International project finance deals as indicators of productive cross-border investment: UNCTAD's approach*

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Abstract

International project finance (IPF) can channel private cross-border capital toward productive investments in (mostly) infrastructure sectors, especially where government budget constraints are tight. Moreover, it has recently gained importance as a tool to finance the Sustainable Development Goals (SDG) and bridge the large infrastructure gap for climate megaprojects. In such contexts, projects often require international capital along with expertise and credibility; they also require a project-specific risk allocation that IPF accommodates. This research note assesses project finance in the context of international productive investments, its link with other forms of international investment (mergers and acquisitions, and cross-border greenfield investments) in the data used, and its use in UNCTAD's publications. Data is a lynchpin for analysis but is not unproblematic. The note explores incongruences and their impact. It also outlines UNCTAD's conceptual choice to capture *ongoing* productive investments in infrastructure through project finance in the world economy.

Keywords: cross-border direct investment, imputation, international project finance, matching, Refinitiv data

JEL classification codes: F30, F39, O16, O18, Q56

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1. Introduction

The financing gap for the Sustainable Development Goals (SDGs) amounts to a massive $4.3 trillion per year (UNCTAD, 2022). A pre-pandemic analysis estimated that developing countries were missing about $2.5 trillion to keep their SDG ambitions on track (UNCTAD, 2020). Lack of infrastructure hampers sustainable and inclusive growth. Although funding is low, the impetus for investment is high. This financing gap and the positive effect of infrastructure on growth (Ramey, 2020) partially explain the massive infrastructure initiatives developed by China (Belt and Road Initiative – BRI) since 2013 and by the G7 in 2022.[1]

Infrastructure can be economic (e.g. transport facilities such as highways, water supply such as sewage networks, energy supply such as power plants). It can also be social (related to human capital, such as hospitals, elderly housing, schools and prisons). Infrastructure shares some key characteristics: it has low demand elasticity, quasi-monopoly status, public service orientation and/or high regulation, long service life and stability of cash flows (Weber et al., 2016, p. 12). These characteristics lead to larger risks of expropriation and opportunistic behaviour by a monopolistic buyer or a monopsonistic supplier. These characteristics call for specific ways in which to finance infrastructure – if it is not entirely financed by a public entity.[2] Project finance is a well-suited financing structure for such cases. The defining elements of IPF are three:

i. The project sponsors constitute a dedicated entity: a special purpose entity (SPE).

ii. The SPE is the borrower.

iii. The recourse of lenders vis-à-vis the sponsors is limited.

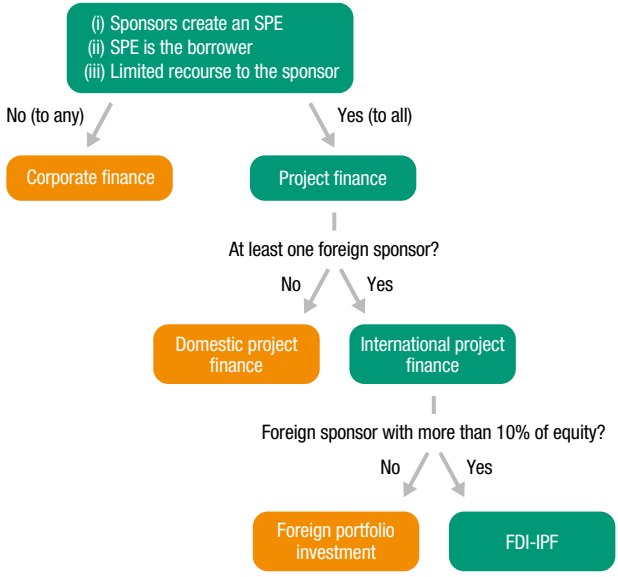
When a project does not satisfy all three criteria, it cannot be considered as project finance: it falls under the umbrella of corporate finance. International project finance (IPF) implies that at least one sponsor in the project finance deal is a foreign resident. When this sponsor owns at least 10 per cent of the project's equity, IPF is FDI-IPF (figure 1). This research note specifically looks at the share of IPF that is FDI-IPF.

From a development perspective, IPF is important because it has a positive impact on economic growth in least developed countries (LDCs) (La Cour and Müller, 2014). This type of finance bankrolls projects in countries that face acute fiscal constraints and supports the building of cornerstone infrastructure in

[1] Since 2013, China has invested between $40 billion to $60 billion every year. The G7 countries have pledged to raise $600 billion dedicated to infrastructure projects in developing countries.

[2] In developing countries, States lack the financial capacity to invest in all of the infrastructure they require.

Figure 1. What is an IPF project ? And what would be FDI-IPF (simplified)?



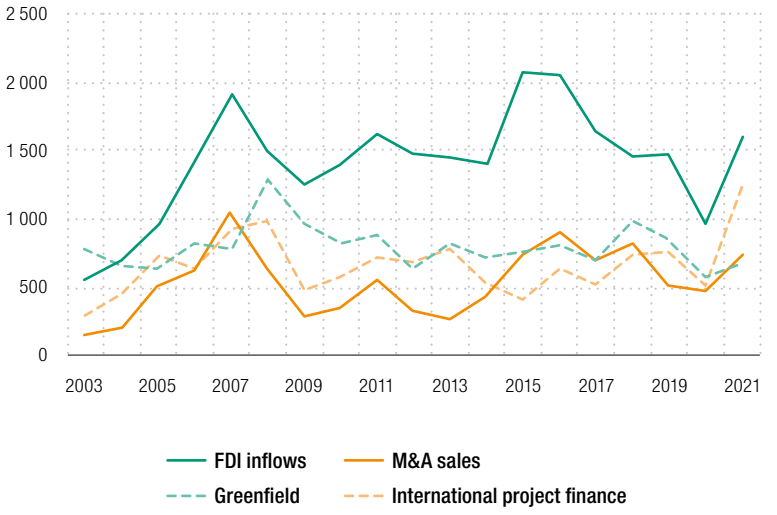
Source: Authors' elaboration, based on UNCTAD (2021).

these countries.[3] Although IPF accounts for approximately one third of all project finance deals, it accounts for 45 per cent of project finance projects in low-income countries and is thus a crucial enabler of development.

IPF is increasingly common in financing infrastructure and across sectors: between 2012 and 2021, the number of projects increased by 68 per cent and the total value of projects increased by 15 per cent.[4] Importantly, IPF has experienced a dramatic shift in the sectors that implement such financing. In 2010, mining, oil and gas, and petrochemicals accounted for 21 per cent of all IPF projects but in 2020 only 12 per cent. Conversely, and on the upside for sustainable development, IPF has contributed to the rise of the renewables sector. IPF renewable projects accounted for 31 per cent of all announced deals in 2010, and for 54 per cent of all deals in 2021. Figure 3 shows the evolution of IPF by sector, over time. The sectoral change also has led to less costly projects being financed through IPF (Steffen, 2018). Figure 4 displays the reduction in average IPF project costs over time.

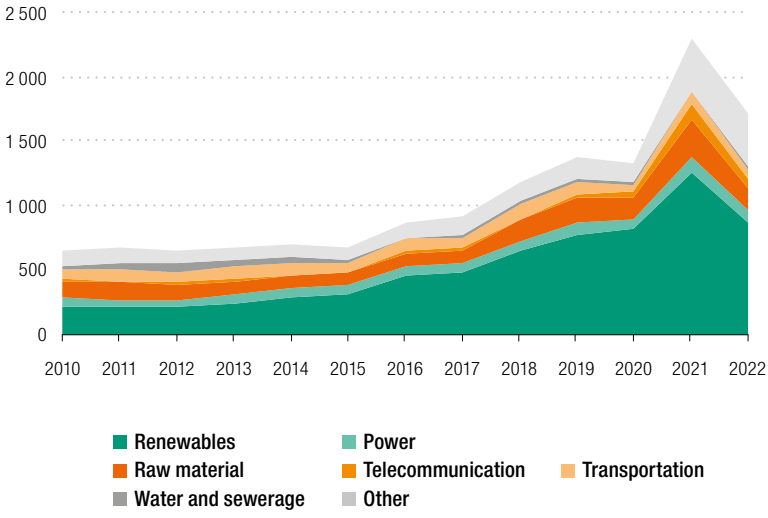
[3] By construction, public-private partnerships (PPPs) are part of project finance.
[4] See UNCTAD (2022), figure 2.

Figure 2. Trends in FDI and types of FDI (Millions of dollars)



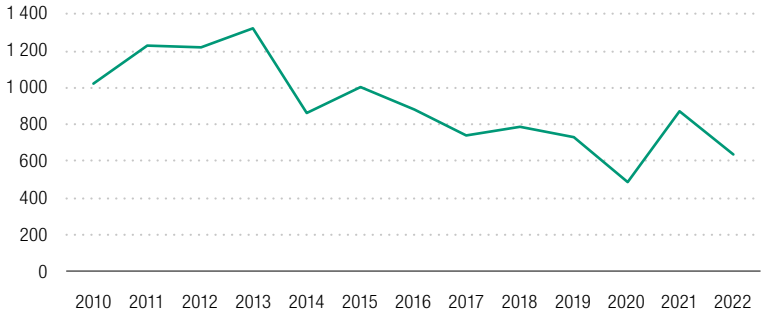
Source: Refinitiv data on project finance deals, UNCTAD.

Figure 3. IPF projects by main sectors, 2010–2022 (Number of deals)



Source: Refinitiv data on project finance deals.

Figure 4. Average IPF project cost, 2010–2022 (Millions of dollars)

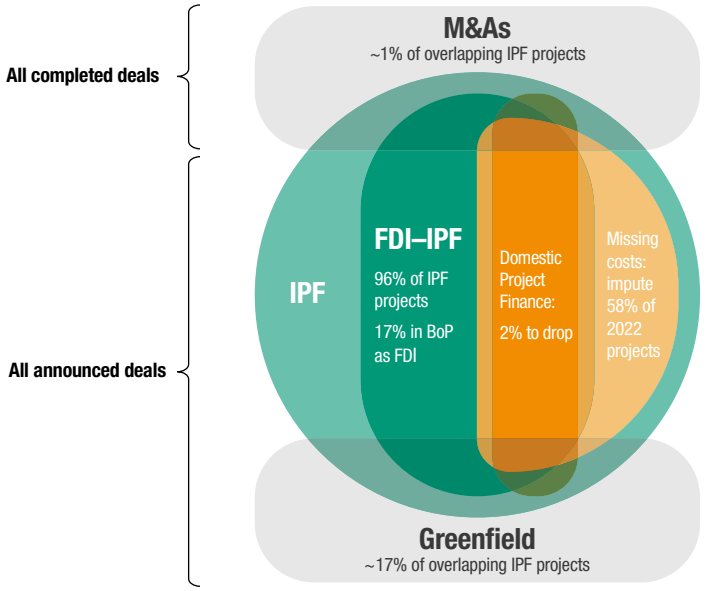


Source: Refinitiv data on project finance deals.
Note: Only projects with cost information are included.

IPF is financing projects that could otherwise be financed using corporate finance. The overlap in terms of projects between cross-border greenfield investments (financed through corporate finance) and IPF can be sizeable. Measuring this overlap is one of the objectives of this research note. Project finance investments can be "gate openers": once some projects have been implemented, investors may feel confident enough to bear the risks inherent in future corporate finance investments. Frequently, infrastructure projects in LDCs do not have precedents against which to anchor decisions. Therefore, project finance is a well-suited financial scheme to pave the way for future infrastructure investments, regardless of their financing structures. LDCs could use this type of investment to create a positive case for future infrastructure investments.

This research note aims to provide the rationale behind the use of IPF data as part of cross-border investments and FDI in UNCTAD's investment research. It highlights the rationale behind the selection of announced IPF deals as indicators of productive cross-border investment intentions. It also explores the possible overlap between IPF and other forms of cross-border investments, namely greenfield investments and mergers and acquisitions (M&As). The research note assesses the quality of IPF data and its suitability for UNCTAD's investment research. Estimating the share of IPF that is FDI is challenging. This note suggests a framework to conceptualize its measurement to inform data-led decision-making. Figure 5 summarizes the layers of difficulties UNCTAD faces when using IPF data, an indicator of both a data challenge and an opportunity. The research note addresses these issues by responding to the following questions: (i) what is IPF and why is it a valuable source of information on FDI? (ii) What are the data limitations, the impacts on reported trends and the possible solutions? (iii) How much of IPF is FDI?

Figure 5. Overall summary of the data challenges covered



Source: Authors' elaboration and calculations, based on Refinitiv data on project finance and merger and acquisition deals and fDi Markets data.

The key issue is that, currently, because of differing definitions and data incongruences, the way IPF is measured conceals the scale of FDI associated with it. Including deals on the basis of announcements provides a forward-looking measure of FDI, and this measure supports the developing-country case for future FDI. Methods to extract this information vary but essentially clean the data by dealing with overlaps, better identifying offshore and onshore companies, and exploring missing information.

2. What is IPF?

When deciding among financing schemes, project finance is traditionally compared with corporate financing. Cross-border greenfield investments are investments funded through corporate financing.[5] A company directly invests in or develops

[5] Here, cross-border greenfield investments are projects in which a company invests abroad through a branch or a subsidiary.

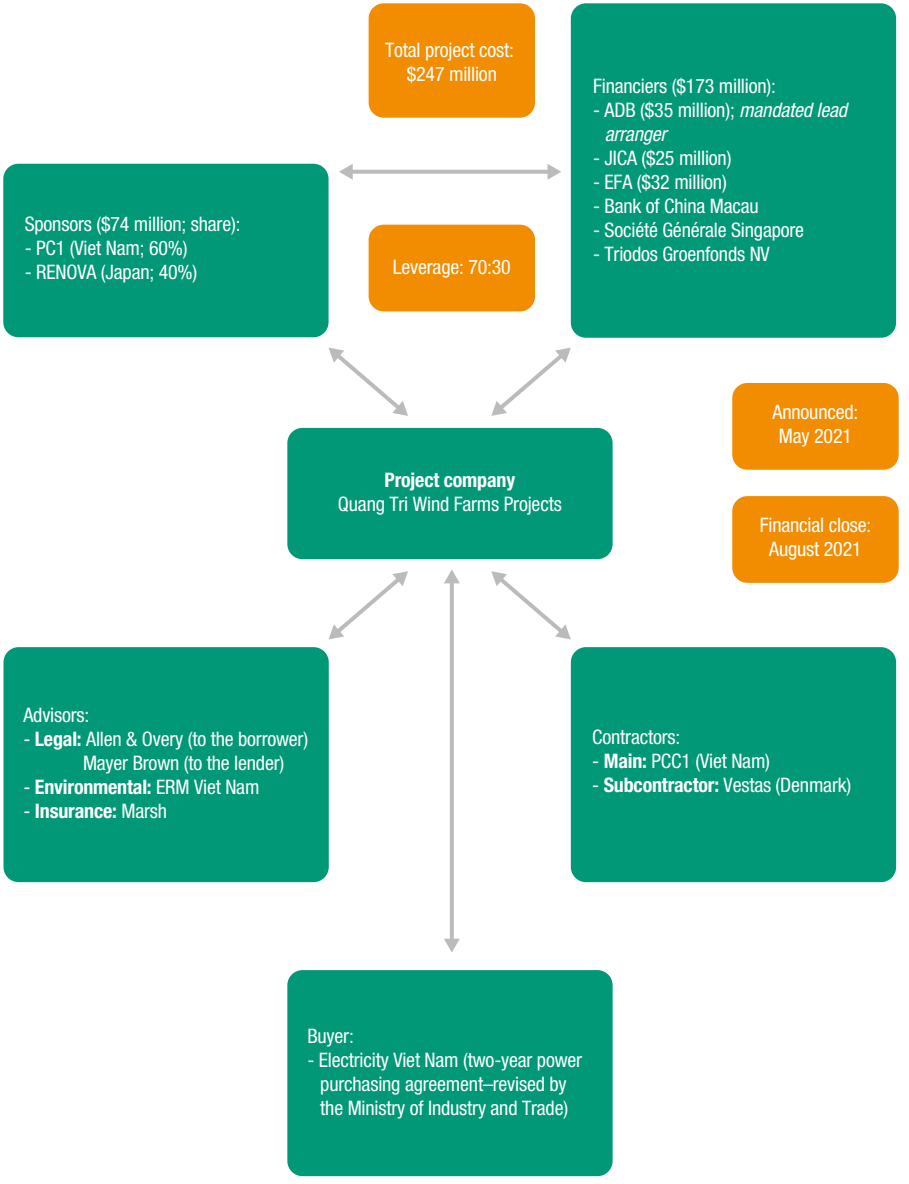
a subsidiary and bears all the risks, particularly on all the company's assets. The link between lenders and equity providers is direct in greenfield investments. In contrast, the link between lenders and sponsors is indirect in IPF investments (the SPE is a buffer that allows limited recourse and thus lower risk for the sponsors). In corporate finance, financing is granted for satisfying several characteristics: customer relations, solidity of the balance sheet and profitability of the project. In contrast, financing in project finance is granted only on the prospect of future cash flows. In corporate finance, leverage is gained through a robust balance sheet, whereas in project finance it comes from cash flows (Gatti, 2013).

An investment becomes a cross-border investment when at least one equity provider is a foreign entity. Cross-border investments add extra layers of complexity and risks; for example, exchange rate variances, jurisdictional differences, risks of expropriation and hold ups by influential buyers or suppliers (Sawant, 2010; Shah and Thakor, 1987). Because of limited recourse, equity providers are more willing to develop an IPF structure than a traditional corporate finance structure, when these perceived risks are high. Project finance is suited for structuring longer-run, evolving projects entailing many stages of negotiations among stakeholders to construct the most suitable financing structure. In this process, negotiations among the main stakeholders are costly. Transaction costs are estimated to account for 5–10 per cent of the total investment but are supposed to save on agency costs in the medium to long run (Gatti, 2013).

A concrete illustration of an IPF infrastructure project in a developing country can draw on the experience of Viet Nam (figure 6). The case in the figure demonstrates what a project looks like when it incorporates the SDGs.[6] Perhaps the most important aspect is the power purchasing agreement with the relevant State-owned enterprise in conjunction with a public agenda that endorses renewable infrastructure in Viet Nam. Public support, whether direct (e.g. equity participation, loans) or indirect (e.g. authorizations, guarantees, feed-in tariffs), is crucial for not only domestic but also international project finance, especially in developing countries (table 1). The case of the Vietnamese wind farm reflects this. Still, even with public support, it is likely that the project would not have occurred without explicit (the power purchasing agreement) or implicit (a long-term State agenda in favor of SDG-oriented investments) guarantees from public entities. It is critical that developing nations consider both State and public support in securing IPF.

[6] Private capital from expert enterprises as sponsors, credible loan providers led by a multilateral development bank and credible contractors.

Figure 6. Quang Tri Farm IPF project in Viet Nam, illustration



Source: Authors' elaboration, based on Refinitiv data on project finance deals, PC1 (https://pc1epc.vn/en/phong-nguyen-wind-power-plant-project), Renova (https://www.renovainc.com/en/development/quangtri_wind/202204_3438/), *PFI 2022 Yearbook* (https://www.pfie.com/story/3180690/foreword-sdgzm8mxvs).

Table 1. Public support in equity in project finance, share of projects by category (Percentage)

Sample	Variables	Values	All projects	Domestic projects	International projects	Domestic projects in developing countries	International projects in developing countries
All projects	Using Refinitiv variable	Some government support	50.4	60.1	27.5	75.3	35.6
Top 100 projects (per category)			47	67	43	78	51
	Checking sponsor's name	No support	56	34	79	24	66
		State-owned enterprise	12	44	4	27	17
		Government	32	21	17	49	17

Source: Refinitiv data project finance deals.

Note: "All projects" refers to all international project finance projects from 2011 until May 2022. "Top 100 projects" is by total cost. Developing countries include both least developed countries and middle-income countries. To read the table, 50.4 per cent of all projects have some government support, and 47 of the 100 biggest projects have some government support.

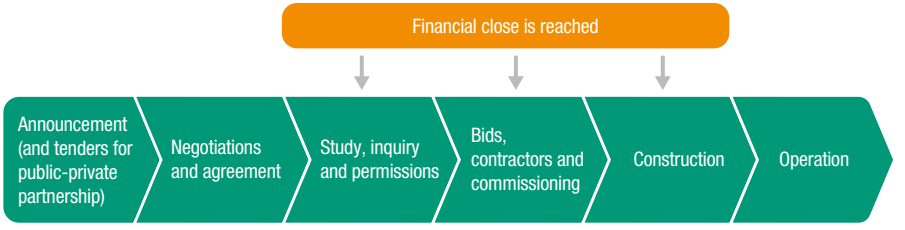
3. Why use announced deals?

A project financing journey is complex and varies according to the context. Nevertheless, it includes milestone events such as project announcement, financial close, construction, completion and inauguration, and transfer. The two most important events from the perspective of data collection are the initial announcement and the financial close announcement. Some institutions use financial close announcements (e.g. the European Investment Bank, the Global Infrastructure Hub and the World Bank), UNCTAD includes initial announcements (referred to as "announced projects").[7]

It is clear that using announcement data will tend to overestimate the numbers and values of projects, because some projects never reach the stage of construction or completion. In contrast, using financial close data will lead to underestimation, because many projects have open-ended financing arrangements or financial close data is not reported, despite the fact that construction has started or the project is completed. Looking at all project finance (including domestic deals) shows that the degree of underestimation from the use of financial close data is actually larger than the degree of overestimation from the use of announcement data. This is not the case for international projects, where relatively more projects reach financial close, but the degree of underestimation remains substantial.

Ultimately, both data strategies are more complementary than conflicting. Restricting data collection analysis to deals that reach financial close gives a post-event view of the state of play rather than of intent. Figure 7 indicates that financial close comes at various stages of the project; and it is clear that often financial close is reached only after the start of the construction (in 56 per cent of IPF projects).

Figure 7. Simplified IPF timeline



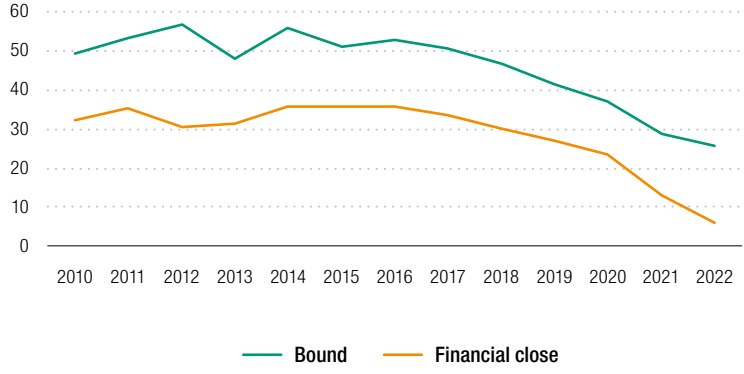
Source: Authors' elaboration, based on Gatti (2013) and Weber et al. (2016).

[7] Canceled and suspended deals are excluded, and data updating makes the set of excluded projects vary over time.

In contrast, using announced deals to reveal data trends provides an indication of the investment intentions of stakeholders before the financial deal closes, and is an indicator of policy commitment with financial intent and opportunity. In a real-world analysis, this enables a wider picture of the current state of play and the future dynamics. In this regard, UNCTAD's World Investment Reports assess the *current* state of the economy and provide insights into what is to come. Keeping announced IPF projects in the data has two key justifications: it is consistent with cross-border greenfield investments, and it captures the *willingness* to invest.

Announcing investment is already a strong signal to the market. It can drive a more positive investment sentiment, in a virtuous circle. This is visible in the current trend of public and private entities building an agenda that is more climate change-oriented, using infrastructure as a lever. For example, Egypt's integration of solar energy into the policy mix enabled the Benban solar complex to be financed largely by project finance. Today it is the fifth largest photovoltaic power station in the world.[8] Concisely, announced projects, even if not completed, play a vital role for sponsors and lenders. Announcements are a decisive signal for international investors about where, when and how to invest.[9]

Figure 8. Share of bound IPF projects, 2010–2022 (Percentage)



Source: Refinitiv data on project finance deals.
Note: A project is deemed bound if it (i) reaches financial close, (ii) is under construction, (iii) is in commissioning or (iv) has a sale agreement signed or completed, in the case of acquisitions.

[8] Louise Sarant, "The rise of solar energy in Egypt", 18 February 2015, Middle East Institute, www.mei.edu.

[9] About half of announced projects in 2010 have not reached the construction stage and thus are likely to never reach the construction stage. On the other hand, beyond one third of all binding projects have not reached financial close. For details, see figure 8.

Importantly, both decisions to announce a deal and to announce financial close are strategic.[10] These decisions play a role in the market value of the project and/or in the return for stakeholders (Blose and Shieh, 1997; Kammoun and Power, 2022).

4. What are the data limitations and the possibilities to overcome them?

4.1 How much do IPF and other cross-border investments overlap?

Data comparability and consistency across different types of FDI is challenged whenever overlaps exist with other FDI types used in the World Investment Reports (M&As and greenfield investment).

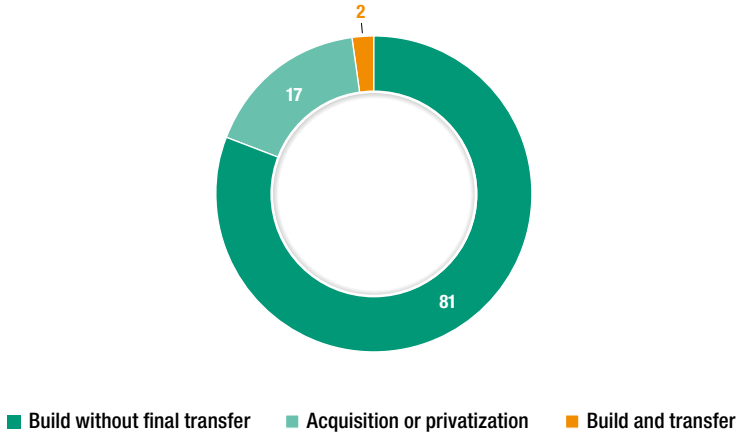
4.1.1 How do IPF deals and M&A deals overlap?

FDI taxonomy, as it is reported in the World Investment Reports,[11] separates projects funded by corporate finance and by project finance, which are both considered productive investments, and M&As, including privatizations, which are less so because the production facility already exists. Although in various cases the situation is intricate, as in the case of acquisition with capital extension, this taxonomy allows the tracking of trends in different types of FDI. Figure 9 shows that 17 per cent of all IPF projects are in fact acquisitions or privatizations and may therefore be relatively less productive. For the sake of consistency, M&A and privatizations might be excluded from productive IPF investments but this exclusion prevents the inclusion of potential capital extensions. Understanding this implication is vital in the data analysis.

Regarding the risk of overlap with M&A data, not all IPF deals that lead only to an acquisition appear in M&A data. Matching IPF and M&A databases, the number of overlapping projects corresponds to 1.3 per cent of all IPF projects (using 2022 data).[12] This accounts for a small proportion of all projects, so the overlap is limited and thus not worrying.

[10] Indeed, 40.30 per cent of IPF deals have identical announcement and financial close dates (when any) and 23.32 per cent of IPF deals have identical announcement and construction start dates.
[11] For example, see UNCTAD (2022), p. 18 and pp. 22–32.
[12] This amounts to 1.45 per cent of all project values.

Figure 9. Announced IPF projects by type, 2022 (Percentage)



Source: Refinitiv data on project finance deals.

4.1.2 How much of IPF might be cross-border greenfield investments?

In World Investment Reports and other UNCTAD publications, greenfield cross-border investments are predominantly projects funded by international corporate finance. In theory, corporate finance and project finance do not overlap; however, it appears that projects can overlap in the databases used. This is both unsurprising because the data sources differ and worrying because data harmonization is poor. Refinitiv and fDi Markets, which UNCTAD uses to extract IPF deals and cross-border greenfield investments, respectively, have different methods for collecting data. The former collects from a broad range of sources (e.g. banking, financial, public), whereas the latter is restricted to public announcements. The result is little common ground for matching both databases and sets. Companies' names differ, capital expenditure values vary and the years of the project can change. Data congruence is paramount for the full picture, yet difficult to achieve.

A simple and imperfect matching procedure is attempted. It is based on the direct investment country and direct investor country, the year of the deal and the first word of the investor's name.[13] Although the procedure is not definitive, it helps map the magnitude of the issue. Matching suffers from two major flaws.

[13] More elaborate matching methods, for example constituting a matching score based on bigram algorithms, lead to less satisfactory matching than this simple method.

First, the process overestimates the number of overlaps when the same firm invested in several projects in the same foreign economy in the same year. The matching process is based on the first word only, so when firms (or investing entities) have the same first word projects might be counted as overlapping although they are not (a typical example arises when the investing entity is a country name starts with "Republic").[14] As displayed in table 2, the case of Uzbekistan from 2020 to May 2022 shows that two project pairs were wrongly included because of the issue of the same company investing in multiple projects. Second, there are several data discrepancies, such as the fact that years are not identical across data sets. In the case of Uzbekistan, three projects cannot be matched for these reasons. It is extremely tedious (if even possible) to decipher the balance between these two opposite effects. Accurate conclusions based on the precision of the overlap identifications cannot be derived.

Table 2. Summary of manual screening in Uzbekistan

Item	Refinitiv (IPF)	fDi Markets (FDI)
Number of projects	26	48
Number of overlapping projects	7	8
Number of projects with missing costs	13	0
Share of overlapping projects	23.1%	14.9%
Share of overlapping project costs	12.3%	41.5%

Source: Refinitiv data for project finance deals, fDi Markets (2020 to May 2022) for FDI.

Note: Numbers of overlapping projects differ because one overlapping project is not considered to be international project finance in the Refinitiv data. fDi Markets imputes costs, hence no costs are missing. Overlapping projects differ because some domestic projects in Refinitiv can overlap with projects in fDi Markets.

Data from 2020 to May 2022 demonstrates that about 17 per cent of all IPF project numbers and 20 per cent of all IPF projects' value could overlap with cross-border greenfield investments extracted from fDi Markets. Table 3 provides details on the different matchings and their outcomes. This overlap is large and raises serious concerns, as the matching method cannot be exact. It is probably better to keep the overlapping projects to IPF data only, as these projects are larger than traditional cross-border greenfield investments and therefore not representative of greenfield FDI. Again, the issue of data congruence is telling and affects deeper analysis of the genesis of funding.

[14] For the 2020–2022 (May) period, only 0.2 per cent of all projects include a foreign State named "Republic ..." as a sponsor.

Table 3. Approximate overlap per database

Number of unique paired projects	Refinitiv (IPF)	fDi Markets (FDI)
Match score > 0.2	2 166	4 976
First word in company name	731	810
Total number of international projects	4 325	29 721
Share of overlapping projects (using the most conservative number: 731 for Refinitiv and 810 for fDi Markets)	16.9%	2.7%
Share of total costs (and imputed costs)	19.8% (18.7%)	13.2%

Source: Refinitiv data for project finance deals, fDi Markets (2020 to May 2022) for FDI.

Note: The matching score uses the Jaccard similarity score, using the matchit command on Stata built by Julio Raffo (see Raffo and Lhuillery, 2009, pp. 1619–1627). Both data sources have two name variables for the investing company(ies). A score is constructed for the four pairs. Restricting matching pairs that have at least one of these scores above 0.2 reduces the matched pairs to 13 with only 7 different projects in fDi Markets and 13 in Refinitiv. Given that two of the six projects cannot be merged because of year discrepancies across the data and that one does not have a common investing country, the five recovered pairs are a rather good result: the five overlapping pairs that could be retrieved are retrieved. Given the lack of accuracy of the matching, the minimum number of each database is used for the subsequent computed statistics. Projects are deemed international in Refinitiv project finance data as soon as at least one sponsor is foreign. The second matching is more realistic, using the fact that one of the company name pairs has an identical first word. This has two drawbacks leading to overestimation of pairs: one when the first word is identical but not the company, the other when the same company is differently named (even the first word can be different).

4.2 Is there domestic project finance in IPF?

What is implicit in the data limitations is that some IPF projects actually might be domestic project finance investments. Knowing where the direct investor's headquarters are and the location of the ultimate investor's headquarters is useful for tracking this issue.

Projects occurring in a country whose sponsor's headquarters is in the same country and whose ultimate sponsor's headquarters is a tax haven can be questioned as being an FDI on two grounds.[15] First, the international component of the investment is doubtful, as the sponsor's headquarters is in the same locale. Second, sponsors located in tax havens might be more interested in the rate of return and the profitability of projects than the impact on the management of projects; hence, the financing is more likely to be portfolio finance, rather than FDI. This second scenario calls for a more cautious analysis, in line with the work of Coppola et al. (2021).[16] Only the first one is addressed in this research note.

The concept of cross-border transactions incorporates investments of international actors that seek to be involved in another economy for reasons such as diversifying,

[15] From UNCTAD's listing.

[16] About 16 per cent of all IPF projects have an ultimate sponsor in an offshore centre.

extending market access and global value chains, and developing new partnerships. Yet, cross-border transactions also include investments from local actors whose ultimate headquarters are based in a tax haven. A typical example is a project implemented in the Russian Federation by a Russian company whose sponsor is based in Cyprus. In such a case, the underlying motive for this investment differs from that of other international investors. About 3 per cent of IPF projects have a different headquarters and ultimate headquarters, with the ultimate one being a tax haven. Profit shifting and round-tripping are likely reasons underlying this phenomenon. However, among these IPF projects, some headquarters are already not located in the country where the project is being built (i.e. some projects have country A not equal to country B in figure 10). The FDI aspect of the investment remains for these projects. In 2 per cent of IPF deals there are headquarters in-country but an ultimate headquarters in a tax haven in another country.[17] When this is the case, the project is still a domestic project finance project. The estimate here accounts only for projects whose foreignness is questioned. Only a lower bound is provided here. These projects do not belong to IPF and should not be included in further analyses.

Figure 10. Headquarters and ultimate headquarters, from FDI to other investments

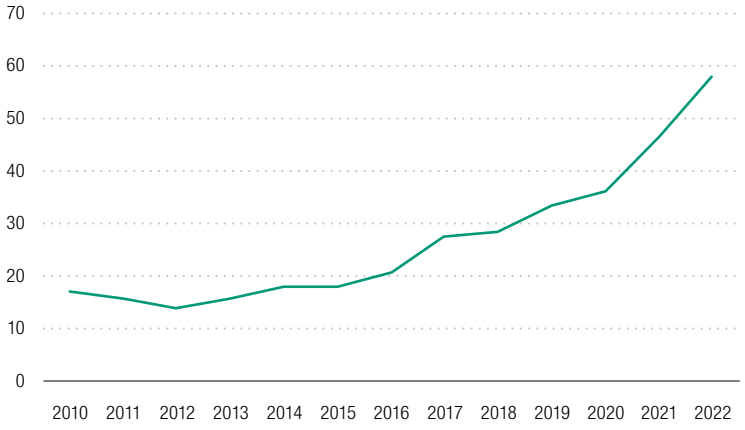
Source: Authors' elaboration, based on UNCTAD (2009).
Note: A project is deemed bound if it (i) reaches financial close, (ii) is under construction, (iii) is in commissioning or (iv) has a sale agreement signed or completed, in the case of acquisitions.

4.3 How important is missing information?

Project costs are necessary to evaluate the total value of IPF and equity information is required to decipher what is true FDI among IPF investments. These elements are often missing. The more recent the financing or investment, the greater the lack of data on missing costs. This is caused by data gaps associated with pending project updates. Figure 11 shows the share of missing costs over time.[18]

[17] When country A in the figure is identical to country B (figure 10).
[18] Equity is non-missing when there is only one sponsor, as one can infer that the unique sponsor owns all the equity. The issue of missing equity information is covered in a subsequent section.

Figure 11. Share of IPF projects with missing costs (Percentage)



Source: Refinitiv data on project finance deals.

The initial multiple imputation used so far has drawbacks; however, these can be reduced when using a non-subjective choice of variables to include in the imputation. To include the most relevant variables in the multiple imputation procedure, a backward selection on a simple robust regression model is implemented. The explained variable is the project cost and only the subset with information on project cost can be used to select the appropriate set of variables. The variables that are statistically significant (at the 10 per cent level of significance in the regression model) are used in the multiple imputations. This produces more satisfactory results than the initial imputation used, which includes subjectively selected variables.

Nevertheless, imputation still is not satisfactory. Total costs for the current year (here using the first nine months of 2022) are missing for 58 per cent of projects. Imputations are conservative, as megaprojects are less likely to be implemented or successful than other projects (Denicol, 2020, p. 2). They systematically underestimate total costs, leading to a likely 20 per cent underestimation of the grand total of project costs in IPF. Indeed, the imputed missing costs represent 58 per cent of the projects but only 37 per cent of all costs (using the backward-selected variables for the multiple imputations).[19] As table 4 shows, cross-

[19] Using the original subjective imputation, the total costs of imputed projects amount to 28.03 per cent of all costs, so the underestimation is even larger: close to a 30 per cent overall underestimation of project costs (for the current year).

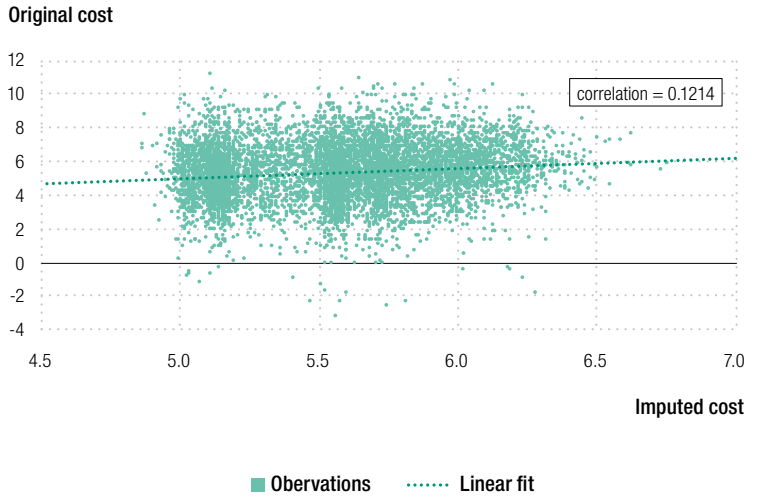
validation exercises are not fully satisfactory either. The means of imputed costs are between two and three times smaller than the actual costs. The linear correlation between the actual costs and the imputed costs when variables are backward selected is +0.275, whereas it would be equal to +1 if imputation were perfect (figures 12 and 13).

Table 4. Cross-validation summary statistics (Millions of dollars)

	Original data	Base multiple imputation	Enriched multiple imputation
Mean	806	281	391
Median	217	266	284
Total costs	6 155 088	2 148 432	2 989 444

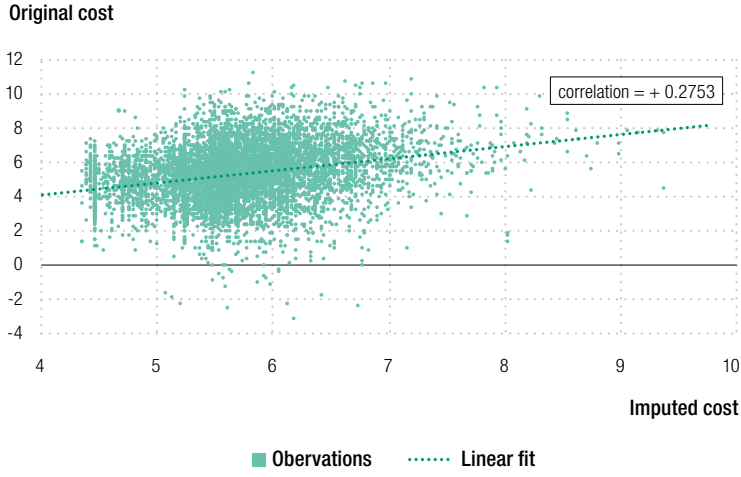
Source: Refinitiv data for project finance deals.
Note: All international projects from 1990 to 2022 (30 September) are included.

Figure 12. Cross-validation of costs using the initial imputation method
(Millions of dollars)



Source: Refinitiv data on project finance deals.
Note: Basic multiple imputations used in UNCTAD's investment research include the level of development of the project host country, year of announcement, sector, type of project, whether the project crosses borders and project home country.

Figure 13. Cross-validation of costsusing enriched imputation, backward selection (Millions of dollars)



Source: Refinitiv data on project finance deals.
Note: Proceeding to a simple backward selection, imputation uses the following variables: year and quarter of announcement, project host country, number of sponsors, project status, whether the project is (i) in financial close, (ii) BRI, (iii) under construction or operational or (iv) providing information on equity.

Although state-of-the-art methods are tested,[20] and although backward-selection multiple imputation is implemented, the imputations cannot be deemed fully satisfactory. Great care is required when interpreting the total values of projects where imputed costs are included. It calls for a use of project numbers rather than projects' values anytime possible, as is done in UNCTAD publications.

5. How much of IPF is FDI?

A big question remains. How much of international project finance qualifies as FDI? There is a discrepancy between a generic criterion of 10 per cent of non-resident equity for all the capital in the project to be FDI and what is included in a balance of payments (BoP). A BoP includes only the non-resident equity-based capital and not debt. Data limitations prevent accurate conclusions. It is only possible to compute shares of equity across projects, for projects with available equity information,

[20] Multiple Imputation with Denoising Autoencoders – MIDAS – is tested but does not deliver better cross-validation results than traditional multiple imputation methods (Lall and Robinson, 2022).

and infer global shares. For this a stepwise procedure is implemented. Thus it is critical to problematize this issue by considering three key questions. First, what is the share of projects with at least one non-resident equity provider with more than 10 per cent of equity? Second, what is the average share of equity owned by non-residents? Third, what is the debt-to-equity ratio?

5.1 What is the share of IPF projects that fulfils the 10 per cent equity criterion?

An investment is deemed to be FDI when an entity is registered outside the economy where the project is implemented and possesses at least 10 per cent of the voting rights (or 10 per cent of the equity). The underlying reason for this definition is the medium- to long-term involvement of the investors in the project. IPF and FDI are almost identical: almost 96 per cent of IPF projects are FDI projects. This magnitude is taken from the deals where information on equity shares among sponsors is available or can be retrieved.[21] The underlying assumption is that the ratio FDI/IPF of deals with information on equity is similar to the set of all deals.

Computing this share by year, by sector or by project region is a natural extension of this exercise. The idea is simply to compute the shares of IPF and of FDI-IPF among projects with equity information in the subset of interest (for example, renewable projects, projects in Sub-Saharan Africa).[22] Beyond the number of projects, the issue is also about the value of IPF that is FDI.

5.2 What is FDI-IPF in BoP accounting?

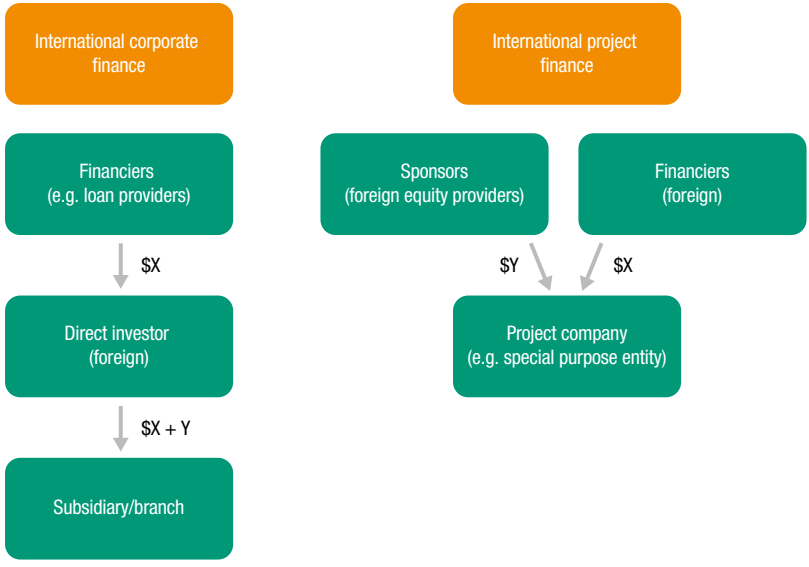
Although the FDI definition is clear, it might be particularly restrictive for project finance because sponsors are not borrowers. The SPE structure of IPF makes it difficult for such financing to feature in FDI statistics. Indeed, the benchmark definition of the Organisation for Economic Co-operation and Development (OECD) recommends "the statistics be compiled excluding resident Special Purpose Entities" (OECD, 2015, p. 6). Not all IPF investment would be included as FDI. Unlike projects funded by corporate finance in which financiers provide loans to equity owners, in projects funded by project finance the borrowing entity is the dedicated entity. Amounts that accrue from financiers are included in the BoP in the case of corporate finance insofar as they translate into intrafirm loans, whereas in the case of project finance they are mostly not included.

[21] The longer the panel, the larger the share of deals with retrievable information. This is a reason why using the long time series 1990-2022.

[22] The subset should not be too restrictive to provide realistic approximations that are not relying on a handful of projects.

Figure 14 sketches corporate finance and project finance projects involving international direct investors in their simplest form.[23] There is only one direct investor in either type of financing and one foreign loan provider. The former invests $Y in equity and the latter lends $X. The key difference is that corporate finance implies that the direct investor is the borrower while project finance implies that the SPE is the borrower. This difference has a tremendous impact on what a BoP would include as FDI. Indeed, in the case of corporate financing, FDI on this project amounts to $(X + Y) whereas in the case of project finance it amounts to $Y only.

Figure 14. International corporate finance and IPF processes



Source: Authors' elaboration, based on UNCTAD (2009).

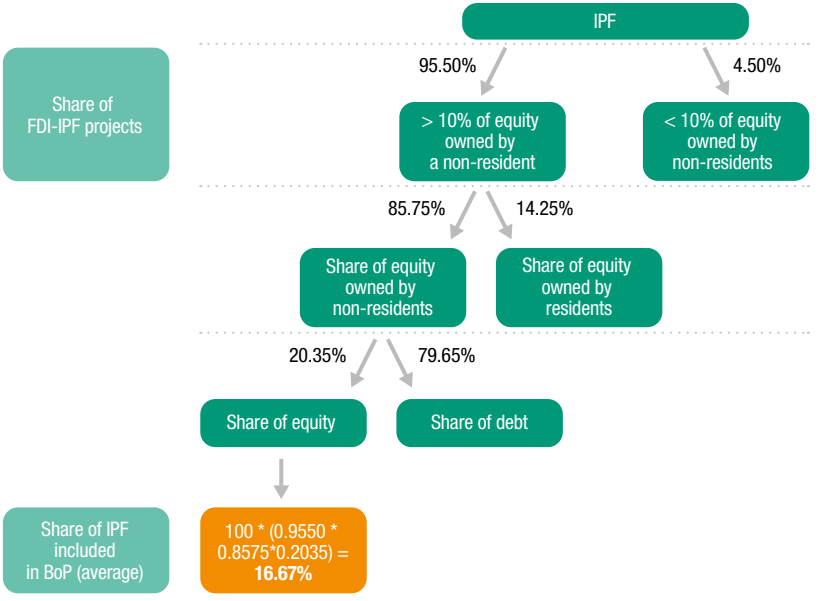
Furthermore, BoP compilation includes only FDI direct investors from entities not residing in the economy of the project. Therefore, among sponsors, only the non-resident sponsors are considered foreign direct investors. In the Vietnamese project illustrated in figure 6, this would imply that the FDI of the project is $29.6 million (= 0.4 * 74), out of the total project costs of $247 million. The remainder belongs to

[23] The most common corporate finance FDI consists of wholly or majority-owned subsidiaries or branches (UNCTAD, 2009). The majority (52.73 per cent) of IPF has only one sponsor.

the "other investment" category of the BoP, whereas $247 million would have been included as FDI if the non-resident sponsor performed a corporate investment.

Moreover, a larger leverage ratio in project finance (a debt-to-equity ratio about twice as large) further reduces the part of the total capital invested that accrues to FDI. As compared with corporate finance, Y is relatively smaller than X in project finance.[24] For all IPF projects, equity accounts on average for 20.35 per cent of capital invested in projects. Among projects that are considered FDI-IPF, the share of equity owned by non-residents amounts to 85.78 per cent. This implies that only 16.67 per cent (= 0.9550 * 0.8578 * 0.2035 * 100) of IPF total project value would be accounted for in the BoP (figure 15).[25]

Figure 15. From IPF to BoP FDI by magnitude



Source: Authors' elaboration, based on Refinitiv data on project finance deals.

[24] Using IJGlobal data that tracks infrastructure investments for corporate and project finance investments, leverage ratios (debt-to-equity ratios) are 2.13 in corporate finance and 4.88 in project finance (data from 2011 until May 2022).

[25] However, the 85.78 per cent of foreign-owned equity might not be fully converted to FDI. If one used the FDI/IPF ratio of 0.9550, assuming that about the same proportion of nonresident equity owners would own beyond 10 per cent of all equity, then the share of IPF that is FDI in value would be closer to 15.92 percent (= 0.9550 * (0.8578 * 0.9550) * 0.2035 * 100).

5.3 What is best to capture productive cross-border investment?

Often financiers do not invest only for profitability motives but are involved in the structuring of projects and investing in the long run (a loan maturity beyond 10 years is frequent if not the norm in IPF). Therefore, all measures arising solely on equity-specific information underestimate the real commitments in terms of international investments. Nevertheless, financiers and sponsors tend to be vastly different actors. Financiers, as loan providers, are mostly banks with financial expertise. Sponsors, as equity providers, have sectoral or local expertise. A new taxonomy introducing financiers might be a promising development, but it would require a rationale separating financiers by their degree of involvement, which would be highly challenging (if even possible).

Going back to the Vietnamese project. it can be advocated that the entire project cost should be included as a cross-border productive investment. Indeed, international lenders offer a syndicated loan; one contractor and one sponsor are non-residents. Because the project is unprecedented in the country, IPF is well-suited and local stakeholders are required. It paves the way for future cross-border productive investments (IPF or greenfield). Overall, the intricate construction of FDI-IPF should not hide that most of the time, cross-border productive IPF investment might simply be measured using the whole project cost. This is what has been done so far in UNCTAD's investment research.

6. Conclusion

The SDG financing gap requires all possible forms of financing, in particular where public fiscal expenditures are tight. Project finance is a structured financing well suited for large projects, such as most infrastructure projects. International capital is needed to best address capital shortages in developing countries.

Capturing *investment intentions* and *locational decisions* in the reporting of investment trends – as is done in UNCTAD publications through the use of announcement-based IPF and greenfield investment data – is important for informed investment policymaking. It also helps policymakers anticipate emerging trends. This is the rationale behind the decision to incorporate announced deals for cross-border greenfield investments as well as IPF deals. UNCTAD's use of IPF departs from other institutions that tend to use financial close deals only. Announcements in this regard are strategic. The best time to announce a project largely differs across deals. Therefore, data would only imperfectly capture the pipeline of a project, even when it is frequently updated, as is the case for Refinitiv data.

Data limitations prevent exact and accurate statistics. Imputing missing costs helps partly to overcome this issue, but it also calls for caution in using total deal values.

Using deal numbers is advised to limit approximation due to imperfect imputation. Furthermore, some IPF projects are domestic project finance and should be dropped from the IPF set (beyond 2 per cent of deals).

Recent World Investment Reports report three types of investment projects to complement FDI data: M&As, greenfield and IPF. Although in theory these are distinct forms of FDI, the data does overlap. The IPF-M&A overlap is minor (about 1 per cent of projects) and can be circumvented rather well. Cross-border greenfield investments and IPF have larger overlaps (more than 15 per cent of IPF projects overlap with greenfield deals) and require caution. A simple matching method is suggested, but it cannot provide an exact identification of the overlapping projects.

Almost all IPF projects are FDI projects: 96 per cent of IPF projects have at least one nonresident sponsor with more than 10 per cent of the equity. But because the SPE is the direct borrower, loans are not part of FDI (in contrast to cross-border greenfield investments, where the direct investor is the borrower). This leads to a less straightforward measure of FDI-IPF than for cross-border greenfield investments. The approximation constructed in the present note concludes that about 17 per cent of IPF would be considered as FDI in the BoP.

Overall, this situation calls for a separation of cross-border productive investments from FDI as understood by BoP compilers. Unless significant changes are made in the compilation of the BoP, they would capture only a small fraction of IPF. Given the rising role IPF plays in financing SDG-oriented infrastructure, it is important to measure all IPF and perhaps depart somehow from the FDI categorization.

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