fonds de capital-investissement ou immobiliers. Si les banques sont les principaux bailleurs de fonds de ces prêts, d'autres institutions financières telles que les

fonds d'investissement, les compagnies d'assurance et les fonds de pension peuvent également y contribuer.

En 2022, 60 % du stock de prêts accordés aux CFI qui utilisent des prêts comme source principale de financement ont été alloués à des investissements immobiliers, tandis que les 40 % restants ont été utilisés pour des investissements en capitaux privés. Les banques allemandes soutiennent principalement le financement des investissements immobiliers, tandis que les banques originaires des Etats-Unis sont les principaux bailleurs de fonds pour les investissements en capitaux privés. Parmi les investissements immobiliers, 52 % concernent des biens commerciaux (notamment des immeubles de bureaux), 23 % des biens industriels (notamment des immeubles logistiques) et 16 % des immeubles résidentiels. Ces investissements immobiliers sont principalement situés en Europe occidentale, avec une concentration significative en Allemagne et au Royaume-Uni. En comparaison, les investissements en capitaux privés sont plus largement répartis entre les secteurs d'activité économique, la plupart des cibles étant situées en Europe occidentale.

La contribution du financement par emprunt à l'investissement final peut varier considérablement parmi les CFI qui s'appuient principalement sur des prêts. Néanmoins, la contribution moyenne des prêts a diminué au cours de la décennie précédant 2022. En 2022, les CFI qui utilisent des prêts comme principale source de financement pour l'acquisition de capitaux privés sont financées en moyenne à 25 % par des fonds internes et à 75 % par des prêts. En comparaison, les CFI qui investissent dans des biens immobiliers sont financées en moyenne à 35 % par des fonds internes et à 65 % par des prêts. Par conséquent, les CFI liées à des fonds de capital-investissement affichent un ratio de levier légèrement supérieur à celui des CFI liées à des fonds immobiliers.

Entre 2014 et 2022, le réseau de créanciers finançant les CFI détenues par des fonds de capital-investissement ou immobiliers s'est développé. Les relations ont évolué, tant en nombre qu'en volume, certains créanciers étant plus actifs que d'autres.

1. Introduction

Luxembourg is one of the euro area countries (along with the Netherlands, Ireland and Belgium) with large positions in inward and outward foreign direct investment (FDI).[1] Most of this FDI essentially flows through Luxembourg in order to be invested elsewhere (Di Nino (2019)).[2] Therefore, a better understanding of the origin and final destination of this pass-through FDI can contribute to a better understanding of the dynamics of capital flows at the regional and global level.

A sectoral breakdown of FDI positions in Luxembourg shows that captive financial institutions (sector S127) account for the largest share of total inward and outward FDI.[3] Captive financial institutions (CFIs) are a special type of financial company that are owned and controlled by one organization, usually the parent company of a group, and generally used exclusively for its own benefit. CFIs are generally used by transnational corporations to manage their business activities and organise their corporate investments worldwide. CFIs can serve different investment and financial purposes through different types of companies.[4] These functions include the pooling of cash from operating subsidiaries, the provision of intragroup loans, the raising of funds in external markets for lending on behalf of the parent company, and the centralised management of treasury activities and receivables.

In this way, the parent company links the companies of a group together and creates intra-group financial links (or internal financial links) between companies belonging to the same group. However, some companies within a group may also have financial links with companies belonging to third groups (or external financial links). This implies the existence of financial links between different groups. Di Filippo (2024), for example, analysed the origin and destination of pass-through FDI in Luxembourg that flows through CFIs. The study focuses on CFIs linked to both resident and non-resident investment funds targeting private equity or real estate. The study shows that while CFIs are mainly linked to each other, certain types of CFIs also have links with other financial entities. These links are mainly with external financial providers that lend to the CFIs or purchase debt securities issued by the CFIs.

[1] See Appendix A.
[2] See also Di Filippo (2024).
[3] See Appendix A.
[4] See IMF (2018), Di Filippo and Pierret (2020a, 2022a).

This paper should be seen as a continuation of Di Filippo (2024). The novelty of this paper is to provide additional developments on the interconnectedness between captive financial institutions and external lenders. The study focuses on CFIs affiliated to (resident and non-resident) investment funds specialising in private equity or real estate. There are several reasons for this choice. First, investment funds are the main owners of CFIs in Luxembourg. In fact, investment funds own 50% of the total number of CFIs and 35% of the total assets of CFIs in 2022.[5,6] Indeed, according to Hoor (2018), CFIs are a suitable tool for investment funds to structure their investments, especially in private equity and real estate. Secondly, according to a recent report published by a private data provider (Preqin (2024)), Luxembourg hosts around 60% of the private capital funds raised in Europe.[7] These investment funds invest mainly in private equity, real estate and debt.

The remainder of the paper is structured as follows. Section 2 presents the structure of private equity and real estate investment funds. This section also lists the different types of investment positions that link firms within the fund structure. Section 3 describes the original dataset developed in Di Filippo (2024) on CFIs linked to (resident and non-resident) private equity or real estate investment funds. In addition, this section presents the sources of information on external lenders. Section 4 provides a breakdown of investment positions by counterparty. This section measures the exposure of CFIs to loans as other investment. This section focuses on CFIs that use loans as their main source of funding and provides a breakdown of loan investment positions by different counterparties (*e.g.* lender, type of CFI, target). Section 5 uses network analysis to assess the evolution of loan investment positions between CFIs and creditors over time. Section 6 is the conclusion.

[5] See Appendix B.
[6] Given the availability of data, the analysis period considered in this paper is limited to 2014-2022. See Section 3.1.
[7] See Preqin (2024). See also Lydia Linna, 2024, "Preqin data: Luxembourg home to 57% of European private capital funds raised", 5 November 2024, https://delano.lu/article/preqin-luxembourg-dominates-eu

2. Structure of private equity and real estate investment funds

2.1 Stylised structure of private equity and real estate investment funds

Charts 1 and 2 show the stylised structure of a private equity investment fund and a real estate investment fund respectively.[8] Private equity investment funds invest in a portfolio of private companies that are not listed on the stock exchange. Real estate investment funds invest in real estate assets. While the fund is traditionally domiciled in one country, the final investments may be located in several countries.

These investment funds are mainly funded by their Limited Partners (the internal investors or clients). The latter are institutional investors and may include pension funds, endowment funds, funds of funds, sovereign wealth funds and family offices. The General Partner (GP) - or sponsor - is the manager of the fund. It selects the final investments to be included in the fund's portfolio. The fund typically acquires a controlling interest in the final investment in order to actively manage these companies, with the aim of making a profit by later selling these companies at a higher price than originally invested.

Fund sponsors typically use a holding and acquisition structure to acquire their final investment. This structure involves the creation of one or more new companies known as "NewCos". These companies are usually classified as CFIs (sector S127) and may be located in different jurisdictions.[9] The holding and acquisition structure serves several purposes.

A first objective is to isolate the risks and liabilities associated with a particular target from the fund and from the other investments that make up the fund's portfolio. Private equity and real estate funds typically hold multiple investments (or targets) in their portfolio. These funds use NewCos to create different holding and acquisition structures that ultimately have a specific target.

[8] For more information about the structure of private equity and real estate investment funds, see Di Filippo (2023), Gilligan and Wright (2020) and Hudson (2014).

[9] Note that the holding and acquisition structure may also include companies belonging to other sectors, depending on the financial structure chosen by the fund sponsor to finance the acquisition of the final target. For example, securitization vehicles (sector S125) may also be part of a holding and acquisition structure, particularly in the case of securitization buy-outs.

In this way, the risks and liabilities associated with a particular target are limited to the particular holding and acquisition structure, thereby protecting the overall fund structure and the other assets held by the fund. By isolating the liabilities in a particular NewCo, the fund sponsor ensures that the financial recourse of creditors is limited to the assets of the NewCo. This prevents creditors from claiming against the assets of the whole fund, thereby protecting the interests of investors and preserving the stability of the fund.

A second objective is to facilitate the allocation of capital. A fund typically invests in several targets, which are likely to have different acquisition prices. The creation of NewCos therefore allows sponsors to allocate more capital to a particular target. NewCos can also be used to achieve a strategical objective. For example, if sponsors wish to have greater influence over a particular target, they are likely to need to control a larger equity stake in that target and can therefore allocate more capital to that asset. Similarly, NewCos allow for differences in the investment preferences of the Limited Partners. For example, some Limited Partners may wish to invest more capital in a particular target. In this way, NewCos allow certain Limited Partners to direct capital to the ultimate target without disrupting other Limited Partners who may not wish to participate.

A third objective is to raise debt capital from external investors. These may be banks that lend to CFIs or private credit funds that buy debt instruments issued by CFIs. In addition to equity capital, the use of debt plays the role of financial leverage in order to increase the return on investment.

As the financing of the final investment brings together multiple investors, the holding and acquisition structure aims to define a clear hierarchy of payouts between investors in the event of a liquidation. NewCos enable this through structural subordination between the different investors. This means that investors funding CFIs that are further down the hierarchy (closer to the actual investment) have a higher priority for payouts in the event of insolvency. For example, in Chart 1 the MidCo is upstream compared to the BidCo. As a result, the (external) debt of the MidCo is likely to have the characteristics of junior debt (or subordinated or mezzanine debt), as opposed to the senior debt of the BidCo. Junior debt is a debt that is subordinated to the repayment of senior

debt. In the event of a default, the subordinated debt cannot be repaid until the senior debt has been repaid. For this reason, subordinated debt is generally riskier for investors and can therefore carry higher interest rates than senior debt.

While the fund is traditionally domiciled in a particular country, NewCos may be domiciled in different jurisdictions. In particular, the domiciliation of NewCos in certain jurisdictions may enhance investor protection (Lavery (2025)). Indeed, insolvency law is not harmonised across European countries. Rather, European jurisdictions have their own insolvency regimes with significant differences in the protection of creditors and debtors during enforcement proceedings. As a result, creditors are likely to locate CFIs in "lender-friendly" jurisdictions that offer them the strongest protection. For example, in leveraged buy-out transactions, two Luxembourg-based NewCos are often incorporated into the holding and acquisition structure. This framework, known as a "Double LuxCo", strengthens the lender's position, by providing it with better protection and easier enforcement of security interests. The "Double LuxCo" would thus prevent debtors from transferring assets or legal proceedings to a more "debtor-friendly" jurisdiction in order to obtain a more favourable legal position during the insolvency proceedings.

Within the holding and acquisition structures set up by fund sponsors, CFIs are mainly linked to other CFIs belonging to their respective fund structures (Charts 1 and 2), creating internal (or intra-group) financial linkages. The latter often take the form of direct investment positions between resident CFIs (or intra-Luxembourg positions) in the form of equity holdings (*E_DI_A*) and intragroup loans (*D_DI_A*). However, within these respective fund structures, certain types of CFI also have links with external financial entities, creating external (or extra-group) financial linkages. These links are mainly with external creditors that provide loans to CFIs (*L_OI_L*, Charts 1 and 2) and with external investors that purchase debt instruments issued by CFIs (*D_PI_L*, Charts 1 and 2).

Chart 1: Stylised structure of a private equity investment fund

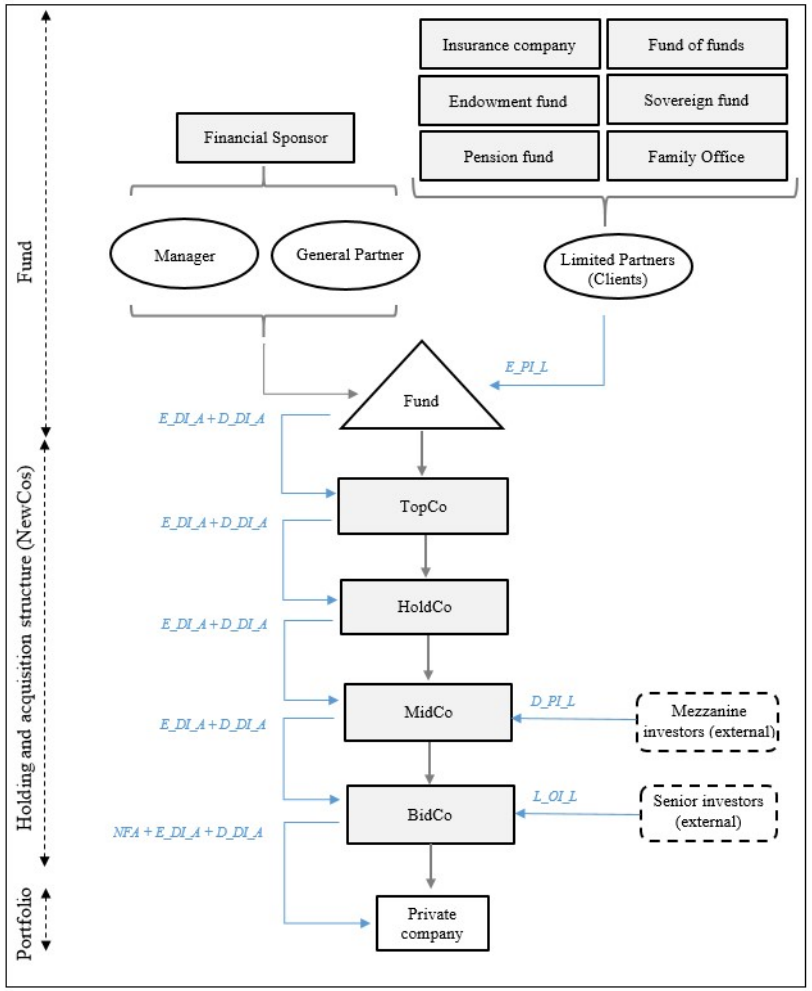
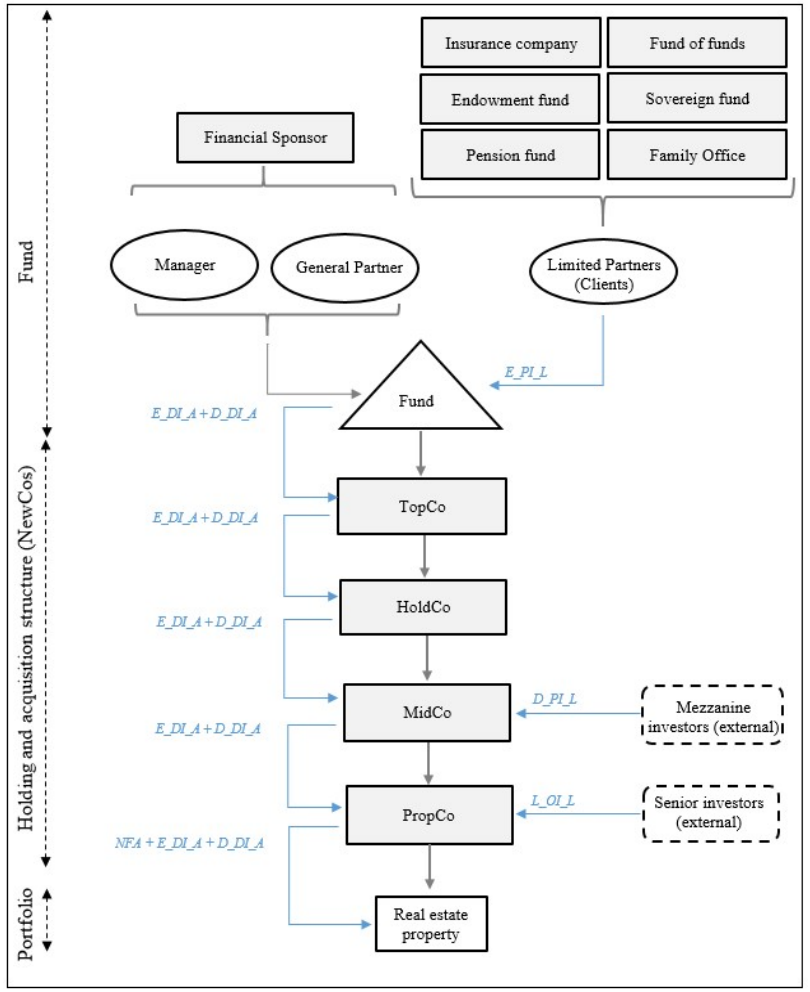


Chart 2: Stylised structure of a real estate investment fund



Source: Di Filippo (2023) adapted from Hudson (2014) and Gilligan and Wright (2020).

2.2 Investment positions relating to investment fund structures

The holding and acquisition structure used by private equity or real estate investment funds (Charts 1 and 2) implies different types of investment positions between the companies involved. These positions can be classified as direct investment positions (*DI*), portfolio investment positions (*PI*) and other investment positions (*OI*).

2.2.1 Direct investment positions

Direct investment refers to a category of investment with the objective of having control or a significant degree of influence on the management of an enterprise (the direct investment enterprise).[10] To this aim, the direct investor must own at least 10 percent of the voting power in the direct investment enterprise.[11] As well as investment in equity that gives control or influence, direct investment also includes investment in indirectly influenced or controlled enterprises[12], investment in fellow enterprises[13], intra-group loans or intercompany debt[14] and reverse investment.[15] Direct investment may also consist of real estate investment, including investment properties and vacation homes.[16]

Thus, the paper defines direct investment (*DI*) positions as follows:

$$DI = NFA^{RE} + E\_DI + D\_DI \quad (1)$$

With NFA^{RE}, real estate as non-financial assets[17]; *E_DI*, equity as direct investment; and *D_DI*, debt as direct investment.

[10] For more information, see OECD (2008), IMF (2009).
[11] See IMF (2009) Paragraph 6.12 p. 101.
[12] See IMF (2009) Paragraph 6.12 p. 101.
[13] See IMF (2009) Paragraph 6.17 p. 103.
[14] See IMF (2009) Paragraph 6.28 p. 105.
[15] See IMF (2009) Paragraph 6.40 p. 107.
[16] See IMF (2009) Paragraphs 4.34 and 4.39 pp. 55-56 and Paragraph 6.31 p. 105.
[17] Non-financial assets cannot be traded on financial markets and include tangible assets with physical value such as real estate (*e.g.* land, buildings, *etc.*), equipment and vehicles. They can also include intangible assets such as patents, intellectual property and data.

Given the structure of private equity and real estate investment funds, direct investment may include domestic direct investment, intra-Luxembourg positions or foreign direct investment. The prevalence of a given type of direct investment depends on the type of counterpart of a particular CFI (Table 1).

Table 1: Measurement of direct investment positions at CFI-level

<table>
<tr><th rowspan="2">Position type</th><th colspan="2" rowspan="2">Counterpart</th><th colspan="2">Resident CFI</th><th colspan="2" rowspan="2">Counterpart</th><th rowspan="2">Position type</th></tr>
<tr><th>DI_L</th><th>DI_A</th></tr>
<tr><td rowspan="2">DDI_L</td><td rowspan="2">Ultimate owner</td><td rowspan="3">Resident</td><td rowspan="5">$E\_DI\_L + D\_DI\_L$</td><td rowspan="5">$NFA^{RE} + E\_DI\_A + D\_DI\_A$</td><td rowspan="3">Resident</td><td rowspan="2">Ultimate target</td><td>DDI_A
if target ultimately owned by a resident</td></tr>
<tr><td>FDI_L2
if target ultimately owned by a non-resident</td></tr>
<tr><td>IL_L</td><td>Intermediary</td><td>Intermediary</td><td>IL_A</td></tr>
<tr><td rowspan="2">FDI_L1</td><td>Ultimate owner</td><td rowspan="2">Non-resident</td><td rowspan="2">Non-resident</td><td>Ultimate target</td><td rowspan="2">FDI_A</td></tr>
<tr><td>Intermediary</td><td>Intermediary</td></tr>
</table>

On the liability side of CFIs, *i.e.* on the upstream side of the ownership chain, the paper assumes two counterparties (resident or non-resident): an ultimate owner or an intermediary entity. On the asset side of CFIs, *i.e.* on the downstream side of the ownership chain, the paper assumes two counterparties (resident or non-resident): an ultimate target or an intermediary entity.

Domestic direct investment positions

Domestic direct investment positions (*DDI*) represent the direct investment positions of a resident CFI *vis-à-vis* a resident ultimate owner (liability side) or a resident target (asset side).

On the liability side, domestic direct investment positions (*DDI_L*) represent the value of a CFI's equity owned by and net loans from a resident ultimate owner. Hence:

$$DDI\_L_t = \sum_{i=1}^{N} DI\_L_{i,t}^{CTP=resident\ ultimate\ owner} \quad (2)$$

With *i* denoting a given resident CFI (*i*=1,…,N), *CTP*, the counterpart and *t*, the time dimension

On the asset side, domestic direct investment positions (*DDI_A*) represent the value of a CFI's equity in and net loans to a resident target ultimately owned by a resident. Thus:

$$DDI\_A_t = \sum_{i=1}^{N} DI\_A_{i,t}^{CTP=resident\ target\ ultimately\ owned\ by\ a\ resident} \quad (3)$$

Intra-Luxembourg positions

Intra-Luxembourg positions (*IL*) represent direct investment positions between resident intermediaries that are neither an ultimate owner, nor a target. Given that investment funds generally use a holding and acquisition structure including several resident CFIs to acquire their targets, the counterpart of intra-Luxembourg positions should mostly be resident CFIs.

On the liability side, intra-Luxembourg positions (*IL_L*) represent the value of a CFI's equity owned by and net loans from resident companies excluding ultimate owners. Thus:

$$IL\_L_t = \sum_{i=1}^{N} DI\_L_{i,t}^{CTP=resident\ intermediary} \quad (4)$$

On the asset side, intra-Luxembourg positions (*IL_A*) represent the value of a CFI's equity in and net loans to resident companies excluding targets. Hence:

$$IL\_A_t = \sum_{i=1}^{N} DI\_A_{i,t}^{CTP=resident\ intermediary} \quad (5)$$

On the asset side, the intra-Luxembourg positions thus exclude direct investments in Luxembourg-based targets. Indeed, the paper disentangles intra-Luxembourg investment positions between resident CFIs within the holding and acquisition structure from direct investment positions that are ultimately invested in a Luxembourg resident ultimate target. The paper classifies the latter positions as inward FDI if the target is ultimately owned by a non-resident, or as domestic direct investment (*DDI_A*) if the target is ultimately controlled by a resident.

Intra-Luxembourg positions may include pass-through funds (or funds in transit).[18] The latter can be defined as funds that pass through an enterprise resident in an economy to an affiliate in another economy so that the funds do not remain in the economy of that enterprise. These funds are often associated with direct investment.

Foreign direct investment positions

Foreign direct investment positions (FDI) represent direct investment positions between residents and non-residents. Inward FDI positions represent the value of non-residents' direct investment in resident entities. Outward FDI positions represent the value of residents' direct investment in non-resident entities. To be considered as foreign direct investment, the direct investor must have control or a significant degree of influence on the management of a direct investment entity that is resident in another economy.[19]

Outward FDI (*FDI_A*) can thus be defined as the direct investment asset position (*DI_A*) of a resident CFI *vis-à-vis* a *non-resident entity*. Hence:

$$FDI\_A_t = \sum_{i=1}^{N} DI\_A_{i,t}^{CTP = non-residen\ \ entity} \quad (6)$$

Given that investment funds generally use a holding and acquisition structure to acquire their targets, the *non-resident entity* can feature a non-resident target or any non-resident intermediaries (mostly CFIs) that ultimately own a non-resident target.

The fact that investment funds generally use a holding and acquisition structure to acquire their targets has several implications for the definition of inward FDI and its non-resident counterpart. Indeed, inward FDI (*FDI_L*) can entail two components.

The first component (FDI_L_1) features inward FDI as the direct investment liability position (*DI_L*) of a resident CFI *vis-à-vis* a *non-resident entity*. Hence:

$$FDI\_L_{1,t} = \sum_{i=1}^{N} DI\_L_{i,t}^{CTP = non-resident\ entity} \quad (7a)$$

[18] See IMF (2009) Paragraphs 6.33 and 6.34 pp. 105-106.
[19] See OECD (2008) and IMF (2009) Paragraph 6.8 pp.100-101, Paragraph 6.11 p. 101 and Paragraph 6.12 p. 101.

Given that investment funds generally use a holding and acquisition structure to acquire their targets, the *non-resident entity* can feature a non-resident ultimate owner or any non-resident intermediaries (mostly CFIs) that are ultimately owned by a non-resident.

The second component (FDI_L_2) features inward FDI in resident targets located at the end of the ownership chain[20] and ultimately owned by a non-resident. This second component thus represents the actual amount of FDI that is ultimately invested in resident targets. Hence:

$$FDI\_L_{2,t}=\sum_{i=1}^{N} DI_{A_{i,t}}^{CTP=\ resident\ target\ ultimately\ owned\ by\ a\ non-resident} \quad (7b)$$

2.2.2 Portfolio investment positions

Portfolio investment positions in debt securities (D_PI_L) include debt instruments issued by a specific CFI and purchased by resident or non-resident external investors. Thus:

$$D\_PI\_L_t = \sum_{i=1}^{N} D\_PI\_L_{i,t} \quad (8)$$

External investors purchasing debt securities issued by CFIs as portfolio investment generally include junior and/or mezzanine investors such as private credit funds.

2.2.3 Other investment positions

Other investment positions in loans (L_OI_L) comprise loans granted by resident or non-resident external investors. Therefore:

$$L\_OI\_L_t = \sum_{i=1}^{N} L\_OI\_L_{i,t} \quad (9)$$

The external investors granting loans to CFIs generally include senior investors such as banks.

[20] On the asset side of a particular CFI (hence, DI_A), given the use of holding and acquisition structures by investment funds to acquire their targets.

3. Data

3.1 Original dataset

This paper uses and updates the original dataset on CFIs affiliated to (resident and non-resident) private equity or real estate investment funds developed in Di Filippo (2024).

Set of CFIs and associated balance sheet data

As regards the set of CFIs and the related balance sheet data, this dataset combines information from three sources: the EuroGroups Register (EGR) managed by Eurostat[21], the Statistical Business Register (SBR) managed by STATEC (the National Statistical Institute of Luxembourg) and the Central Balance Sheet Register (CBSR) also managed by STATEC. CFIs resident in Luxembourg are identified on the basis of the NACE codes reported in the past to the EGR, supplemented by the current NACE codes reported in the SBR.[22] In accordance with statistical standards, the set of CFIs includes resident companies falling under NACE codes 64.20 ("Activities of holding companies") and 64.305 ("Wealth management companies" or *Société de gestion de patrimoine familial*). The compilation of the CFI balance sheets is based on accounting data from the standardised chart of accounts, which is available in electronic form in the Central Balance Sheet Register.

Overall, the NACE code and the availability of accounting data in the chart of accounts provided by the CBSR determine the set of CFIs analysed in this paper.[23]

Although the CBSR provides accounting data for a large majority of Luxembourg companies, there is a limitation related to the delay in data availability. At the time of writing this paper, the CBSR only contains sufficient accounting data for resident companies for the period

[21] For more information, see Bikauskaite *et al*. (2019).
[22] The NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities (Eurostat (2013)). Statistics produced on the basis of NACE codes are comparable at the European level and, in general, at the world level, in line with the United Nations (2008)'s International Standard Industrial Classification (ISIC).
[23] Note that in this paper, the direct investment positions are calculated on the basis of accounting data from the standardised chart of accounts available in electronic format in the Central Balance Sheet Register. This means that the direct investment positions are estimated at book value and not at their current market value. For a discussion of the limitations of measuring direct investment positions at book value and the possibility of measuring direct investment positions at market value, see Di Filippo (2024).

2011-2022. This means that the analysis period considered in this paper is limited to the period 2011-2022 at an annual frequency.

Group affiliation and sponsor counterpart

In order to focus on CFIs that are ultimately owned by (resident and non-resident) investment funds, this paper applies the method developed in Di Filippo and Pierret (2020b) and Di Filippo (2022b) to affiliate CFIs to their respective parent company. This method relies exclusively on public information from the National Business Register, including CFI shareholders and the annual financial accounts. Additional publicly available sources may also be required, such as the EDGAR database maintained by the US Securities and Exchange Commission or other data sources (*e.g.* Bloomberg).

For investment funds, the parent company is the fund sponsor, *i.e.* the person, group of persons or institution that takes the initiative to establish an investment fund and sets its terms.[24] The fund sponsor can be considered as the capital manager who allocates the capital provided by the Limited Partners (LPs).[25]

The database also identifies the sponsors' domicile, *i.e.* the country in which they have their operational headquarters.

In the database, sponsors are primarily capital managers that use resident CFIs to invest funds provided by LPs in private equity or real estate. Sponsors may include investment firms specialising in private equity or real estate. Sponsors may also include investment management companies affiliated with investment banks, universal banks or insurance groups, as well as pension funds and sovereign wealth funds that use resident CFIs to invest in private companies or real estate.

This paper assumes that the fund sponsor is the ultimate controlling investor of the target company and therefore the ultimate owner of the target company.

[24] The sponsor generally comprises a General Partner (GP) and a management company. The GP is the entity with the legal authority to make decisions for the fund. This entity also assumes all legal liability. The management company (or fund manager or investment advisor) is the operating entity that allocates capital and manages investments.
[25] The Limited Partners (LPs) are the main investors of the fund and may be institutional investors, including pension funds, endowment funds, insurance companies, family offices and funds of funds.

Target counterpart

The identification of the final investment (target) of CFIs is also based on publicly available information, in particular the annual financial accounts of the CFIs available in the National Business Register. This procedure requires going down the chain of ownership to the last CFI that ultimately owns the target company. The dataset also assigns the domicile of the target company and its main scope. When sponsors invest in complex structures such as multinationals, the country of operational headquarters is used to assign a domicile to the target. When sponsors invest in targets with simple structures (such as real estate), the domicile of the target is the country of final investment. The scope of the target refers to the identification of its main economic activity (for private equity) or the type of property (for real estate).

3.2 Data on external lenders

Compared to Di Filippo (2024), the novelty of this paper is the analysis of the linkages between CFIs and external lenders. To this end, the original dataset is supplemented with information on external lenders. Several sources are available to analyse the counterpart of the loan.

Information on external lenders can be obtained from the Analytical Credit Datasets (AnaCredit), a harmonised credit register covering the euro area countries. This database contains confidential, granular loan-level data on bank loans granted to companies. Creditors include credit institutions and foreign branches located in euro area countries, as well as foreign branches located outside the euro area but affiliated to a bank headquartered in the euro area. This comprehensive database is maintained by the European Central Bank (ECB) and the national central banks of the Eurosystem. In order to facilitate the comparability of data across member states, a harmonised framework for data collection has been introduced in all member states. The data are available on a monthly basis from September 2018. A key feature of AnaCredit is the reporting threshold: only loans granted to legal entities with a value equal to or exceeding 25,000 euro at any time during the reference period are reported. Consequently, AnaCredit excludes loans to natural persons (households) and focuses exclusively on lending to enterprises.

The annual financial accounts available through the National Business Register for resident companies, can also be a valuable source of information for external lenders. These data are usually

available on an annual basis, starting with the accounting year of the reporting company. In addition, specialised online platforms can provide additional information on external investors supporting investments by private equity or real estate funds.

4. Empirical evidence

4.1 Breakdown of investment positions by different counterparties

Chart 3 shows the breakdown of investment positions by different counterparties, mainly sponsors, target companies, external finance providers and holding and acquisition structures. The chart distinguishes between different types of investment positions, notably external financing positions (*L_OI_L*, *D_PI_L*) and direct investment positions. The latter are subdivided into foreign direct investment positions (*FDI_L*, *FDI_A*), intra-Luxembourg positions (*IL_L*, *IL_A*) and domestic direct investment positions (*DDI_L*, *DDI_A*).[26]

On the liabilities side, resident CFIs, which form the holding and acquisition structure, raise their funds mainly in the form of FDI from non-resident sponsors (*FDI_L1*) and external financing and, to a lesser extent, domestic direct investment from resident sponsors (*DDI_L*). External investors finance the liability side of CFIs, in the form of debt securities as portfolio investment (*D_PI_L*) or loans as other investment (*L_OI_L*).

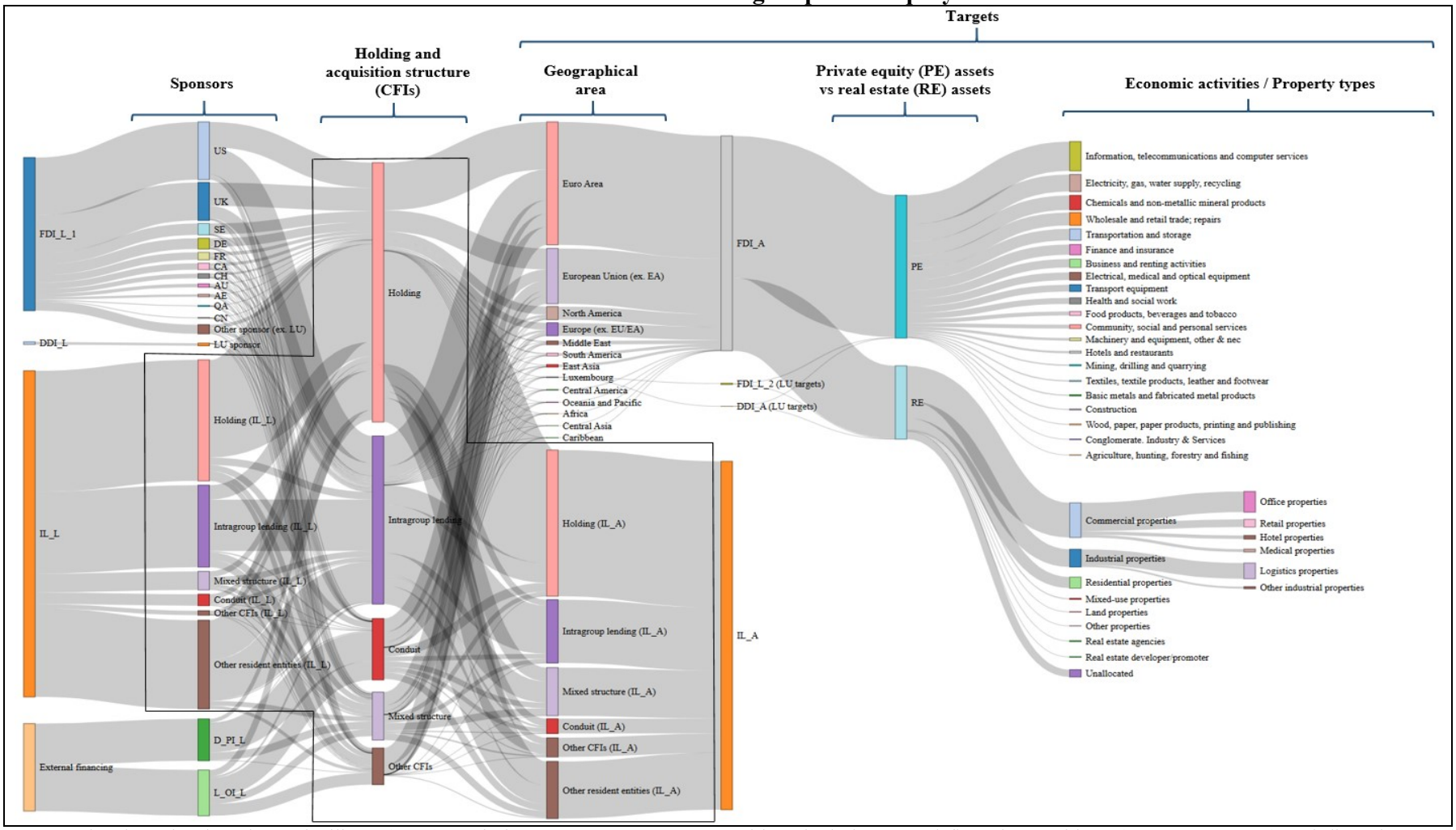
Most sponsors of private equity or real estate funds are domiciled in the United States or the United Kingdom. These sponsors use Luxembourg-based CFIs to structure their investments in the target companies.

On the assets side, outward FDI (*FDI_A*) finances the acquisition of targets located mainly in Western Europe (especially the euro area) and, to a lesser extent, in North America (mainly in the United States). Direct investments in Luxembourg targets initiated by resident sponsors (*DDI_A (LU targets)*) and non-resident sponsors (*FDI_L2 (LU targets)*) account for only a small part of total direct investment by investment funds.[27]

This means that the inward FDI initiated by fund sponsors is mainly channelled through Luxembourg *via* resident CFIs to be invested elsewhere, mostly in targets located in Western Europe (especially in the euro area).

[26] In Chart 3, "FDI_L_1" on the left-hand side represents *FDI_L1* in section 2.2.1, while "FDI_L_2 (LU targets)" below the "Targets" brace represents *FDI_L2* in section 2.2.1.
[27] In 2022, inward FDI position ("FDI_L_2 (LU targets)") and domestic direct investment position (*DDI_A*) ultimately invested in targets resident in Luxembourg represent 0.9% of the total inward FDI position (*FDI_L1*).

Chart 3: Breakdown of investment positions: Evidence from CFIs in Luxembourg affiliated to investment funds focusing on private equity or real estate



Source: Updated version based on Di Filippo (2024). Period: 2022. NB: Investment positions include external financing positions (*L_OI_L*, *D_PI_L*) and direct investment positions. The latter are subdivided into FDI positions (*FDI_L*, *FDI_A*), intra-Luxembourg positions (*IL_L*, *IL_A*) and domestic direct investment positions (*DDI_L*, *DDI_A*). External financing positions include portfolio investment in debt securities (*D_PI_L*) and other investment in loans (*L_OI_L*). Direct investment positions regroup outward FDI (*FDI_A*), inward FDI in resident CFIs (*FDI_L_1*), inward FDI in resident targets (*FDI_L_2 (LU targets)*), domestic direct investment in resident CFIs (*DDI_L*), and domestic direct investment in resident targets (*DDI_A (LU targets)*). Intra-Luxembourg positions represent the direct investment positions between resident CFIs, on the liability side (*IL_L*) and on the asset side (*IL_A*).

Private equity accounts for about 65% of the outward FDI position, with real estate accounting for the remaining 35%.

Direct investment in private equity (*FDI_A*, *FDI_L2*, *DDI_A* in PE) targets companies that are quite diversified across economic activities. The latter include mainly "Information, telecommunications and computer services", "Electricity, gas, water supply, recycling", "Chemicals and non-metallic mineral products", "Wholesale and retail trade; repairs", "Transportation and storage", "Finance and insurance", "Business and renting activities", "Electrical, medical and optical equipment", "Transport equipment" and "Health and social work".

Direct investment in real estate (*FDI_A*, *FDI_L2*, *DDI_A* in RE) is more concentrated by type of property, mainly targeting commercial real estate (office and retail properties), industrial buildings (especially logistics facilities) and, to a lesser extent, residential properties.

Chart 3 shows that the holding and acquisition structure consists mainly of holding companies and intragroup lending corporations, followed by mixed structures and conduit companies. Among the various investment positions held by resident CFIs, intra-Luxembourg investment positions are the most important counterpart, both on the liabilities side (*IL_L*) and on the assets side (*IL_A*). [28]

Intra-Luxembourg positions link resident CFIs with other resident companies, mostly CFIs.[29] Thus, CFIs are mainly linked to other CFIs belonging to their respective fund structures (Charts 1, 2, 3), resulting in internal (or intra-group) financial linkages. The latter often take the form of direct investment positions between resident CFIs (or intra-Luxembourg positions) in the form of equity holdings and intragroup loans. However, within the respective fund structures, certain types of CFIs are also linked to external financial institutions, thus creating external (or extra-group) financial linkages. This is particularly the case for conduits, mixed structures and "other CFIs", which account for most of these external financial links. [30] These links are with

[28] See *IL_L* and *IL_A* in Chart 3.

[29] On both the asset and liability sides of the holding and acquisition structure, the counterpart "Other resident entities" mostly consists of CFIs (sector 127) whose type could not be identified from the data available in the Central Balance Sheet Register. On the liability side of the holding and acquisition structure, the counterpart "Other resident entities (IL_L)" also includes private equity and real estate investment funds domiciled in Luxembourg.

[30] The category "Other CFIs" regroups the following types of CFIs: CFIs with predominantly non-financial assets, extra-group loan origination companies and loan origination companies. For more information on these specific types of CFI, see Di Filippo and Pierret (2020a, 2022a).

external financial providers that provide loans to CFIs (*L_OI_L*, Chart 3) or purchase debt securities issued by CFIs (*D_PI_L*, Chart 3).

Given the availability of data at the micro level and the objective of this study, the paper focuses on loan financing by external financial providers.

4.2 Assessment of CFI exposure to loans as other investment

Charts 4a and 4b focus on CFIs that are ultimately owned by (resident and non-resident) private equity or real estate funds. Chart 4a shows the share of CFIs in the total number and total assets in different ranges of the ratio of loans (as other investment) to liabilities.[31]

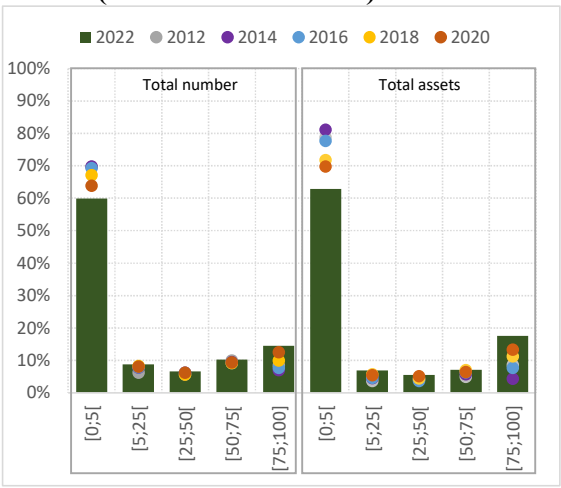
Most CFIs have loans that represent less than 5% of their liabilities (Chart 4a). In 2022, these CFIs account for 60% of all CFIs linked to private equity or real estate funds and 63% of total assets. This can be explained by the fact that within the holding and acquisition structure set up by the fund sponsors, only certain CFIs have direct exposure to external lenders (Charts 1, 2, 3). This means that, when external loan positions of CFIs are aggregated across all fund structures, a significant number of CFIs have minimal exposure to external lenders.

Despite the relatively low credit exposure of most CFIs, some CFIs may have a higher exposure. This suggests that the level of credit exposure varies from CFI to CFI. In other words, loans may be used as a predominant or non-predominant item within the possible means of financing the acquisition of the target.[32]

[31] Liabilities is the difference between total liabilities and capital (*E_DI_L*).
[32] The financing sources regroup mainly internal financing (equity *E_DI_L* or intragroup loans *D_DI_L*) and external financing (debt securities *D_PI_L* or loans *L_OI_L*).

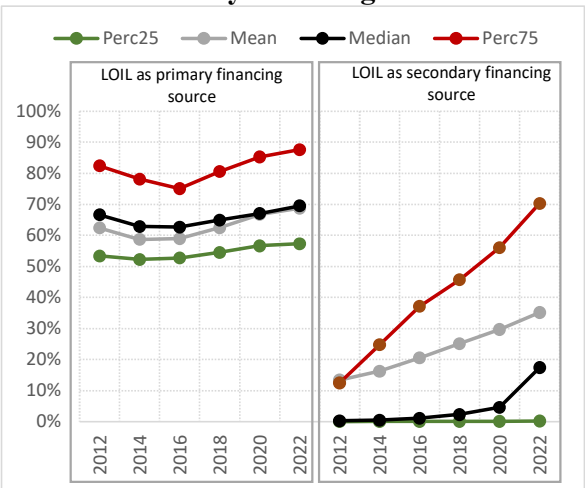
Chart 4: Ratio of loans (as other investment)-to-liabilities over time

Chart 4a: Across ranges of the ratio of loans (as other investment)-to-liabilities



NB: The x-axis mentions the intervals comprising the value of the ratio of loans-to-liabilities. Units: Percent.

Chart 4b: CFIs using loans as primary or secondary financing source



NB: The item *L_OI_L* predominates (respectively, does not predominate) on the liability side of CFIs with *L_OI_L* as a primary financing source (respectively, CFIs with *L_OI_L* as a secondary financing source).

Chart 4b divides CFIs using loans into two groups, depending on whether the item loans (as other investment) predominates on their liabilities side.

In 2022, CFIs using loans as their main source of funding[33] represent 15% of the total number of CFIs, hold 10% of total assets and absorb 70% of the stock of loans issued to CFIs linked to private equity or real estate investment funds. On average, these CFIs have a credit exposure equal to 70% of their liabilities (Chart 4b).

In comparison, CFIs using loans as a secondary source of funding[34] represent 30% of the total number of CFIs, hold 30% of total assets and have a 25% share of the stock of loans granted to CFIs affiliated to private equity or real estate investment funds. On average, these CFIs have a loan exposure equivalent to 35% of their liabilities (Chart 4b).

The remainder of the analysis focuses on CFIs that use loans as their main source of funding, as they have the highest exposure to loans as other investment.

[33] For CFIs using loans as a primary financing source, the item loans (as other investment) predominate over the alternative financing sources (mainly, *E_DI_L*, *D_DI_L*, *D_PI_L*) on the liability side.
[34] For CFIs using loans as a secondary financing source, the item loans (as other investment) does not predominate over the alternative financing sources (mainly, *E_DI_L*, *D_DI_L*, *D_PI_L*) on the liability side.

4.3 Focus on CFIs using loans as a primary financing source

Within the holding and acquisition structure set up by fund sponsors, CFIs that use loans as their primary source of financing are typically downstream (close to the target they are financing).[35] In terms of structural subordination, this means that lenders providing loans to CFIs have priority for payout in a liquidation process, compared to other investors upstream in the ownership chain. In other words, loans can be considered as senior debt compared to alternative forms of debt provided by other financial investors upstream in the ownership chain. In addition, equity shares (*E_DI_A*) and non-financial assets (*NFA*, usually real estate) are often pledged by borrowing CFIs as collateral for the loan agreement. This indicates that loans can be considered as senior secured debt.

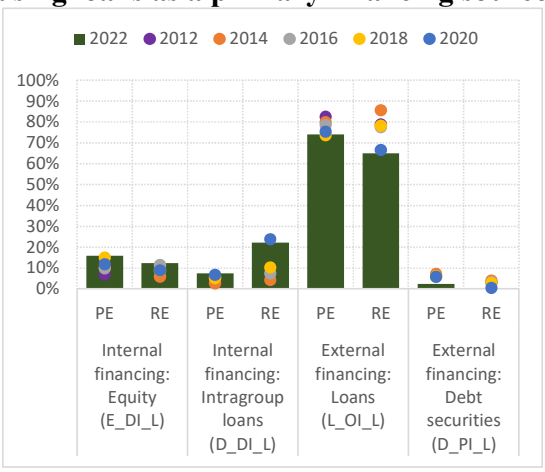
Chart 5a shows the average contribution of the different sources of finance to the direct investment of CFIs using loans as the main source of finance for the acquisition of private companies or real estate.[36]

In 2022, CFIs that use loans as their main source of financing for the acquisition of private equity are financed on average 25% by internal funds and 75% by loans (Chart 5a). In comparison, CFIs investing in real estate are financed on average 35% internally and 65% by loans (Chart 5a). CFIs linked to private equity funds are therefore slightly more leveraged than those linked to real estate funds.

[35] The probability of being downstream (close to the target they finance) amounts to around 85%, on average, over the period 2011-2022.

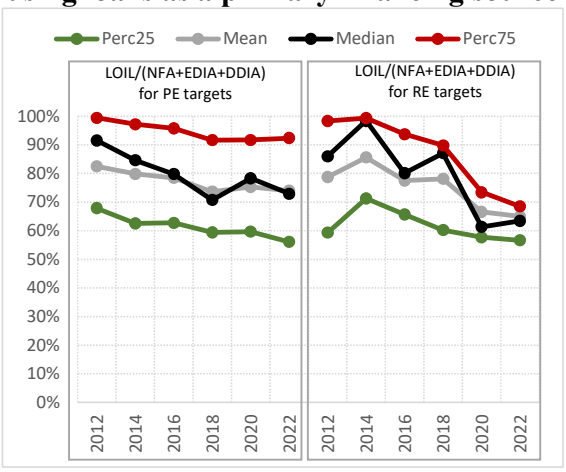
[36] Chart 5a shows the average contribution of the different sources of finance to the direct investment of CFIs. For a given CFI, direct investment (denominator) is defined as: *NFA+E_DI_A+D_DI_A*. The sources of financing (numerator) regroup *E_DI_L* (Internal financing: Equity), *D_DI_L* (Internal financing: Intragroup loans), *L_OI_L* (External financing: Loans as other investment) and *D_PI_L* (External financing: Debt securities as portfolio investment).

Chart 5a: Target financing for CFIs using loans as a primary financing source



NB: Average ratio across CFIs with loans as a primary financing source. PE (RE) refers to private equity (real estate).

Chart 5b: Loan-to-value ratio for CFIs using loans as a primary financing source



NB: Ratio *L_OI_L*/(*NFA+E_DI_A+D_DI_A*) across CFIs with loans as a primary financing source[37]

The contribution of loan financing to the final investment can vary considerably for CFIs that rely mainly on loans for financing. Nevertheless, the average contribution of loans declines over the decade leading up to 2022 (Chart 5b).

As the contribution of debt in the form of loans to the financing of targets is greater than the contribution of internal financing (in the form of equity holdings and intragroup loans), this creates financial leverage for fund sponsors to increase the expected returns on investments. The leverage technique consists of buying a target today with the funds it will generate tomorrow, which is equivalent to buying the target on credit. The CFI repays the debt to the creditor based on the income generated by the target. This income can be in the form of dividends from the target company (if it is profitable) or in the form of rental income from the target property.

[37] The loan-to-value (LTV) ratio represents the share of an asset that is being financed by the loan. It is calculated as the loan held by a CFI (*L_OI_L*, on the liabilities side) divided by the direct investment of that CFI (*NFA+E_DI_A+D_DI_A*, on the assets side).

4.4 Breakdown of loan investment positions

Chart 6 provides a breakdown of the loan investment positions (*L_OI_L*) held by CFIs with loans as the main source of financing. These CFIs are part of the holding and acquisition structure that is ultimately owned by investment funds.

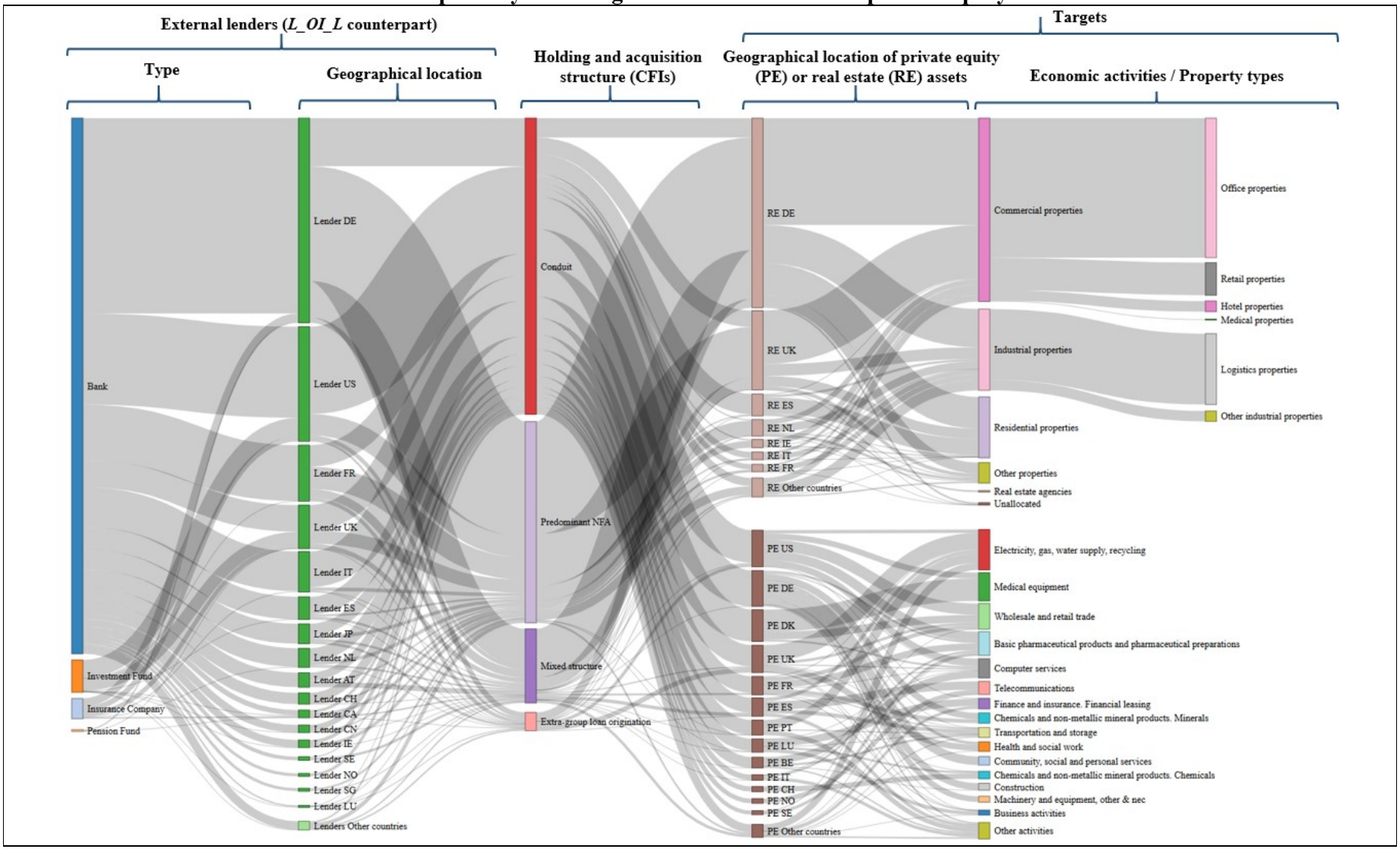
In this chart, external lenders are consolidated at group level. In other words, if a lender's parent group is based in Germany and provides a loan to a Luxembourg CFI to finance a UK target through its UK branch, then the paper assigns the loan position to the parent group's domicile (DE) rather than the branch's domicile (UK). In another scenario, where a creditor's parent company is domiciled in Germany and finances a target directly or indirectly through a branch located in Germany by providing a loan to a Luxembourg CFI, the paper assigns the domicile of the parent company (DE). The reason for consolidating the credit positions of the lenders at group level is to identify where the credit risks are ultimately concentrated.

In addition, the chart shows the targets financed with loans, broken down by geographical location and main economic activity (for private companies) or type of property (for real estate properties).

Chart 6 shows that banks (sector S122) are the main lenders (90% of the loan investment position in 2022). Non-bank lenders may also lend to CFIs. This is particularly the case for investment funds, insurance companies and pension funds. Note that banks may cover different types of lenders, including commercial banks, universal banks, investment banks and private banks. Lending by banks is mostly direct (99% of the loan investment position in 2022) or indirect through investment funds (sector S124) or securitisation vehicles (sector S125), which are ultimately owned by the bank.

Within the holding and acquisition structure set up by fund sponsors, loans are granted to certain types of CFI. Conduits account for the largest share of lending (50%), followed by CFIs with predominantly non-financial assets (34%), mixed structures (13%) and extra-group loan origination companies (3%). These CFIs are in turn mostly linked to other CFIs that are part of the holding and acquisition structure used by fund sponsors to acquire their ultimate target.

Chart 6: Breakdown of investment positions in loans as other investment (*L_OI_L*): Evidence from CFIs with loans as a primary financing source and affiliated to private equity or real estate investment funds



NB: External lenders (*L_OI_L* counterpart) are consolidated at group level. Period: 2022

The majority of loan funding is used to finance real estate assets. In 2022, 60% of the stock of loans issued to CFIs using loans as the main source of financing was provided for real estate investments, while the remaining 40% was used for private equity investments.[38] The financing of real estate investments is mainly supported by German lenders (51% of the stock of loans for real estate investments), while US lenders are the most important finance provider for private equity investments (32% of the stock of loans for private equity investments).

Of the real estate investments, 52% are in commercial properties (mainly office buildings), 23% in industrial properties (mainly logistics facilities) and 16% in residential properties. These real estate investments are mainly located in Western Europe, with a significant concentration in Germany and the United Kingdom. In comparison, private equity investments are more broadly diversified across economic activities (including 18% in utilities and 12% in medical equipment companies), with most targets located in Western Europe.

In 2022, the share of loans ultimately financing investments in Luxembourg is rather low (less than 3% of the stock of loans).[39] In fact, the loans are mainly used to finance investments outside Luxembourg (Chart 6). Moreover, the stock of loans is largely held by non-resident foreign-controlled creditors (96.5%), followed by resident foreign-controlled creditors (3.1%), and resident national-controlled creditors (0.3%). This indicates that the capital inflows in the form of loans as other investment are mainly channelled through Luxembourg-based CFIs to finance outward foreign direct investment.

Overall, while most CFIs in Luxembourg are mainly interconnected with each other, certain types of CFIs also have links with other financial institutions, in particular banks. Among the CFIs owned by private equity or real estate investment funds, those that use loans as their main source of financing represent only a small proportion, accounting for 15% of the total number and

[38] In Chart 6, a higher proportion of the loan positions is used to finance real estate investments, although private equity investments are relatively more leveraged than real estate investments (Chart 5a). This is because, when focusing on CFIs with loans as the primary source of financing, loans finance a higher number of real estate investments than private equity investments.

[39] In terms of loans granted to CFIs that ultimately own resident targets, loans are mainly granted by non-resident foreign-controlled creditors (85%), followed by resident national-controlled creditors (10%) and resident foreign-controlled creditors (5%). Around 80% of the loans granted to CFIs by resident national-controlled creditors ultimately finance resident targets.

10% of the total assets. This is in line with the dominance of holding and intragroup companies among these CFIs (Chart 3). As the ownership chains of investment funds have a transnational dimension, there may be some leverage in CFIs that are not domiciled in Luxembourg, even if they are part of an ownership chain that includes Luxembourg resident companies. A more complete picture of the leverage of private equity and real estate investment funds therefore requires the consideration of transnational ownership chains.

5. Network analysis

5.1 Motivation

In order to assess the evolution of loan investment positions between CFIs and external lenders over time, the paper uses network analysis. For this purpose, the loan investment positions between external lenders and CFIs owned by private equity or real estate funds are mapped in a network.

Given the different dimensions of the dataset, the network can be defined in different ways. In this paper, a two-mode network is chosen where the nodes consist of external lenders (or creditors) and the direct investments (or targets) of CFIs. [40,41] The target is defined by its main economic activity/property type and its geographical location. Lenders are consolidated at group level.

Within this network, the links (or edges) between the nodes represent the loan investment positions between the creditors and the CFIs at a given point in time. As the creditors' loan positions (asset side) mirror the CFIs' loan positions (liability side), the network is reversible (*i.e.* bidirectional or undirected). As the amount of loan positions (or links) between creditors and debtors varies, the network is weighted. The weight of an outgoing link (respectively, incoming link) corresponds to the total amount of money that a creditor has lent to a CFI in order to finance

[40] Since the network combines two types of nodes (creditors and direct investments of CFIs), the network has two modes. In this type of network, the links are always between nodes of different types. In other words, in a two-mode network, edges should only exist between the modes, but not within the modes.

[41] This definition of the network allows for a *simple network* with unique edges between the nodes. *Multiple networks* have parallel (or multiple) edges between the nodes. This would have been the case if we had considered the type of target (*e.g.* by main economic activity/property type, geographical location or both) in the network. Indeed, for a given type of target, several loans can be granted by lenders.

its direct investment (respectively, or that the CFI has borrowed from a lender to finance its direct investment). Since the network is reversible, outgoing links are similar to incoming links.

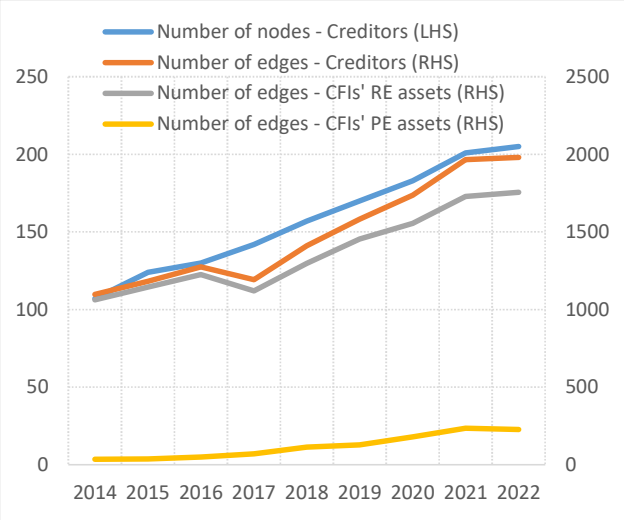
This reversible and weighted two-mode network regroups about 300 creditors with loan investment positions against about 3000 CFIs in the period 2014-2022.

5.2 Network-aggregated indicators

To evaluate the evolution of the network over time, the paper calculates several metrics at the network level.

The number of "nodes as creditors" increases over time (Chart 7), suggesting that the proportion of creditors in this network increases over time. The number of edges for creditors tends to increase over time, suggesting that the number of loan investment positions increases over time. This result holds for real estate investments and private equity investments, although the share of credit-financed real estate investments is higher than that of private equity investments.

Chart 7: Number of nodes and edges in the network



The number of edges is always higher than the number of "nodes as creditors". This is due to the fact that creditors can finance several investments in a given period.

Chart 8: Network strength

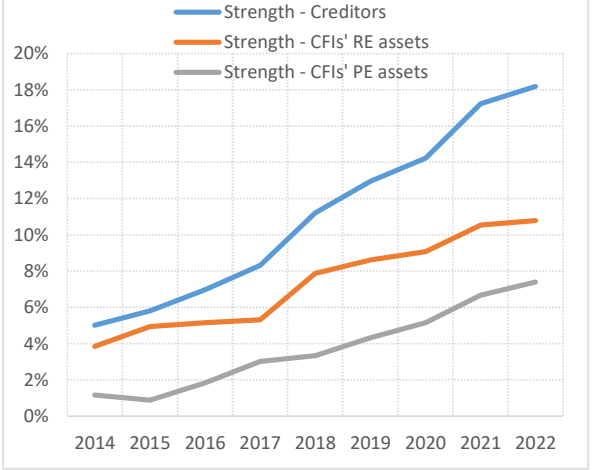


Chart 9: Network average degree

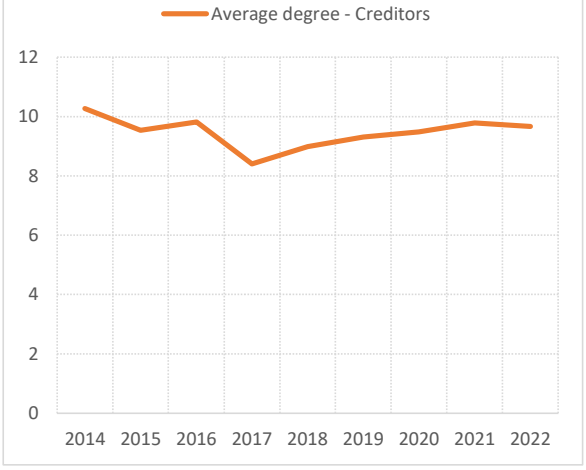


Chart 8 complements the analysis by looking at the strength of the network over time.[42] This measure increases over time, suggesting that loan investment positions have grown over the period. This result holds for loan positions financing private equity or real estate.

Thus, over the period 2014-2022, lending activity within the network developed through an increase in the number of participating lenders and an increase in both the number of loans and their respective amounts. However, the average degree (*i.e.* the number of edges per node, Chart 9) decreased in the period 2014-2017 and increased thereafter. The decrease in 2014-2017 can be explained by the fact that the number of participating creditors (or the number of nodes) increased more than the number of edges. The increase in the years 2018-2022 can be explained by the fact that the number of edges increased more than the number of nodes during this period.

5.3 Node-specific indicators

While network-aggregated indicators characterise the network as a whole, node-specific indicators focus on the position of the individual nodes that make up the network. In particular, the paper examines whether the distribution of loans among the lenders is similar or whether some lenders are more active than others in this network.

[42] The node strength is the sum of the weights attached to the links belonging to a node. In order to compare the evolution of the network strength across periods, the paper calculates the network strength as the sum of the weights attached to the links belonging to a node divided by the total weight of the links over the whole period.

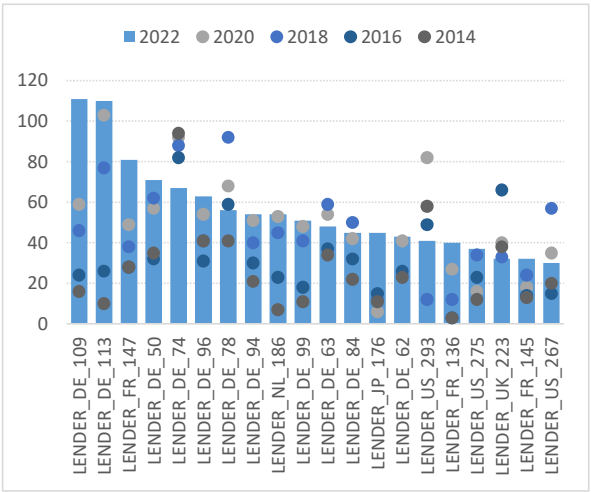
For this purpose, node-level degree centrality and strength are calculated and applied to weighted networks (Opsahl *et al*. (2010)). These metrics convey different messages about nodes. Degree centrality assigns an importance score based simply on the number of links each node has. Thus, lenders that issue a higher number of loans would therefore have a higher degree centrality. Strength assigns an importance score based simply on the sum of the edge weights of each node. Lenders that grant larger loans would therefore have a higher strength.

Charts 10 and 11 show the degree centrality and strength at the node level, respectively, by focusing on the lenders with the highest scores in 2022. These charts show that some lenders are more active than others in lending activity to CFIs ultimately owned by private equity or real estate investment funds. In fact, the top 20 lenders with the highest scores in terms of degree centrality and strength account for around 60% of the total number of connections and 60% of the total amount of loans granted.

Creditors resident in Germany have a high number of links (Chart 10). This result is consistent with the breakdown of loan investment positions (Chart 6). The share of German lenders decreases in favour of other lenders, especially US lenders, when looking at the size of connections (Chart 11). This can be explained by the fact that German lenders grant a higher number of loans, but in smaller amounts. They mainly finance real estate acquisitions (which are relatively less expensive than private equity deals) in Germany through Luxembourg-based CFIs (see Chart 6). On the other hand, US lenders mainly finance private equity investments (see Chart 6), which are more expensive, but in smaller numbers than real estate financing. This means that the importance of US lenders increases when the volume of connections is taken into account (Chart 11).

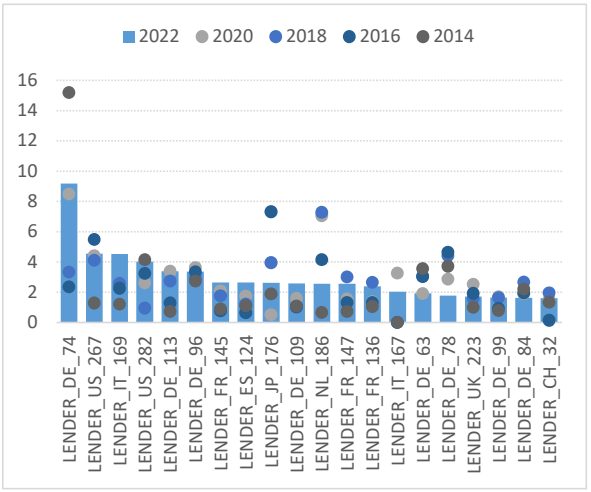
In addition, the relative importance of lenders' connections to CFI financing may vary over time, either in terms of the number or size of connections.

Chart 10: Degree centrality across nodes as creditors



NB : Chart 10 shows only the creditors with the highest degree centrality.

Chart 11: Strength across nodes as creditors



NB : Chart 11 shows only the creditors with the highest strength.

Overall, the analysis shows that the network of lenders funding CFIs ultimately owned by private equity or real estate funds has flourished over the period 2014-2022. The relationships have evolved both in terms of number and size, with certain lenders being more active than others. In other words, pass-through financing, which consists in capital inflows in the form of loans as other investment to finance outward FDI by resident CFIs ultimately owned by private equity or real estate funds, has increased over the period 2014-2022.

6. Conclusion

This paper examines the relationship between captive financial institutions (CFIs, sector S127) and external lenders. The paper focuses on Luxembourg-based CFIs owned by resident and non-resident investment funds specialising in private equity or real estate.

Within the holding and acquisition structures set up by fund sponsors, CFIs are primarily linked to other CFIs belonging to their respective fund structures, resulting in internal (or intra-group) financial linkages. The latter often take the form of direct investment positions between Luxembourg-based CFIs in the form of equity holdings and intragroup loans. However, within these respective fund structures, certain CFIs also have links with external lenders, giving rise to external (or extra-group) financial linkages.

At the aggregate level, this means that a significant proportion of CFIs have low exposure to external lenders. In 2022, CFIs with a credit exposure of less than 5% of their liabilities accounted for 60% of all CFIs linked to private equity or real estate investment funds and 63% of total assets. This is consistent with the fact that CFIs in Luxembourg are mainly interconnected with each other, namely in the form of holding companies and intragroup lending companies. While the majority of CFIs have a low credit exposure, some CFIs may have a higher exposure. This is, of course, particularly the case for CFIs that rely on loans as their main source of funding. In 2022, the credit exposure of these CFIs averaged 70% of their liabilities. They represent 15% of all CFIs linked to private equity or real estate funds and have a 10% share of total assets. The links between investment funds and external lenders take the form of indirect links established through certain types of CFIs (in particular conduits, entities with predominantly non-financial assets, mixed structures and extra-group loan origination companies).

CFIs that use loans as their main source of funding absorb 70% of the loans granted to CFIs that are linked to private equity or real estate funds. While banks are the main providers of these loans, other financial institutions such as investment funds, insurance companies and pension funds may also contribute.

In 2022, 60% of the stock of loans granted to CFIs using loans as a primary source of funding was provided for real estate investments, while the remaining 40% was used for private equity investments. German banks predominantly support the financing of real estate investments, while US banks are the leading finance providers for private equity investments. Of the real estate investments, 52% are in commercial real estate (mainly office buildings), 23% in industrial real estate (mainly logistics facilities) and 16% in residential real estate. These real estate investments are mainly located in Western Europe, with a significant concentration in Germany and the United Kingdom. By comparison, private equity investments are more broadly diversified across economic activities, with most targets located in Western Europe.

The contribution of loan financing to the final investment can vary considerably for CFIs that rely mainly on loans for financing. Nevertheless, the average contribution of loans declines over the decade leading up to 2022. In 2022, CFIs using loans as the main source of funding for private equity acquisitions are, on average, financed 25% by internal funds and 75% by loans. In comparison, CFIs investing in real estate are, on average, financed 35% internally and 65% by

loans. As a result, CFIs linked to private equity funds have a slightly higher leverage ratio than CFIs linked to real estate funds.

Between 2014 and 2022, the network of creditors financing CFIs ultimately owned by private equity or real estate investment funds has flourished. Relationships have evolved both in terms of number and volume, with certain lenders being more active than others.

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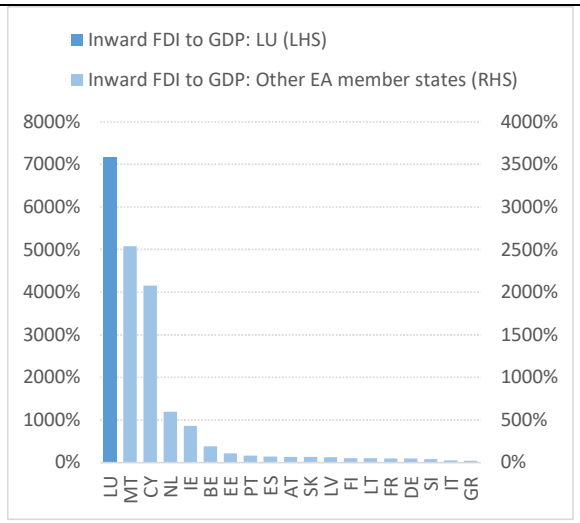
Appendix

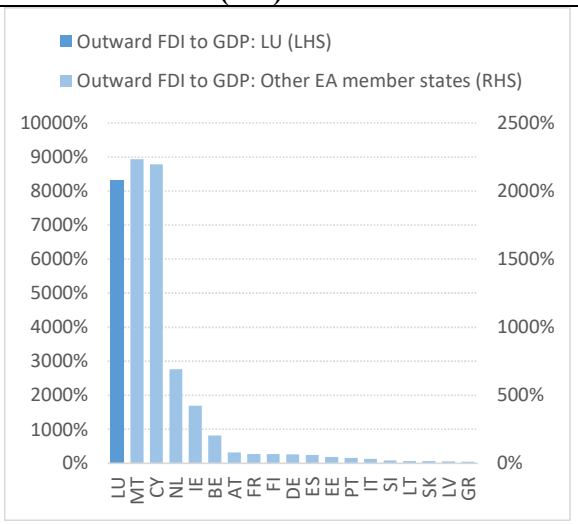
A. Foreign Direct Investment: selected statistics

Chart A.1 shows the ratio of inward and outward FDI positions to GDP for the euro area countries. Luxembourg has the largest inward and outward FDI positions compared to the other euro area countries.

Chart A.1: Ratio of FDI-to-GDP across euro area (EA) countries



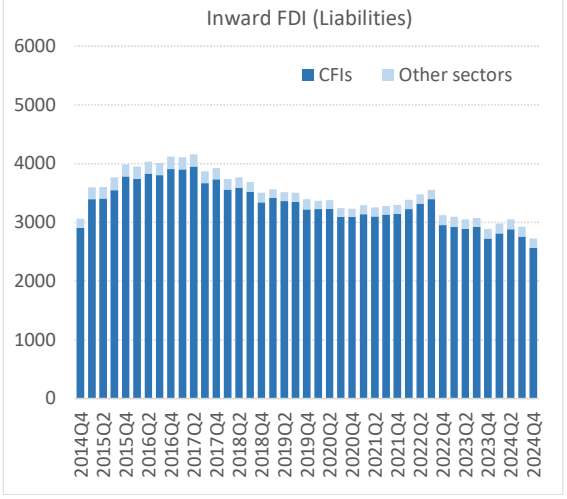
Source: ECB-SDW. Units: Average 2014-2024



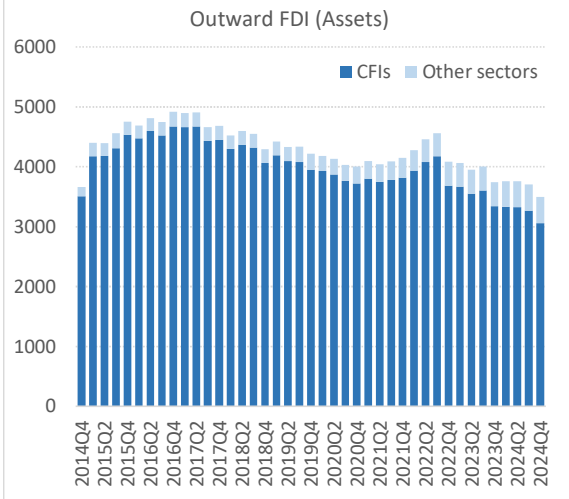
Source: ECB-SDW. Units: Average 2014-2024

Chart A.2 shows a sectoral breakdown of FDI stocks in Luxembourg, taking into account sector S127 (captive financial institutions) and the other sectors. On average, over the period 2011-2024, FDI positions whose counterpart is sector S127 account for 95% of inward FDI positions and 93% of outward FDI positions.

Chart A.2: Sectoral breakdown of FDI in Luxembourg



Source: BCL. Units: Percent



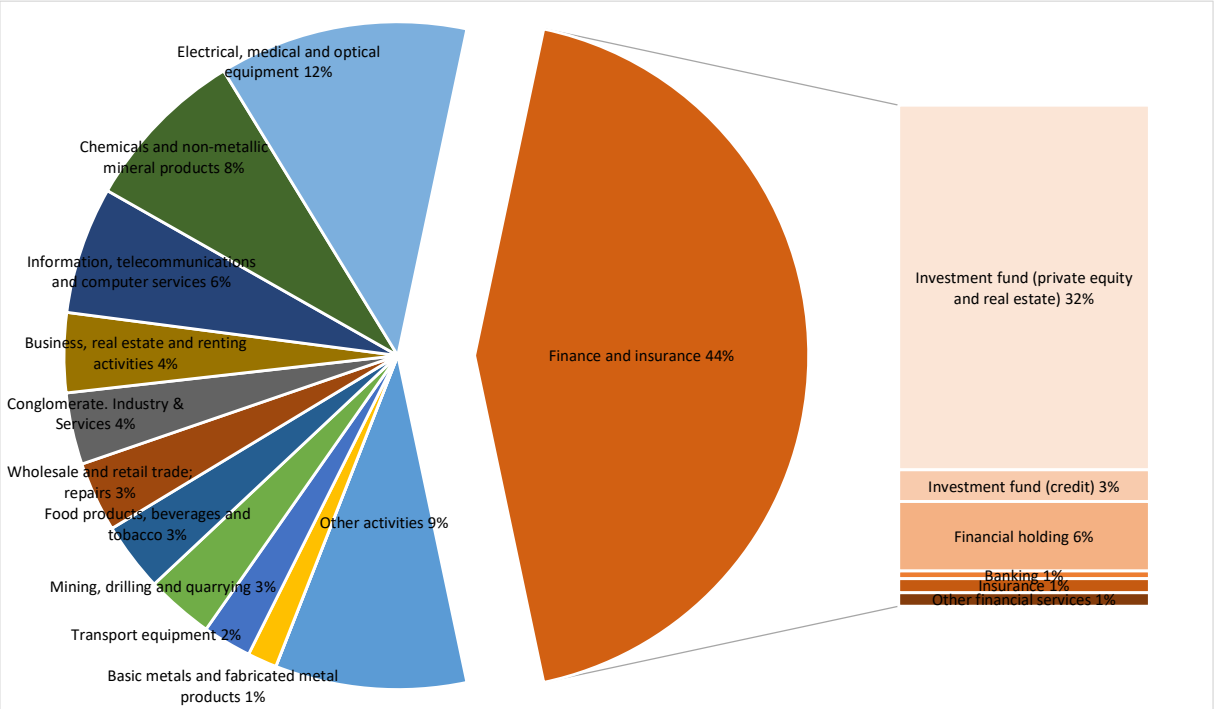
Source: BCL. Units: Percent

Since inward FDI positions mimics the evolution of outward FDI positions, this suggests that FDI in Luxembourg is essentially pass-through funds (or funds in transit).

B. Breakdown of CFIs' total assets by main economic activity of their parent group

Chart B.1 breaks down the total assets of CFIs resident in Luxembourg by the main economic activity of their parent group. In 2022, groups active in "Finance and insurance" own the largest share of CFIs (44%) followed by "Electrical, medical and optical equipment" (12%), "Chemicals and non-metallic mineral products" (8%), "Information, telecommunications and computer services" (6%), "Business, real estate and renting activities" (4%), "Conglomerates. Industry & Services" (4%), "Wholesale and retail trade; repairs" (3%), "Food products, beverages and tobacco" (3%), "Mining, drilling and quarrying" (3%), "Transport equipment" (2%) and "Basic metals and fabricated metal products" (1%). Together, these categories account for about 90% of the total assets held by CFIs in Luxembourg.

Chart B.1: Total assets of CFIs by main economic activity of their parent group

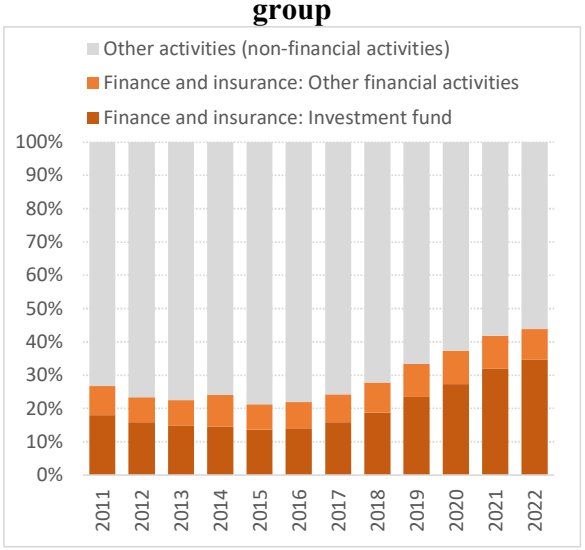


Source: BCL, new database based on EGR-SBR-CBSR. Units: Percent of total assets held by CFIs affiliated to a group. Period: 2022

Within the set of CFIs owned by finance and insurance groups, 80% of CFI assets in 2022 are owned by investment funds (Chart B.1). About 90% of these assets are owned by investment funds specialising in private equity or real estate. The remainder is mostly owned by credit investment funds (or private debt funds).

Chart B.2 shows the evolution of the shares of the total assets held by CFIs belonging to groups engaged in finance and insurance (financial activities) and those undertaking non-financial activities. The share of total assets of CFIs affiliated to groups undertaking financial activities increases from 2015, mainly driven by investment funds. In comparison, the share of total assets of CFIs affiliated to groups operating in other activities (mainly non-financial activities) decreases from 2015 onwards.

Chart B.2: Evolution of CFIs' total assets by main economic activity of their parent group



Units: Percent

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