Course 2024–2025 in Sustainable Finance
Lecture 5. Impact Investing

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[1]The opinions expressed in this presentation are those of the authors and are not meant to represent the opinions or official positions of Amundi Asset Management.

Agenda

- Lecture 1: Introduction
- Lecture 2: ESG Scoring
- Lecture 3: Impact of ESG Investing on Asset Prices and Portfolio Returns
- Lecture 4: Sustainable Financial Products
- **Lecture 5: Impact Investing**
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- Lecture 7: Engagement & Voting Policy
- Lecture 8: Extra-financial Accounting
- Lecture 9: Awareness of Climate Change Impacts
- Lecture 10: The Ecosystem of Climate Change
- Lecture 11: Economic Models & Climate Change
- Lecture 12: Climate Risk Measures
- Lecture 13: Transition Risk Modeling
- Lecture 14: Climate Portfolio Construction
- Lecture 15: Physical Risk Modeling
- Lecture 16: Climate Stress Testing & Risk Management

Values vs. value

"For some investors, ESG decision making is driven by ***values****, that is by preferences — in particular non-pecuniary preferences [...] For other investors and managers, ESG decision making is driven by* ***financial value****, that is, by a firm's risk and return opportunities. [...] Clear identification may be complicated by the fact that ESG investing can also be motivated by a combination of values and value." (Starks, 2023).*

Impact investing

Definition (Global Impact Investing Network)

Impact investing refers to "*investments with the intention to generate positive, measurable social and environmental impact alongside a financial return*".

Figure 1: Global Impact Investing Network (GIIN)

www.thegiin.org

Four core characteristics

1. **Intentionality**: an investor's intention to have a positive social or environmental impact through investments is essential to impact investing;
2. **Range of return expectations and asset classes**: impact investments target financial returns that range from below market (sometimes called concessionary) to risk-adjusted market rate, and can be made across asset classes, including but not limited to cash equivalents, fixed income, venture capital, and private equity;
3. **Investment with return expectations**: impact investments are expected to generate a financial return on capital or, at minimum, a return of capital;
4. **Impact measurement and management**: a hallmark of impact investing is the commitment of the investor to measure and report the social and environmental performance and progress of underlying investments, ensuring transparency and accountability while informing the practice of impact investing and building the field.

The intentionality-additionality-measurability framework

France Invest & FIR propose a framework based on three dimensions:

1. **Intentionality**
   The intention of the investment to contribute to the generation of a measurable social or environmental benefit
2. **Additionality**
   The positive impact that would not have occurred without this specific investment
3. **Measurability**
   The process of measuring the social and/or environmental impact of investments

The intentionality-additionality-measurability framework

The 9 core characteristics are:

Intentionality
- Thesis
- Strategy
- Governance

Additionality
- Coverage
- Time horizon
- Commitment

Measurability
- Metrics
- Transparency
- Remuneration

What would happen if the investment were not made?

The intentionality-additionality-measurability framework

Intentionality

What specific impact goal(s) does the investment seek to achieve?

- What are the ex-ante impact goals?
- How do the impact goals contribute to the UN SDGs?
- How does the investment policy support the impact goals?
- Does the impact cover the entire investment?
- What governance supports the achievement of the impact goals (impact committee, scientific committee, etc.)?

The intentionality-additionality-measurability framework

Additionality

What would happen if this investment were not made?

- Do the recipients of the funding typically have difficulty obtaining funding?
- Does the investment horizon allow for the long-term viability of the enterprise/project?
- What is the commitment to working with investee managers to achieve impact, and if so, how is it implemented?
- What initiatives are in place to support the impact of the investment beyond direct engagement with investees?

The intentionality-additionality-measurability framework

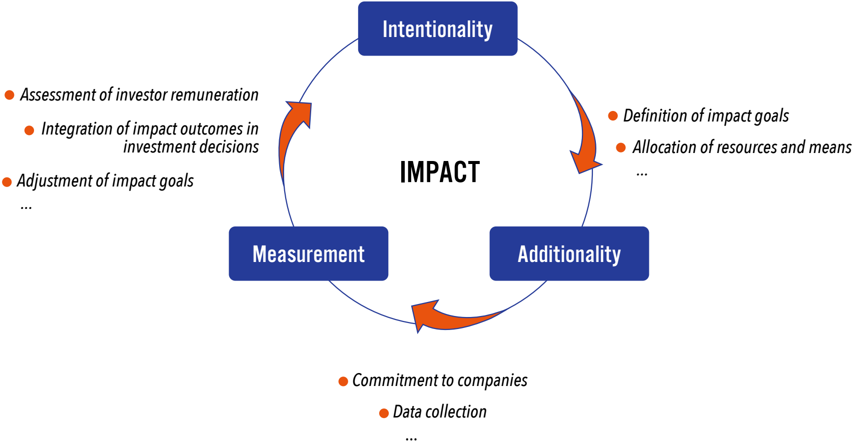
Measurability

How will impact and progress towards the goal(s) be measured?

- What is the impact reporting methodology?
- What are the impact KPIs?
- How are these impact KPIs used to inform decision-making?
- How are these impact indicators used to engage companies in the portfolio?
- What is the frequency of impact reporting?

The intentionality-additionality-measurability framework

Figure 2: Links between intentionality, additionality and impact measurement



Other frameworks

- The 5 dimensions of impact were developed by the Impact Management Principle (IMP) and incorporated into Impact Frontiers
- The Operating Principles for Impact Management (OPIM) were launched in 2019, led by the International Finance Corporation (IFC)
- The Compass was developed by the GIIN and is a methodology for comparing and assessing impact
- The B Impact Assessment is a system for B-Corp certification. A Benefit Corporation, or B-Corp, is a type of for-profit company that includes a positive impact on society, employees, the community and the environment as one of its legally defined goals
- The Theory of Change (ToC) in impact investing is a framework that explains how and why a desired change is expected to occur in a particular context

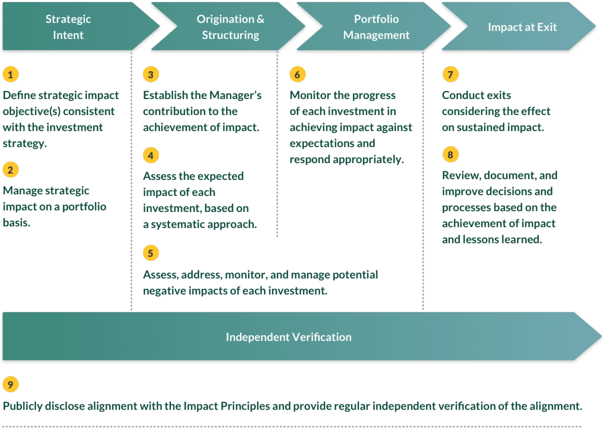
Impact Management Project (IMP)

Table 1: The five dimensions of impact

Impact dimension	Impact questions
What	What tells us what outcome the enterprise is contributing to, whether it is positive or negative, and how important the outcome is to stakeholders
Who	Who tells us which stakeholders are experiencing the outcome and how underserved they are in relation to the outcome
How much	How Much tells us how many stakeholders experienced the outcome, what degree of change they experienced, and how long they experienced the outcome
Contribute	Contribution tells us whether an enterprise's and/or investor's efforts resulted in outcomes that were likely better than what would have occurred otherwise
Risk	Risk tells us the likelihood that impact will be different than expected

Operating principles for impact management (OPIM)

Figure 3: The nine operating principles for impact management



Source: `www.impactprinciples.org`.

Historical perspectives

> *"Portfolio screening is by far the most prevalent approach [...] The second SRI approach, targeted investing, may hold greater promise for minority media, particularly for small local firms. Also known as community investing or high-impact investing, this method seeks out opportunities where relatively small capital investment can generate substantial social returns. Unlike portfolio screening, there is usually no demand that returns match or beat a specific benchmark." (Kurtz, 1999, page 685).*

$\Rightarrow$ Links between, impact investing, ethical investing, community investing and philanthropic investing

Historical perspectives

Figure 4: The Rockefeller Foundation

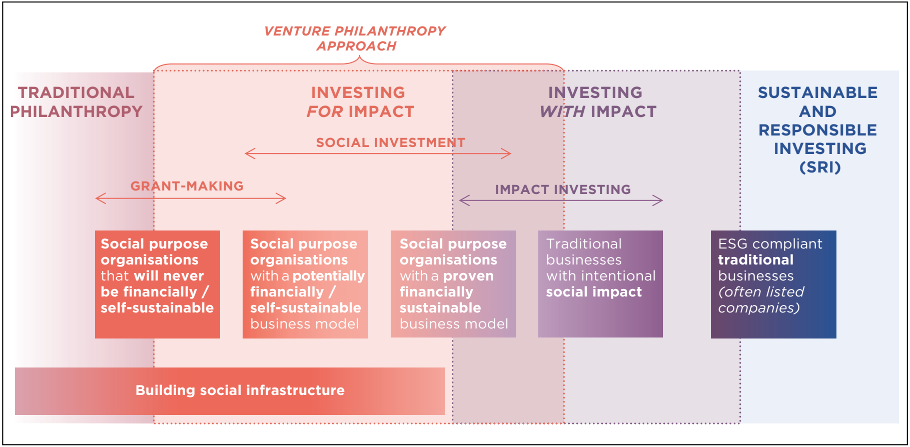
- October 2007
  Bellagio meeting organized by the Rockefeller Foundation $\Rightarrow$ adoption of the term impact investing
- June 2011
  Publication of the book *Impact Investing: Transforming How We Make Money While Making a Difference* by Antony Bugg-Levine and Jed Emerson
- September 2009
  Launch of the Global Impact Investing Network (GIIN)

Historical perspectives

- Venture philanthropy
- Network of Foundations Working for Development (netFWD)
- Development Finance Institutions (DFI)
    - Bilateral DFIs
    - Multilateral DFIs ($\approx$ multilateral development banks or MDBs)
- Private equity investors

Investing FOR impact vs. investing WITH impact

Figure 5: The impact ecosystem spectrum



Source: Gianoncelli *et al.* (2019).

Investing FOR impact vs. investing WITH impact

Investors FOR Impact

- Support innovative solutions to pressing societal problems
- Take risks that traditional investors are unwilling to take
- Provide in-depth non-financial support and technical assistance

Investors WITH Impact

- Need to guarantee some financial return alongside social impact
- Invest in proven solutions and/or organizations with viable business models
- Have access to large pools of resources and scale proven business models

Investing FOR impact vs. investing WITH impact

Figure 6: The charter of investors *for* impact

Source: Gianoncelli *et al.* (2019).

Investing FOR impact vs. investing WITH impact

Table 2: A typology of sustainable investments

	ESG-screened	ESG-managed	Impact-Aligned	Impact-Generating
Objective (underlying strategic purpose of the investment)	Mitigation of ESG-related risks and/or ethical considerations	Systematic reflection on ESG-related risks and opportunities	Address social and environmental challenges and goals	Actively contributing to social and environmental solutions and transformations
Materiality (measurement of tangible real-world parameters)	Materiality not addressed, *i.e.*, no further detailed description of approach or outputs	Materiality not measured, *i.e.*, only basic description of approach or outputs	Proof of materiality through the assessment of outputs via benchmark analysis or SDG alignment	Proof of materiality through the measurement of expected and generated impact
General approach (applied investment appraisal)	Any consideration of E, S, or G factors in investment appraisals; typically focusing on exclusion criteria	Comprehensive set of exclusion criteria; at least one further pre-investment decision approach* is applied	Comprehensive set of exclusion criteria; sophisticated combination of pre- and post-investment† decision approaches	Focus on impact generation by providing additional capital, incorporating forward-looking targets and/or post-investment† decision approaches
Documentation (efforts to increase transparency)	No detailed documentation	Basic description and ideally external verification	Detailed description and external verification	Detailed description and external measurement of impact achievements

Source: Busch *et al.* (2021).

Investing FOR impact vs. investing WITH impact

Table 3: Methodology for market studies on sustainability-related investments

	Basic ESG	Advanced ESG	Impact-Aligned	Impact-Generating
Investment objective	Integration of ESG factors	Systematic analysis & incorporation of ESG factors	Align with positive impacts on environment and/or society	Measurable contribution to positive real-world impacts
Investment approach	Binding negative or positive screening	Binding negative & positive screening ($\leq$ 80% of initial universe investable)	Binding negative & positive screening for assets with positive impact	Exclude non-transformable activities & use stewardship or provide new capital to assets to generate measurable positive impact
Performance Measurement		Measurement of ESG performance	Measurement of company impact	Measurement of company impact & investor contribution
Ambition level	Low	Moderate	Medium	High
Investment focus			Double materiality	

Source: Busch *et al.* (2024).

Impact measurement

We need to distinguish between two types of impact:

1. The impact of the company, project or investee
2. The contribution of the investor

Impact measurement

General formula

The investor impact $\mathbb{I}_j^{(\text{investor})}(t)$ for metric j is equal to:

$$\mathbb{I}_j^{(\text{investor})}(t) = \sum_{i=1}^{n} c_i^{(\text{investor})} \mathbb{I}_{i,j}(t)$$

where:

- $\mathbb{I}_{i,j}(t)$ is the impact measure of project i for metric j
- $c_i^{(\text{investor})}$ is the investor's contribution to project i

Impact measurement

Example #1

Consider an investor who has established an infrastructure fund in Africa that specializes in clean energy and housing. The investor's portfolio has financed three energy projects (two solar farms and one wind farm) and the construction of new homes in two countries. The impact data is reported below.

Project	Investor contribution	Avoided CO_2 emissions	Amount of renewable energy	Number of additional jobs	Number of new homes built
1	10%	1 700	1 300	300	
2	5%	1 500	650	100	
3	20%	700	1 150	75	
4	50%	5 000		150	5 000
5	12%	3 200		510	15 000

Impact measurement

For the avoided CO_2 emissions, we have:

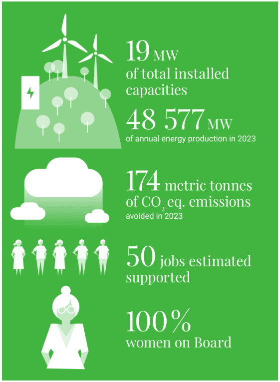
$$
\begin{aligned}
\mathbb{I}_{\text{avoided}}^{(\text{investor})}(t) &= 0.10 \times 1\,700 + 0.05 \times 1\,500 + 0.20 \times 700 + \\
&\quad 0.50 \times 5\,000 + 0.12 \times 3\,200 \\
&= 3\,269
\end{aligned}
$$

These five projects have avoided $3\,269\,\mathrm{tCO_2e}$ emissions. Similarly, the investor's portfolio has helped generate 392.5 MWh/year of renewable energy, created 183 jobs, and built 4 300 new homes

Impact measurement

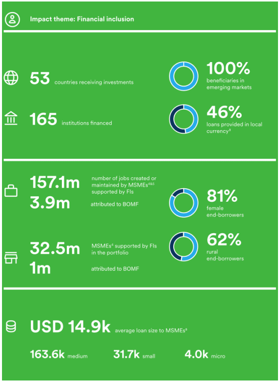
Figure 7: Impact reporting

(a)



Useroles

(b)



BlueOrchard Microfinance fund

Source: www.mirova.com & https://www.blueorchard.com/products/blueorchard-microfinance-fund-bomf.

Impact measurement

1. Calculating $\mathbb{I}_j^{(\text{investor})}(t)$ requires defining the project's impact $\mathbb{I}_{i,j}(t)$. The most used approach is the pre-post comparison:

$$\mathbb{I}_{i,j}(t) = \mathrm{KPI}_{i,j}(t) - \mathrm{KPI}_{i,j}(t-h)$$

This method compares the pre-investment KPI at time $t-h$ and the post-investment KPI at time t

2. Another approach is to use a benchmark:

$$\mathbb{I}_{i,j}(t) = \mathrm{KPI}_{i,j}(t) - \mathrm{KPI}^{\star}_{i,j}(t)$$

where $\mathrm{KPI}^{\star}_{i,j}(t)$ is the benchmarked KPI. For example, the benchmark may be a control group

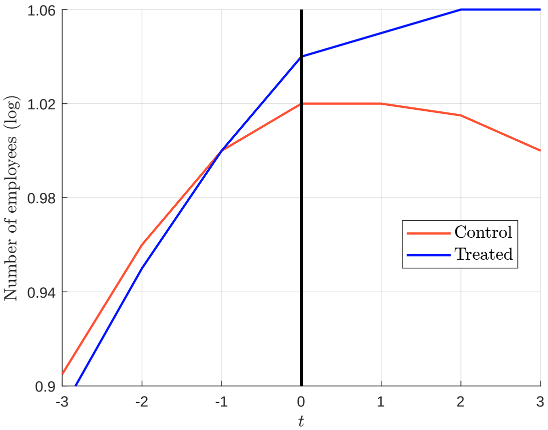
3. A third method is to use randomized controlled trials:

$$\mathbb{I}_{i,j}(t) = \frac{1}{n'} \sum_{i'=1}^{n'} \left(\mathrm{KPI}_{i,j}(t) - \mathrm{KPI}_{i',j}(t)\right)$$

where $i' \in \mathcal{C}$ and $\mathcal{C}$ is the control group that serves as the baseline against which the impact of the investment is compared

Impact measurement

Figure 8: Impact on employment of EIB-supported lending to small and medium-sized enterprises



Source: European Investment Bank (2021).

Sustainable development goals

Figure 9: SDGs addressed by the BlueOrchard Microfinance Fund (BOMF)

Core SDGs

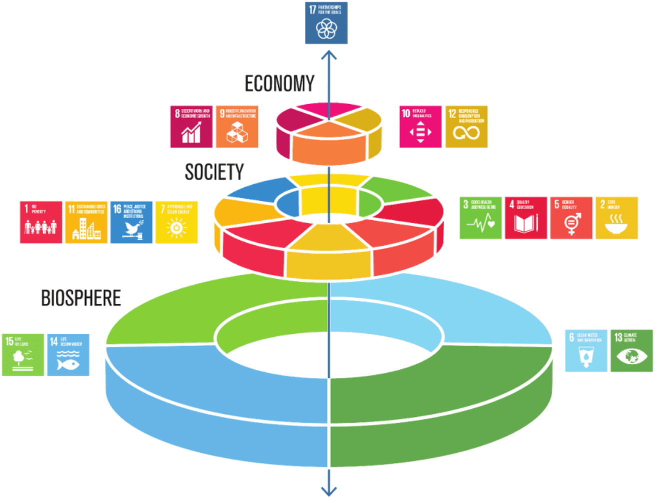
Aligned SDGs

Source: `www.blueorchard.com/products/blueorchard-microfinance-fund-bomf`.

5Ps framework

1. People: SDG 1 (no poverty), SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 4 (quality education), SDG 5 (gender equality)
2. Planet: SDG 6 (clean water and sanitation), SDG 13 (climate action), SDG 14 (life below water), SDG 15 (life on land)
3. Prosperity: SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation and infrastructure), SDG 10 (reduced inequality), SDG 11 (sustainable cities and communities), SDG 12 (responsible consumption and production)
4. Peace: SDG 16 (peace, justice, and strong institutions)
5. Partnership: SDG 17 (partnerships for the goals)

The SDG wedding cake

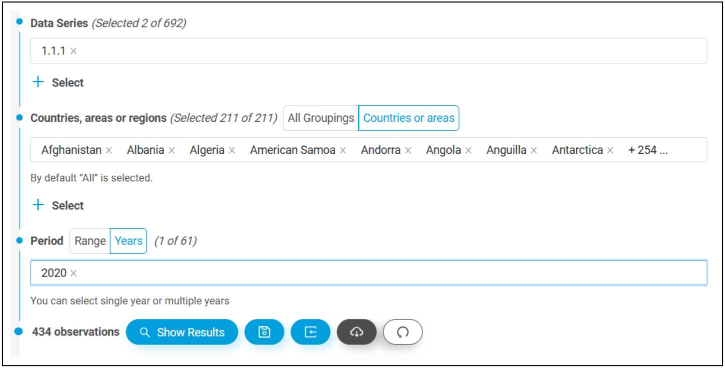


Source: `www.stockholmresilience.org`.

Where we stand with the SDGs

https://unstats.un.org/sdgs/dataportal

Figure 10: SDG indicator selection window



Where we stand with the SDGs

The 2023 report comes to a pessimistic conclusion about achieving the SDGs by 2030:

> *"Halfway to the deadline for the 2030 Agenda, the SDG Progress Report shows* ***we are leaving more than half the world behind****. Progress on more than 50 per cent of targets of the SDGs is weak and insufficient; on 30 per cent, it has stalled or gone into reverse. These include key targets on poverty, hunger and climate. Unless we act now, the 2030 Agenda could become an epitaph for a world that might have been." United Nations (2023).*

Where we stand with the SDGs

- **Extreme poverty has increased**, reversing decades of progress. Projections indicate that 575 million people will remain impoverished by 2030, and only one-third of countries will have halved their national poverty levels by then. The COVID-19 pandemic has contributed significantly to this setback. In 2020, 97 million more people were living on less than \$2.15 a day compared to pre-pandemic levels, bringing the total number of people living in extreme poverty to 724 million
- **More than 600 million people worldwide are projected to be hungry** in 2030. Nearly 2.4 billion people, or one in three, were moderately or severely food insecure in 2021. The prevalence of undernourishment increased from 7.9% in 2019 to 9.2% in 2021. Conflicts, economic shocks, and climate change worsened food security, with food prices increasing by 30% in 2021.

Where we stand with the SDGs

- **Education gaps are widening**, with 84 million children expected to be out of school by 2030 and 300 million students lacking basic numeracy and literacy skills by that year. In low-income countries, 40% of children of primary school age lack basic reading skills.
- **Gender inequality persists**, with 56% of countries lacking anti-discrimination laws for women. At the current rate, it will take 300 years to end child marriage, 286 years to close gaps in legal protection and eliminate discriminatory laws, and 140 years to achieve equal representation in workplace leadership. In 2020, women made up 40% of the global workforce but held only 28% of managerial positions, 25% of women aged 15-49 experienced physical or sexual violence by an intimate partner, and one in five young women were married before their 18th birthday.
- **Global temperatures have risen** by $1.1^{\circ}\mathrm{C}$ and may reach or exceed $1.5^{\circ}\mathrm{C}$ by 2035.

Where we stand with the SDGs

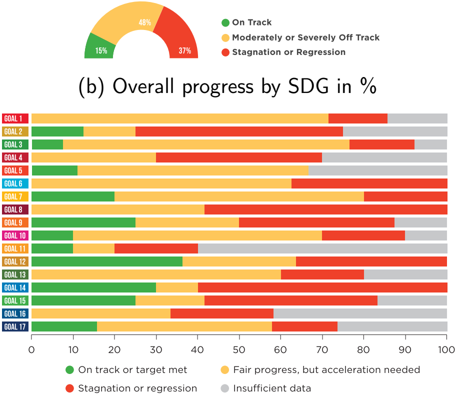
- **Significant reductions in child mortality have been achieved**, with 146 out of 200 countries on track to meet the under-5 mortality target. Effective HIV treatment has reduced AIDS-related deaths by 52% since 2010.
- **The global population with access to electricity rose** from 87% in 2015 to 91% in 2021. Renewable energy capacity in developing countries reached a record 268 watts per capita in 2021. Despite progress, 759 million people still lack electricity, and 675 million people still live in the dark.
- **Internet access expanded** by 66%, reaching 5.3 billion people in 2022.

Progress assessment

Figure 11: Progress assessment for the 17 SDGs based on assessed targets, 2023 or latest data

(a) World-level progress

(b) Overall progress by SDG in %



Source: United Nations (2023).

SDR country profile

Figure 12: Finland (2024)

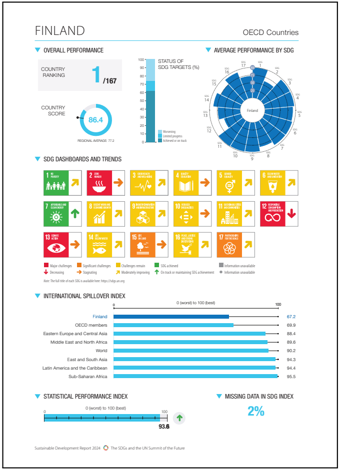
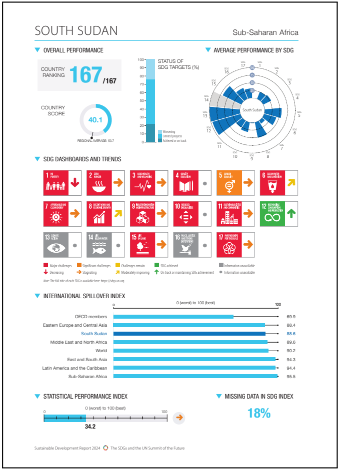


Figure 13: South Sudan (2024)



Progress assessment

SDG index

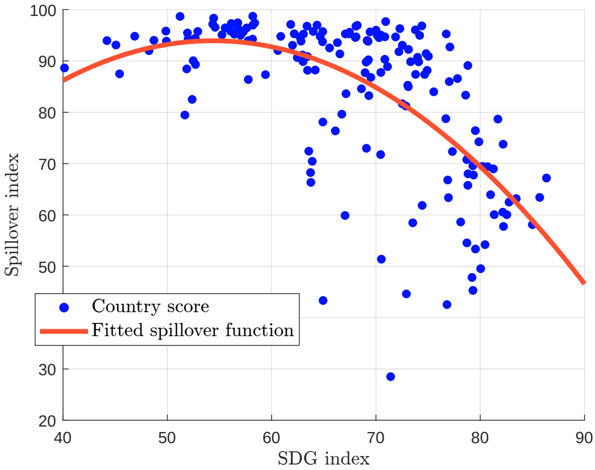
The SDG index (or overall score) measures overall progress toward achieving all 17 SDGs. The score can be interpreted as a percentage of SDG achievement. A score of 100 indicates that all SDGs have been achieved. Therefore, the difference between 100 and a country's SDG index score is the distance, in percentage points, that must be overcome to reach optimum SDG performance.

Spillover index

The spillover index assesses a country's spillover effects. Indeed, each country's actions can have a positive or negative impact on the ability of other countries to achieve the SDGs. The spillover index aggregates such spillovers along three dimensions: environmental and social impacts embodied in trade, economic and financial, and security. A higher score means that a country is causing more positive spillovers and fewer negative ones.

Progress assessment

Figure 14: Relationship between the SDG index and the Spillover index



Aligning SDGs with ESG

SDGs and impact investing

Figure 15: Investors' view of the top 5 SDGs in Germany

Source: Bundesinitiative Impact Investing (2022).

SDGs and impact investing

Blended finance & DFIs

The leverage between private and public capital is insufficient:

> *"Each \$1 of MDB and DFI invested mobilises on average \$0.75 of private finance for developing countries, but this falls to \$0.37 for low-income countries. Expectations that blended finance can bridge the SDG financing gap are unrealistic: 'billions to billions' is more plausible than 'billions to trillions'." (Attridge and Engen, 2019).*

SDGs and impact investing

Two use of the SDG landmark:

- The SDGs are used to channel the capital, and the real motivation is to finance economic growth and improve the social situation in poor countries, *e.g.* microfinance.
- The SDGs are more often used to indicate that the investment is related to this framework, but the motivation is not necessarily to finance economic growth and improve social conditions in poor countries.

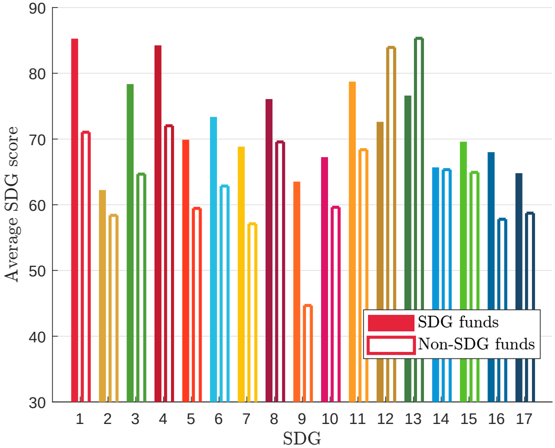
SDG funds

"SDG funds are funds stating to contribute towards achieving the SDGs

⇒ The ESMA report identifies 289 SDG funds and AUM of €74 bn

SDG funds

Figure 16: Sovereign performance per SDG



Source: Balitzky and Mosson (2024).

How to calculate the alignment of an SDG fund

- Let $\mathbb{I}_i$ be the SDG index of country i
- Let $w_{i,j}$ be the weight of country i in fund j
- The SDG index for fund j is the weighted average given below:

$$\mathbb{I}_j = \sum_{i=1}^{n} w_{i,j} \mathbb{I}_i$$

- The preference ordering may be:

$$j \succ j' \Leftrightarrow \mathbb{I}_j \geq \mathbb{I}_{j'}$$

How to calculate the alignment of an SDG fund

Example #2

Below, we consider three SDG funds that hold sovereign debt or have country exposures. Amounts are in millions of dollars. For each country, we provide the SDG and spillover indexes calculated by Sachs *et al.* (2024).

Table 4: SDG data and country exposures for three SDG funds

Country	SDG index	Spillover index	Fund #1	Fund #2	Fund #3
Denmark	85.00	58.10		100.1	65.8
France	82.76	62.49		356.8	25.6
Australia	76.88	66.80		211.3	
Morocco	70.85	94.70			56.5
Bangladesh	64.35	96.98	25.9		
Honduras	62.00	93.05	10.3		
Nigeria	54.58	96.55			12.3
Haiti	52.68	94.43	19.7		

How to calculate the alignment of an SDG fund

- The SDG index for Fund #1 is equal to:

$$\mathbb{I}_1^{\mathrm{SDG}} = \frac{25.9 \times 64.35 + 10.3 \times 62.00 + 19.7 \times 52.68}{25.9 + 10.3 + 19.7} = 59.80$$

- For the spillover index, we get:

$$\mathbb{I}_1^{\mathrm{Spillover}} = \frac{25.9 \times 96.98 + 10.3 \times 93.05 + 19.7 \times 94.43}{25.9 + 10.3 + 19.7} = 95.36$$

- Finally, the results for the three SDG funds are:

Score	Fund #1	Fund #2	Fund #3
$\mathbb{I}_j^{\mathrm{SDG}}$	59.80	81.24	77.32
$\mathbb{I}_j^{\mathrm{Spillover}}$	95.36	63.20	74.66

- We obtain the following ranking:

$$\mathbb{I}_2^{\mathrm{SDG}} \geq \mathbb{I}_3^{\mathrm{SDG}} \geq \mathbb{I}_1^{\mathrm{SDG}} \Rightarrow \mathrm{Fund}_2 \succ \mathrm{Fund}_3 \succ \mathrm{Fund}_1$$

What do you think? What is wrong?

GIIN figures

Figure 17: Global Impact Investing Network

- In October 2022, the GIIN estimated that more than 3 000 public and private organizations were managing \$1.164 trillion in impact investing AUM globally as of December 2021
- The geographic breakdown of impact AUM is 55% in Europe, 37% in North America, 3% in Africa, 2.5% in Asia and 1% in Latin America
- In October 2024, the GIIN produced a new figure: \$1.571 trillion USD in impact investing AUM

PitchBook impact database

We have:

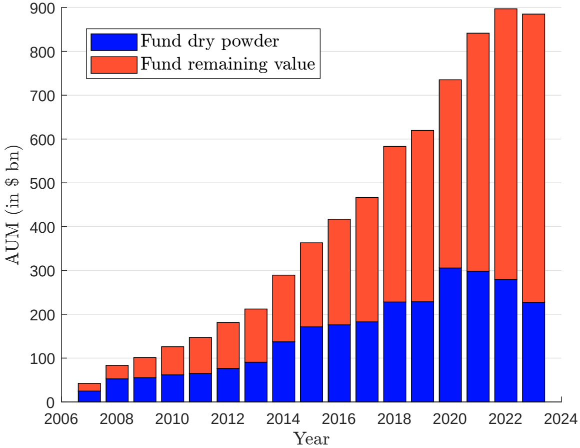
$$
\begin{aligned}
\text{Current AUM} &= \text{Dry powder} + \text{Remaining value} \\
&= \text{Cumulative capital raised} + \text{Mark-to-market} + \\
&\quad\ \text{Termination value}
\end{aligned}
$$

where:

- cumulative capital raised is the total amount of money committed by investors to the funds
- mark-to-market reflects any appreciation or depreciation of the investments based on their current market price
- termination value is the value realized from exited investments
- dry powder is the uninvested portion of the capital raised (the capital available for future investments)
- remaining value is the current value of the investments still held by the funds, including the mark-to-market value of those investments

PitchBook impact database

Figure 18: Size of the impact investing market (AUM in $ bn)



Source: `https://pitchbook.com` & Author's calculations.

PitchBook impact database

Table 5: Strategy representation of impact investing (as of December 2023)

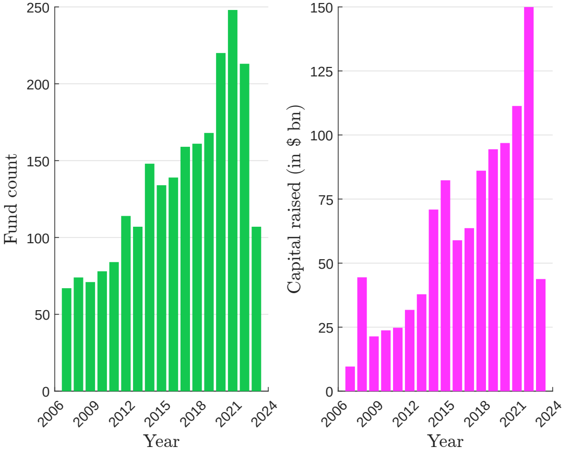
Strategy	Fund count	Capital raised
Private equity (buyout)	21.90%	14.49%
Venture capital	40.18%	7.03%
(Private) debt	7.16%	6.26%
Real estate	5.80%	3.93%
Real assets*	20.55%	66.96%
Other	4.41%	1.33%

*Real assets = infrastructure & natural resources.

Source: `https://pitchbook.com` & Author's calculations.

PitchBook impact database

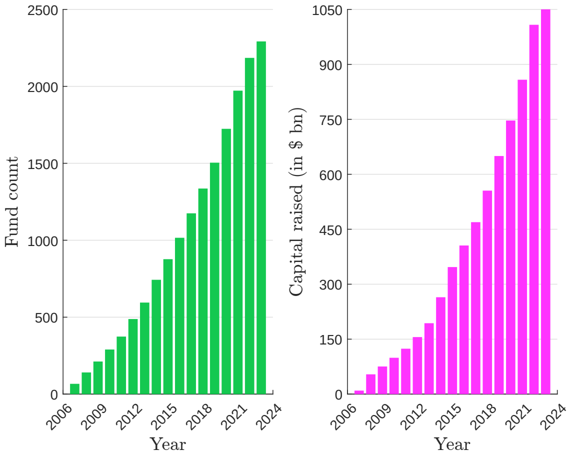
Figure 19: Fundraising activity



Source: `https://pitchbook.com` & Author's calculations.

PitchBook impact database

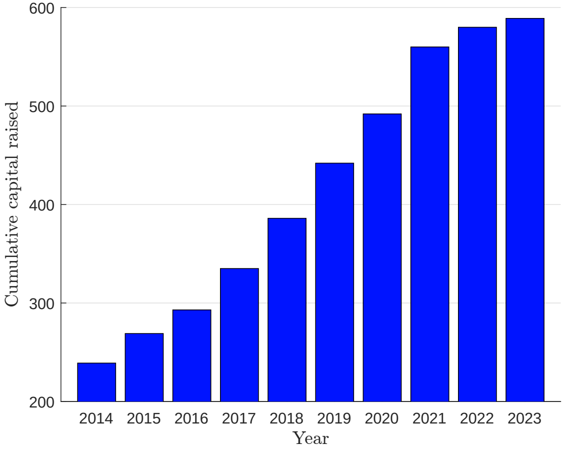
Figure 20: Cumulative fundraising



Source: `https://pitchbook.com` & Author's calculations.

Phenix impact database

Figure 21: Cumulative capital raised in € bn



Source: Phenix Capital (2024).

Phenix impact database

Figure 22: Phenix Capital Group's mapping of the SDGs to the themes commonly used by impact investing practitioners

Source: www.phenixcapitalgroup.com/sustainable-development-goals-impact-investing-themes.

Phenix impact database

Table 6: Most targeted SDGs

Rank	All Funds	Private Equity	Private Debt	Real Assets	Public Equity	Public Debt
1	SDG 7	SDG 3	SDG 1	SDG 7	SDG 7	SDG 11
2	SDG 9	SDG 2	SDG 5	SDG 11	SDG 3	SDG 7
3	SDG 3	SDG 9	SDG 7	SDG 15	SDG 9	SDG 13
4	SDG 2	SDG 7	SDG 2	SDG 2	SDG 12	SDG 12
5	SDG 11	SDG 12	SDG 8	SDG 12	SDG 11	SDG 14

Source: Phenix Capital (2024).

Social impact bonds

Social impact bond (SIB) = **pay-for-success bond** ($\approx$ call option)

The Peterborough SIB

- On 18 March 2010, the UK Secretary of State for Justice announced a six-year SIB pilot scheme that will see around 3 000 short term prisoners from Peterborough prison, serving less than 12 months, receiving intensive interventions both in prison and in the community
- Funding from investors will be initially used to pay for the services
- If reoffending is not reduced by at least 7.5%, the investors will receive no recompense

Social impact bonds

Table 7: Number of social impact bonds per start year

Year	#	Year	#	Year	#
2010	1	2015	24	2020	35
2011	1	2016	26	2021	22
2012	13	2017	41	2022	14
2013	7	2018	47	2023	9
2014	9	2019	36	2024	1

Source: `https://golab.bsg.ox.ac.uk/knowledge-bank/indigo/impact-bond-dataset-v2`.

Blue bonds

Definition

A blue bond $\approx$ a green bond, with a specific focus on ocean and sea protection

Blue bonds

1. Coastal climate adaptation and resilience (climate change adaptation)
2. Marine ecosystem management, conservation, and restoration (terrestrial and aquatic biodiversity
3. Sustainable coastal and marine tourism
4. Sustainable marine value chains (environmentally sustainable management of living natural resources and land use)
5. Marine renewable energy (renewable energy)
6. Marine pollution (pollution prevention and control/sustainable water and wastewater management/circular economy adapted products, production technologies and processes)
7. Sustainable ports (clean transportation)
8. Sustainable marine transport (clean transportation)

Blue bonds

Seychelles blue bond

- Seychelles issued the first blue bond in 2018, raising $15 million for marine conservation and sustainable fishing
- The 10-year bond aims to expand marine protected areas and enhance fisheries governance
- The World Bank provided a $5 million guarantee to reduce investor risk
- The Global Environment Facility (GEF) supported the bond with a $5 million loan to help cover interest payments
- It's a use of proceeds (UoP) bond

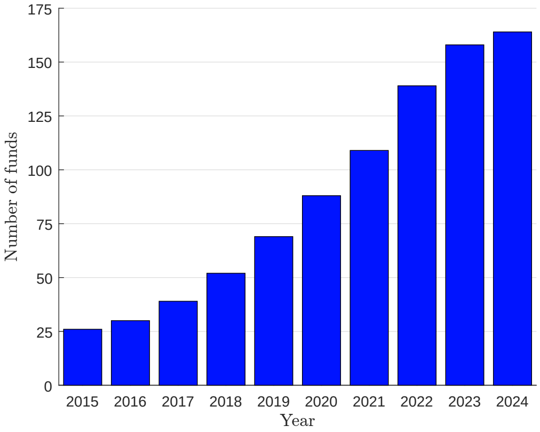
Blue bonds

Table 8: Some examples of blue bonds

Year	Type	Amount (in $ mn)	Bond name
2018	UOP	15	Seychelles blue bond
2018	DFN	21	Seychelles debt-for-nature swap
2019	UOP	220	Nordic-Baltic blue bond I (Nordic Investment Bank)
2020	UOP	220	MOWI green bond
2020	UOP	150	Nordic-Baltic blue bond II (Nordic Investment Bank)
2020	UOP	940	Bank of China blue bond
2021	UOP	300	ADB Australia/NZ blue bond
2021	DFN	365	Belize debt-for-nature swap
2022	UOP	385	Bahamas blue bond
2022	DFN	150	Barbados debt-for-nature swap
2023	UOP	3.5	Cabo Verde marine & ocean-based blue bond (International Investment Bank)
2023	DFN	656	Galapagos debt-for-nature swap (Ecuador)
2023	UOP	150	Indonesia blue bond (Republic of Indonesia)
2023	UOP	100	Ørsted blue bond
2023	UOP	50	Bank of Ayudhya blue bond (Thailand)
2023	DFN	500	Gabon debt-for-nature swap

Blue bonds

Figure 23: Cumulative number of funds targeting the blue ocean economy



Source: Phenix Capital (2024) & Author's calculations.

Structured blended finance funds

Definition

Blended finance is an investment strategy that combines public or philanthropic and private capital to fund projects in emerging and frontier markets

Structured blended finance funds

"Blended finance is a structuring approach that allows organizations with different objectives to invest alongside each other while achieving their own objectives (whether financial return, social impact, or a blend of both). The main investment barriers for private investors addressed by blended finance are (i) high perceived and real risk and (ii) poor returns for the risk relative to comparable investments. Blended finance creates investable opportunities in developing countries which leads to more development impact. Blended finance is not an investment approach, instrument, or end solution. It is also different from impact investing. Impact investing is an investment approach, and impact investors often participate in blended finance structures."

Source: `https://www.convergence.finance/blended-finance`.

Structured blended finance funds

There are four main typical blended finance structures:

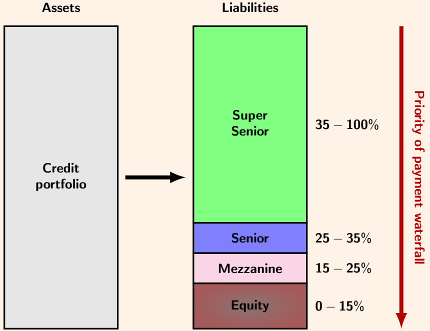
- **Concessional capital**
  Public or philanthropic investors provide funds at below-market rates within the capital structure to reduce the overall cost of capital or to provide an additional layer of protection for private investors
- **Credit enhancing**
  Public or philanthropic investors provide credit enhancement through guarantees or insurance against specific risks, such as political instability or natural disasters
- **Technical assistance facility** (TAF)
  Transaction is associated with a grant-funded technical assistance facility that can be utilized pre- or post-investment to strengthen commercial viability and developmental impact
- **Design-stage grants**
  Transaction design or preparation is funded by grants (including project preparation or design-stage grants)

Structured blended finance funds

Tranching technique and collateralized debt obligation

A collateralized debt obligation (CDO) is a pay-through ABS structure whose securities are bonds linked to a series of tranches

Structure of a collateralized debt obligation (example)



Structured blended finance funds

- Given an investment portfolio of n bonds, the cumulative loss of the portfolio at time t is equal to:

$$L_t = \sum_{i=1}^{n} N_i \cdot (1 - \mathcal{R}_i) \cdot \mathbb{1}\{\boldsymbol{\tau}_i \leq t\}$$

  where N_i, $\mathcal{R}_i$ and $\boldsymbol{\tau}_i$ are the nominal amount, the recovery rate and the default time of bond i

- The loss of tranche $[A, D]$ is given by:

$$L_t^{[A,D]} = (L_t - A) \cdot \mathbb{1}\{A \leq L_t \leq D\} + (D - A) \cdot \mathbb{1}\{L_t > D\}$$

  where A and D are the attachment and detachment points expressed in \$

- The outstanding notional amount of the tranche is therefore:

$$N_t^{[A,D]} = (D - A) - L_t^{[A,D]}$$

  This notional amount is then reduced by the loss of the tranche

Structured blended finance funds

- At inception date $t = 0$, $N_t^{[A,D]}$ is equal to the tranche thickness $D - A$. At the fixing date t, we have:

$$N_t^{[A,D]} = \begin{cases} D - A & \text{if} \quad L_t \leq A \\ D - L_t & \text{if} \quad A \leq L_t \leq D \\ 0 & \text{if} \quad L_t > D \end{cases}$$

- We now define the income of each tranche. The gain between two fixing dates $t-1$ and t is equal to:

$$\Delta \Pi_t = \sum_{i=1}^{n} \boldsymbol{c}_i \cdot N_i \cdot \mathbb{1}\left\{\boldsymbol{\tau}_i > t\right\}$$

  where $\boldsymbol{c}_i$ is the (fixed) coupon paid by bond i between $t-1$ and t
- The cumulative profit generated by the portfolio at time t is then equal to $\Pi_t = \Pi_{t-1} + \Delta \Pi_t$ where $\Pi_0 = 0$

Structured blended finance funds

- We need to define the revenue sharing policy between the different tranches:

$$\Delta\Pi_t^{[A,D]} = \varphi^{[A,D]}(\Delta\Pi_t)$$

In general, the gain for tranche $[A, D]$ depends on the total income $\Delta\Pi_t$ of the portfolio and the pricing formula $\varphi^{[A,D]}$

- The cumulative profit of tranche $[A, D]$ is then $\Pi_t^{[A,D]} = \Pi_{t-1}^{[A,D]} + \Delta\Pi_t^{[A,D]}$ where $\Pi_0^{[A,D]} = 0$
- We deduce that the cumulative return of the tranche is equal to:

$$R_t^{[A,D]} = \frac{\Pi_t^{[A,D]} - L_t^{[A,D]}}{D - A}$$

This is the difference between the income and the loss of the tranche

- Finally, the average return is $\bar{R}_t^{[A,D]} = \frac{1}{t} R_t^{[A,D]}$

Structured blended finance funds

Example #3

Consider a simple blended finance fund where the junior and senior tranches account for 20% and 80% of the investment, respectively. The total fund size is \$500 million, invested equally in 100 emerging market (EM) green bonds. We assume that these green bonds are homogeneous, each paying an annual coupon of 10%. The recovery rate is set to zero. To define the income distribution policy, the senior tranche receives an annual coupon of 4% until the junior tranche is exhausted, while the junior tranche receives the remaining income generated by the bond portfolio. Finally, the maturity of the fund is set at ten years.

Structured blended finance funds

- For the junior tranche, the attachment and detachment points are 0 and \$100 mn
- For the senior tranche, the attachment and detachment points are \$100 mn and \$500 mn
- We have $N_i = \$5$ mn, $\mathcal{R}_i = 0$ and $\boldsymbol{c}_i = 10\%$
- Let $n_t^{\tau} = \sum_{i=1}^{n} \mathbb{1}\left\{\boldsymbol{\tau}_i \leq t\right\}$ be the cumulative number of defaults
- We have:

$$\left\{\begin{array}{l} L_t = \sum_{i=1}^{100} 5 \times (1-0) \times \mathbb{1}\left\{\boldsymbol{\tau}_i \leq t\right\} = 5 n_t^{\tau} \\ L_t^{(\text{junior})} = \min\left(5 n_t^{\tau}, 100\right) \\ L_t^{(\text{senior})} = \max\left(5 n_t^{\tau} - 100, 0\right) \end{array}\right.$$

Structured blended finance funds

- The outstanding notional amount of the junior tranche is:

$$N_t^{(\text{junior})} = 100 - L_t^{(\text{junior})} = \max\left(100 - 5n_t^{\tau}, 0\right)$$

- For the senior tranche, we get:

$$N_t^{(\text{senior})} = 400 - L_t^{(\text{senior})} = \min\left(500 - 5n_t^{\tau}, 400\right)$$

- The income generated by the bond portfolio is:

$$\Delta\Pi_t = \sum_{i=1}^{100} 10\% \times 5 \times \mathbb{1}\left\{\tau_i > t\right\} = 0.5\left(100 - n_t^{\tau}\right)$$

  The maximum annual income is \$50 mn

- If there are 20 defaults, $\Delta\Pi_t = \$40$ mn is sufficient to pay the guaranteed income for the senior tranche, which is equal to $400 \times 4\% = \$16$ mn

Structured blended finance funds

- We deduce that:

$$\begin{aligned}\Delta\Pi_t^{(\mathrm{senior})} &= \varphi^{(\mathrm{senior})}\left(\Delta\Pi_t\right) \\ &= 16 \times \mathbb{1}\left\{n_t^{\tau} \leq 20\right\} + \Delta\Pi_t \times \mathbb{1}\left\{n_t^{\tau} > 20\right\}\end{aligned}$$

and:

$$\begin{aligned}\Delta\Pi_t^{(\mathrm{junior})} &= \varphi^{(\mathrm{junior})}\left(\Delta\Pi_t\right) \\ &= \Delta\Pi_t - \Delta\Pi_t^{(\mathrm{senior})} \\ &= \left(\Delta\Pi_t - 16\right) \times \mathbb{1}\left\{n_t^{\tau} \leq 20\right\}\end{aligned}$$

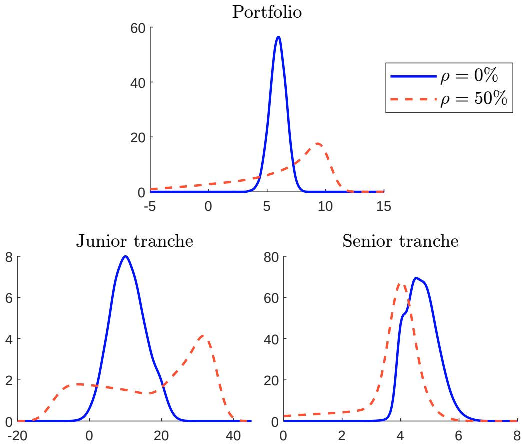
Structured blended finance funds

Table 9: Simulation of the blended finance fund

	t	$n_t^{\mathcal{T}}$	L_t	$L_t^{(\text{junior})}$	$L_t^{(\text{senior})}$	$\Delta\Pi_t$	$\Delta\Pi_t^{(\text{junior})}$	$\Delta\Pi_t^{(\text{senior})}$	Π_t	$\Pi_t^{(\text{junior})}$	$\Pi_t^{(\text{senior})}$	$\bar{R}_t$	$\bar{R}_t^{(\text{junior})}$	$\bar{R}_t^{(\text{senior})}$
Scenario #1	1	0	0.0	0.0	0.0	50.0	34.0	16.0	50.0	34.0	16.0	10.00%	34.00%	4.00%
	2	1	5.0	5.0	0.0	49.5	33.5	16.0	99.5	67.5	32.0	9.45%	31.25%	4.00%
	3	2	10.0	10.0	0.0	49.0	33.0	16.0	148.5	100.5	48.0	9.23%	30.17%	4.00%
	4	2	10.0	10.0	0.0	49.0	33.0	16.0	197.5	133.5	64.0	9.38%	30.88%	4.00%
	5	4	20.0	20.0	0.0	48.0	32.0	16.0	245.5	165.5	80.0	9.02%	29.10%	4.00%
	6	5	25.0	25.0	0.0	47.5	31.5	16.0	293.0	197.0	96.0	8.93%	28.67%	4.00%
	7	5	25.0	25.0	0.0	47.5	31.5	16.0	340.5	228.5	112.0	9.01%	29.07%	4.00%
	8	6	30.0	30.0	0.0	47.0	31.0	16.0	387.5	259.5	128.0	8.94%	28.69%	4.00%
	9	7	35.0	35.0	0.0	46.5	30.5	16.0	434.0	290.0	144.0	8.87%	28.33%	4.00%
	10	8	40.0	40.0	0.0	46.0	30.0	16.0	480.0	320.0	160.0	8.80%	28.00%	4.00%
Scenario #2	1	6	30.0	30.0	0.0	47.0	31.0	16.0	47.0	31.0	16.0	3.40%	1.00%	4.00%
	2	10	50.0	50.0	0.0	45.0	29.0	16.0	92.0	60.0	32.0	4.20%	5.00%	4.00%
	3	16	80.0	80.0	0.0	42.0	26.0	16.0	134.0	86.0	48.0	3.60%	2.00%	4.00%
	4	20	100.0	100.0	0.0	40.0	24.0	16.0	174.0	110.0	64.0	3.70%	2.50%	4.00%
	5	25	125.0	100.0	25.0	37.5	0.0	37.5	211.5	110.0	101.5	3.46%	2.00%	3.82%
	6	30	150.0	100.0	50.0	35.0	0.0	35.0	246.5	110.0	136.5	3.22%	1.67%	3.60%
	7	32	160.0	100.0	60.0	34.0	0.0	34.0	280.5	110.0	170.5	3.44%	1.43%	3.95%
	8	36	180.0	100.0	80.0	32.0	0.0	32.0	312.5	110.0	202.5	3.31%	1.25%	3.83%
	9	40	200.0	100.0	100.0	30.0	0.0	30.0	342.5	110.0	232.5	3.17%	1.11%	3.68%
	10	41	205.0	100.0	105.0	29.5	0.0	29.5	372.0	110.0	262.0	3.34%	1.00%	3.92%
Scenario #3	1	4	20.0	20.0	0.0	48.0	32.0	16.0	48.0	32.0	16.0	5.60%	12.00%	4.00%
	2	7	35.0	35.0	0.0	46.5	30.5	16.0	94.5	62.5	32.0	5.95%	13.75%	4.00%
	3	10	50.0	50.0	0.0	45.0	29.0	16.0	139.5	91.5	48.0	5.97%	13.83%	4.00%
	4	20	100.0	100.0	0.0	40.0	24.0	16.0	179.5	115.5	64.0	3.98%	3.88%	4.00%
	5	24	120.0	100.0	20.0	38.0	0.0	38.0	217.5	115.5	102.0	3.90%	3.10%	4.10%
	6	27	135.0	100.0	35.0	36.5	0.0	36.5	254.0	115.5	138.5	3.97%	2.58%	4.31%
	7	29	145.0	100.0	45.0	35.5	0.0	35.5	289.5	115.5	174.0	4.13%	2.21%	4.61%
	8	30	150.0	100.0	50.0	35.0	0.0	35.0	324.5	115.5	209.0	4.36%	1.94%	4.97%
	9	33	165.0	100.0	65.0	33.5	0.0	33.5	358.0	115.5	242.5	4.29%	1.72%	4.93%
	10	34	170.0	100.0	70.0	33.0	0.0	33.0	391.0	115.5	275.5	4.42%	1.55%	5.14%

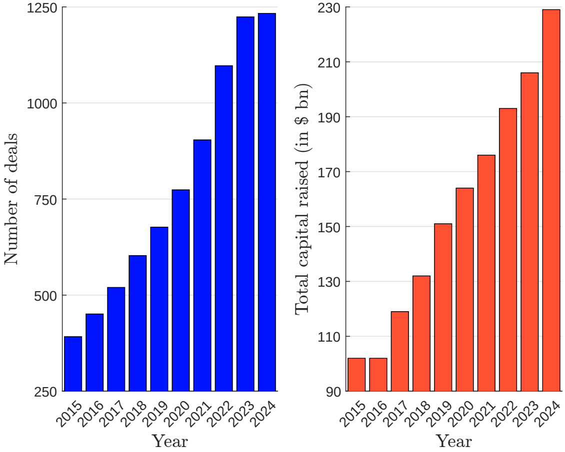
Structured blended finance funds

Figure 24: Probability density function of the average returns $\bar{R}_{10}$, $\bar{R}_{10}^{(\text{junior})}$ and $\bar{R}_{10}^{(\text{senior})}$ (in %)



Structured blended finance funds

Figure 25: Growth of blended finance activities



Source: `www.convergence.finance/blended-finance` & Author's calculations.

Microfinance funds

Definition

A microfinance fund is a financial vehicle that provides capital and other financial services to low-income individuals and businesses, often in developing countries

Figure 26: SDGs targeted by microfinance

Microfinance funds

"Private debt, also known as private credit, are loans made to companies that are not provided by banks or public markets. These private market investments can range in size and scale and be implemented in different forms, such as direct lending[2], mezzanine finance[3], and microcredit[4]." Phenix Capital (2023).

Table 10: Frequency of private debt funds per targeted region

Region	Africa	Asia	Latam	Europe	Middle East	North America	Oceania
Frequency (in %)	30.7	23.9	20.8%	19.5	4.1	13.7	1.8

Source: Phenix Capital (2024) & Author's calculations.

[2] A specialised form of private debt, in which loans are made to middle-market companies. It is the private debt strategy with lower risk, achieved by using collateral.

[3] A specialised form of financing in which loans are subordinated to banks, with no collateral. It is the most equity-like form of private debt.

[4] A common form of microfinance, characterised by small loans to individuals or small companies.