Do Development Financial Institutions Create Impact through Venture Capital Investments?*

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Abstract

Despite managing $23 trillion in assets, Development Financial Institutions' (DFIs) investment activities remain understudied. We document DFIs' substantial growth in venture capital (VC) investments, now participating as limited partners in one-sixth of all VC deals. We collect the mandates of DFIs and identify four main objectives they pursue through VC investments: building a VC ecosystem, supporting entrepreneurship and small and medium-sized enterprises, fostering innovation, and promoting sustainable business practices. We empirically test whether DFIs meet these objectives by addressing market failures, including externalities, information frictions, and coordination challenges. Our findings vary between developed and developing economies. In developing economies, DFIs are more likely to target industries with positive externalities, provide capital to underrepresented fund managers, and improve return transparency. However, they are less likely than conventional VC investors to support young funds or early-stage deals. Firms backed by DFIs grow similarly to those backed by conventional VCs in terms of profitability, employment, patenting, and sustainability, while having fewer follow-on investments from conventional VCs. In developed economies, we find limited evidence that DFIs address market failures and their impact is more muted. Overall, our findings suggest that DFIs create impact in some aspects but have significant room to enhance their impact by aligning investments with stated mandates and embracing higher risk in their portfolios.

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Keywords: Development Financial Institutions, DFIs, Venture Capital, Entrepreneurship, Impact Investing.

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1 Introduction

Development Financial Institutions (DFIs) are government-backed entities with a mandate to support economic development through investments. According to the Public Development Banks and Development Financing Institutions Database, these institutions collectively managed more than $23 trillions in 2023 and have investments around the world. Over the past three decades, many DFIs have expanded their mandates to support innovation and entrepreneurship and have significantly increased their venture capital (VC) investments. We document that DFIs, such as the International Finance Corporation, European Investment Fund, British International Investment, Small Industries Development Bank of India, and Oregon Growth Board, participate in one out of every six VC deals.[1] In developing countries, where access to risk capital is limited, DFIs are expected to play a pivotal role in fostering nascent VC ecosystems. Despite their large size and potential, the scope of DFI investments in the VC market and the broader economic impacts remain underexplored.

DFIs could create a positive societal impact above and beyond that of conventional VC investors by addressing market failures to improve social welfare (De Haas and Gonzalez-Uribe, 2024). First, DFIs can internalize both positive and negative externalities. For example, they could internalize positive externalities by investing in socially valuable but less commercially attractive projects at concessional terms (Flammer, Giroux, and Heal, 2024). DFIs can address negative externalities by setting high sustainability standards, such as requiring portfolio firms to disclose environmental impacts. Second, DFIs can mitigate information frictions in the VC market, where promising projects often struggle to secure private capital (Cole, Melecky, Mölders, and Reed, 2020), by conducting due diligence and signaling confidence to crowd-in conventional VC investors. Third, DFIs can address coordination failures that arise — particularly in

[1] Our sample encompasses four types of DFIs. First, international multilateral DFIs are formed and funded by multiple countries and finance firms in multiple countries (e.g., Asian Development Bank, European Investment Fund, and International Finance Corporation). Second, international unilateral DFIs are funded by one country but invest broadly (e.g., British International Investment, German Investment Corporation (DEG), and Dutch Entrepreneurial Development Bank (FMO)). Third, domestic national DFIs are funded by one country and invest primarily domestically (e.g., Bpifrance, Brazilian Development Bank, Small Industries Development Bank of India). Fourth, domestic subnational DFIs are funded by one region within a country, such as a city, province, or state, and invest primarily in that region (e.g., Alberta Enterprise Corporation, Catalan Institute of Finance, and Oregon Growth Board). DFIs in our sample overlap with development banks, which do not necessarily have VC investments. Conversely, many DFIs in our sample do not have loan investments.

developing economies — when private investors are hesitant to invest until a robust VC ecosystem is already in place. DFIs can act as anchor investors by committing early capital, pooling resources for large projects, and providing connections with local authorities.

Based on these theoretical underpinnings, this paper empirically asks whether DFIs create impact through their VC investments. The answer is not obvious. On the one hand, DFIs have the potential to address market failures given their mandates and relatively cheap funding (de Aghion, 1999). On the other hand, investments by DFIs can lead to market distortion and inefficient allocation of capital (EBRD, 2024). DFIs have also been criticized for being non-transparent and politically motivated (Frigerio and Vandone, 2020). Assessing their investment impact is challenging due to the lack of third-party evaluations and limited public access to relevant data (James and Anderton, 2023). Consequently, research on DFIs is scarce (De Haas and Gonzalez-Uribe, 2024).

Our paper seeks to fill this gap by addressing the challenges of data availability and impact measurement. To operationalize our tests of DFIs' impact, we collect the VC-related mandates and strategies of the largest 30 DFIs. These mandates show that DFIs pursue not only financial returns but also aim to address market failures. We categorize DFIs' mandates into four objectives: (1) building a VC ecosystem, (2) supporting entrepreneurship and SMEs, (3) fostering innovation, and (4) promoting sustainable business practices. We map each objective to specific impact indicators based on the market failures discussed above. For example, the indicator "early investor" under the objective "SMEs" asks whether DFIs are more likely to invest in deals of earlier stages than conventional VC investors. Another example is the "High-tech Focus" indicator under the objective "Innovation", which evaluates whether DFIs are more likely to invest in firms within cutting-edge industries. These indicators serve both normative and positive purposes: they test whether DFIs invest in ways that address market failures and whether they act in accordance with their objectives.

To investigate the impact of DFIs, we construct a comprehensive database of 344 DFIs with VC investments across 57 economies. Using Preqin and hand-collected sources, we identify 2,770 VC funds and

33,106 deals that received financing from DFIs from 1995 to 2021. DFIs primarily invest through funds as limited partners but also have a small number (2,501) of direct investments. Our analysis is conducted at both the fund and firm levels. At the firm level, we merge Preqin with several other databases, including Orbis, SDC Platinum, Trucost, and RepRisk. Throughout the paper, we discuss DFI investments in developed and developing economies separately. The reason is that market failures can be more pronounced in developing countries, so DFIs have a larger room to create impact. Moreover, the relative importance of DFIs can be higher in developing economies. For instance, the African Development Bank is the largest VC investor in Africa, while the Small Industries Development Bank of India is the largest VC investor in India. Finally, international DFIs tend to have better resources to create impact and are more likely to operate in developing countries than domestically oriented DFIs.

Our main findings can be summarized as follows. Across developed and developing countries, DFIs are more likely to provide capital to underrepresented fund managers. However, DFIs are less likely than conventional investors to invest in early-stage funds or funds managed by new general partners. DFIs are less likely to invest in firms seeking early-stage investment and do not tilt towards high-tech industries. These results suggest that DFIs are more risk-averse than conventional VCs. Our second broad result is that DFIs are not effective in attracting conventional investors. DFI-backed funds have fewer follow-on funds under the same series or general partners, and DFI-backed firms attract more DFI investments but fewer investments from conventional VCs. Our third broad result is that firms backed by DFIs grow similarly to those backed by conventional VCs. Using a stacked difference-in-difference method, we find that firms backed by DFIs show a similar financial growth trajectory to matched firms funded by conventional investors. This is true both before and after the investment, suggesting that DFIs are not selecting into worse projects. However, we find that DFI-backed firms do not develop a better innovation capacity or improve their sustainability metrics, despite DFIs' mission to promote innovation and sustainable business practices.

Our analysis shows significant differences in how DFIs invest in developed and developing countries.

In developing countries, DFIs are more likely to focus on sectors with positive externalities, like clean technology and urban planning. Moreover, funds financed by DFIs in developing countries do not have fewer subsequent follow-on financing. Firms backed by DFIs are also more likely to receive follow-on funding. DFIs increase the transparency of private markets in developing economies as DFI-backed VC funds are significantly more likely to disclose financial performance. In developed countries, we find little evidence that DFIs address market failures beyond supporting underrepresented managers. DFIs in developed countries are slightly less likely than conventional investors to invest in the high-tech sectors. Additionally, DFI-backed companies take longer to exit through IPOs or successful M&A deals. These results are summarized in Table 1, where we present the impact indicators, corresponding market failures, empirical proxies, and performance of DFIs.

Ideally, we would draw stronger causal inferences on the impact of DFI investments, but this is difficult even with matching and DiD. VC fund and firm selection hinges on many unobserved factors, so clean identification usually needs quasi-experiments (Lerner, 2009). A key pursuit of our paper is to provide aggregate evidence. We therefore emphasize DFIs' fund and deal selection when evaluating their impact, while treating the investment outcomes as conditional on the selection process.

Based on the selection patterns, we document that DFIs have considerable room to enhance the impact of their VC investments. The improvement is particularly crucial given the substantial assets under management by DFIs, which are ultimately supported by taxpayers' money. To enhance the effectiveness of these resources and fulfill their broader development mandates, DFIs could reallocate capital toward projects that more directly tackle market failures and adopt a greater tolerance for risk.

The literature. Our paper relates to three streams of literature. First, it contributes to the literature on DFIs, including development banks. DFIs have the potential to overcome long-term capital shortages and underinvestment caused by market failures (de Aghion, 1999), but they can also lead to fiscal burdens and inefficient capital allocation (EBRD, 2024). DFIs have supported industrialization and alleviated financing constraints in developing countries (Amsden, 2001; Rodrik, 2004; Cole, Melecky, Mölders, and

Reed, 2020), but their investments can also crowd out private capital and be politically motivated (Lazzarini, Musacchio, Bandeira-de Mello, and Marcon, 2015; Ru, 2018; Dreher, Lang, and Richert, 2019; Frigerio and Vandone, 2020). [2] Prior research on DFIs focuses on bank lending in developing economies, and our contribution is to examine DFIs' VC investments in both developed and developing economies. Studying VC investments allows us to provide a comprehensive account of global DFI activities, addressing a data challenge in the literature. [3] We find that the impact of these VC investments is limited, contributing to the ongoing discussion on the effectiveness of DFIs' investment strategies (Bulow and Rogoff, 2005; Clemens and Kremer, 2016). We also show that DFIs' investments are more effective in developing countries, where market failures are more pronounced, offering greater opportunities for impact.

Second, by examining the VC investments of DFIs, our paper bridges the gap between development economics and VC literature. While VC has traditionally been concentrated in developed countries and received limited attention from development economists, governments around the world are increasingly recognizing its importance in fostering innovation and economic growth (Lerner, 1996, 2009; Kerr and Nanda, 2015; Brander, Du, and Hellmann, 2015; Lerner and Nanda, 2020; Bai, Bernstein, Dev, and Lerner, 2021; Draghi, 2024; Howell, 2024). The literature shows mixed evidence on the effectiveness of government and political involvement in venture capital (e.g., Bernstein, Lerner, and Schoar, 2013; Andonov, Hochberg, and Rauh, 2018; Colonnelli, Li, and Liu, 2024). We provide evidence of the limited effectiveness of government involvement through DFIs in addressing market failures. We also contribute to this literature by proposing a framework of impact indicators and empirical proxies that enrich the study of the intersection between VC and economic development. On a practical level, this framework provides policymakers with actionable tools to evaluate and improve the effectiveness of government-backed VC initiatives, particularly in addressing market failures and achieving development goals.

Finally, we contribute to the literature on impact investing [4], particularly in private markets (Cole,

[2]Similar issues are observed across other government-owned banks and entities (Sapienza, 2004; Dinç, 2005; Khwaja and Mian, 2005; Alok and Ayyagari, 2020).

[3]We show in Online Appendix Table IA.3 that VC data availability is significantly better than bank lending data for DFIs. Consequently, studying a large number of DFIs' lending is difficult.

[4]For impact investing in the public market, see, for instance, Edmans, Levit, and Schneemeier (2022); Hartzmark and

Melecky, Mölders, and Reed, 2020; Zhang, 2021; Cole, Jeng, Lerner, Rigol, and Roth, 2023; Jeffers, Lyu, and Posenau, 2023; Flammer, Giroux, and Heal, 2024). The literature has primarily focused on the financial performance of impact investors, and our contribution is to examine their non-financial objectives in private markets. Barber, Morse, and Yasuda (2021) find that DFIs show a significant willingness to pay by accepting to invest in underperforming impact funds. We extend this research by documenting that DFIs reach limited non-financial objectives that could have countervailed the lower financial returns. Cole, Jeng, Lerner, Rigol, and Roth (2023) show that private general partners engaged in impact investing often focus on nascent industries and demonstrate greater risk tolerance, but do not seem to expand financing frontiers. We find that DFIs, acting as limited partners, do not exhibit higher risk tolerance and are not more likely to invest in cutting-edge industries or early-stage deals. Overall, the evidence suggests that public impact investors, such as DFIs, are different from private impact investors in terms of their financial and non-financial outcomes.

2 Institutional Background and Objectives of DFIs

Development Financial Institutions (DFIs) are government-backed entities with mandates to support economic development through investments. These institutions collectively manage over 23 trillion dollars and have investments in nearly all countries. Over the past two decades, DFIs have experienced structural shifts in their mandates and investment vehicles, increasingly providing capital to the VC industry.

In venture capital, limited partners (LPs), typically institutional investors and wealthy individuals, provide capital for the investment. This capital is managed by general partners (GPs), who identify promising startups, make investment decisions, and guide these companies towards success (Sahlman, 1990). VC investments are high-risk due to the uncertainty of new ventures but offer the potential for high returns if startups grow or disrupt markets (Kaplan and Strömberg, 2001). The high-risk and high-reward VC industry is a cornerstone of the modern financial system, instrumental in nurturing early-stage companies

Shue (2022); Berk and Van Binsbergen (2025); Oehmke and Opp (2025)

with high growth potential (Hellmann and Puri, 2002; Gompers and Lerner, 2004; Kerr, Lerner, and Schoar, 2014) and fostering innovation and economic growth (Hellmann and Puri, 2000; Kortum and Lerner, 2000; Samila and Sorenson, 2011).

Despite its importance, the VC industry faces numerous challenges and market failures. Information asymmetries exist because startups often lack the track record to signal their true potential to investors (Akerlof, 1978; Howell, 2020). Similar to private equity, the challenge of illiquidity prevails in the VC industry, affecting LPs, GPs, and start-ups (Cumming, Fleming, and Schwienbacher, 2005; Franzoni, Nowak, and Phalippou, 2012; Robinson and Sensoy, 2016). There are also coordination problems, especially in developing economies where the supportive infrastructure for startups and investors is underdeveloped (Gompers and Lerner, 2001). These challenges can lead to underinvestment in certain sectors or regions, impeding the optimal allocation of resources necessary for innovation and growth.

When investing in VC funds, DFIs have broader objectives that focus on fostering development and go beyond the goal of maximizing risk-adjusted investment performance. The overarching reason why DFIs invest in VC deals is to address market failures, such as externalities, information frictions, and coordination frictions. To understand more precisely their broader objectives, we collect the mission statements and investment policies of the largest DFIs from their websites and annual reports. Figure 1 presents a word cloud that summarizes the mandates and investment policies of the 30 largest DFIs in our sample based on the number of VC investments.[5] Based on this figure and the mission statements, we classify the DFI objectives when investing in VC deals into four objectives: building a venture capital ecosystem; supporting entrepreneurship and small and medium-sized enterprises (SMEs); fostering innovation; and promoting sustainable business conduct.

The first objective is to build a venture capital ecosystem and it addresses information frictions and coordination failures in private markets. DFI investments can stimulate the growth of the VC industry by providing capital to young managers without prior track record or underrepresented managers who

[5]The largest 30 DFIs account for almost two-thirds of the DFI investments and cover all four types of DFIs: international multilateral, international unilateral, domestic national, and domestic subnational. Online Appendix Table IA.2 presents the list of the largest 30 DFIs and the source text used to generate the word cloud.

struggle more to raise funds. Thus, DFIs can help with developing the local VC industry and ecosystem that nurtures startups and eventually leads to broader economic development.

The second objective focuses on supporting entrepreneurship and SMEs. DFI investments can address information frictions and internalize positive externalities. Information frictions hinder promising businesses from securing private capital because investors lack sufficient information to assess their potential. DFIs can conduct due diligence can reduce these frictions by identifying viable projects and signaling confidence to private investors (Cole, Melecky, Mölders, and Reed, 2020). SMEs generate positive externalities by creating jobs, boosting tax revenue, and driving innovation in high-impact industries like clean energy and education. DFIs can internalize these externalities by providing targeted investments in high-externality industries.

The third objective targets innovation, and DFI investments in VC deals can stimulate innovative activity in the economy. A higher degree of innovation output potentially has positive externalities for the other firms in the economy and can lead to improvement in overall efficiency (Romer, 1986). Innovative startups often struggle to secure financing because they have longer research and development cycles before commercialization. The delays in cash flow generation can make them unattractive to conventional VC funds. DFIs can fulfill the role of providing risk capital to crowd in conventional investors as well as connecting these firms to scientific and engineering resources.

The fourth objective covers objectives that promote sustainable business conduct. Negative externalities can arise from environmental damage, such as deforestation or pollution, and corporate scandals, including corruption or labor rights abuses. DFIs can address these issues by increasing disclosure standards and helping general partners and portfolio firms develop sustainability frameworks. By fostering better management practices, DFIs can also set an example for conventional investors to adopt sustainable management.

These four objectives are more relevant in developing countries, where the VC ecosystems are less mature, firms face more financial frictions, and the standard for sustainable business practices is lower. The

ambition for DFIs to enhance sustainable business conduct is especially relevant in developing countries, where the regulatory framework and enforcement are lagging.

These objectives lay the foundation for the rest of the paper as we subsequently map each objective to a number of testable impact indicators based on existing literature and data availability. These impact indicators allow us to test whether DFIs create impact and adhere to their stated mandates and investment focuses. Table 1 summarizes these impact indicators and serves as a map to navigate the paper. We provide rationales and additional data underlying these indicators in each respective section.

3 Data on DFIs and VC Deals

3.1 Development Financial Institutions

We hand-collected a comprehensive database of development financial institutions (DFIs) that invest in venture capital. Our definition of DFIs captures all government agencies that invest to promote economic growth, stimulate innovation, increase employment, and develop the financial industry. We manually verify the list of DFIs based on their description and website information. Our sample of DFIs excludes government-owned banks without development mandates, public pension funds, sovereign wealth funds, and philanthropic foundations. DFIs in our sample partially overlap with development banks, which do not necessarily have VC investments. However, many DFIs in our sample do not have any loan investments.

Table 2 shows that our sample encompasses 344 DFIs that invest in venture capital.[6] Figure 2 presents the number of DFIs with venture capital investments by country. Many countries have multiple DFIs and the highest concentration is in China with 59, USA with 26, India with 21, Italy with 18, and South Korea with 18 DFIs. In total, 57 countries have at least 1 DFI that invests in venture capital, and there are additionally major international DFIs.[7]

[6]Our coverage of DFIs is broader than the list of Public Development Banks and Development Financial Institutions compiled by Peking University. The Peking University list covers 533 DFIs, but we check manually and only 189 of them invest in venture capital. Our sample expands the coverage by including additional DFIs, especially in the domestic national and domestic subnational categories. We validate the coverage of our database by cross-checking with two lists of major DFIs provided by the European Development Finance Institutions and OECD.

[7]This figure excludes 37 International-Multilateral DFIs (e.g., Asian Development Bank, European Investment Fund, and

We classify the DFIs into four categories based on their location and geographical focus: multilateral international, unilateral international, domestic national, and domestic subnational DFIs. Online Appendix Table IA.4 presents the distribution of DFIs across the four categories. First, international multilateral covers 29 large DFIs that are formed and funded by multiple countries and have an investment objective to finance projects in multiple countries (e.g., Asian Development Bank, European Investment Fund, and International Finance Corporation). Second, international unilateral includes 25 DFIs that are funded by one country but invest broadly in many other countries, predominantly in developing economies (e.g., British International Investment, German Investment Corporation (DEG), and Dutch Entrepreneurial Development Bank (FMO)). Third, domestic national includes 160 DFIs that are funded by one country and invest primarily domestically to foster economic development (e.g., Bpifrance, Brazilian Development Bank (BNDES), Small Industries Development Bank of India). Fourth, domestic subnational includes 130 DFIs that are funded by one region within a country, such as a city, province, or state, and invest primarily in that region (e.g., Alberta Enterprise Corporation, Catalan Institute of Finance, and Oregon Growth Board).

3.2 DFI Investments in Venture Capital

We focus on the venture capital (VC) investments of DFIs for two reasons. First, VC is the asset class that closely matches the mandates and mission statements of DFIs. Online Appendix Table IA.2 lists the mandates of the largest DFIs based on the number of investments. Almost all DFIs in our sample explicitly state one of the following missions: developing a venture eco-system, stimulating entrepreneurship and SMEs, fostering innovation, and promoting sustainable business conduct. Second, VC has attracted significantly more financing from DFIs than other asset classes in private markets. VC deals account for 80% of the deals financed by DFIs in private markets, and the remaining part is split between buyout and infrastructure deals.

International Finance Corporation) because they are formed and funded by multiple countries, so we do not assign them to one particular country.

Using the Preqin dataset, we match 344 DFIs to 2,770 unique VC funds and 2,501 direct investments from 1995 to 2021. Through their fund commitments and direct investments, DFIs provide capital to 103,614 deals. Since multiple DFIs can serve as an LP in the same VC fund and firms can receive multiple rounds of financing, the number of unique firms that receive capital from DFIs is lower and equals 21,667.

Preqin provides a largely complete coverage of DFI investments. Preqin collects limited partners' fund investment information from regulatory filings, Freedom of Information Act (FOIA) requests, surveys, and voluntary reportings (Kaplan and Lerner, 2016). Similar to U.S. public pension funds, DFIs are public institutions and are subject to FOIA requests in many countries, such as the U.S., Japan, South Korea, and Ireland. Even though not all DFIs are legally obliged to disclose their fund investments, they increasingly face public scrutiny and may disclose voluntarily in annual reports or through publicly available datasets (James and Anderton, 2023).

We also manually verify that Preqin provides comprehensive coverage of the DFI investments in VC. We first verify that nearly all multilateral and unilateral DFIs with VC investments are included in the Preqin dataset. Next, in Online Appendix Table IA.3, we show that the fund investments of 28 out of the 30 largest DFIs (based on the number of VC fund investments) either can be requested according to country or state laws or are publicly available through websites and annual reports. This has two important implications for our paper. First, it is unlikely that we label DFI-backed funds as conventional funds. Second, we can examine the (nearly) full picture of DFIs' venture capital investments.

In our analysis, we distinguish between DFI investments in VC deals in developed and developing economies. We classify countries into developed and developing based on the International Monetary Fund 2023 classification. The classification of countries is stable over time as they do not move across the two categories.[8]

Figure 3 plots the number of VC deals financed by DFIs over the 1995–2021 period. The number of investments by DFIs has increased over time, but their share of the VC market has been relatively stable

[8]The only two exceptions are South Korea and Argentina. In our analysis, we follow the 2023 classification as most deals are at the end of the same period, so South Korea is classified as a developed economy and Argentina as a developing economy.

since 2003. Overall, DFIs provide capital to 17% of the deals, making them important investors in the venture capital space.

In our analysis, we examine the characteristics of VC investments on a fund level and deal level. The main fund-level variables capture the general partners (GP) experience, background, and performance. *First Fund* equals one if a VC fund is the first fund raised by the general partner within the specific series of funds raised by this general partner. *GP Age* is the difference between the vintage year of the VC fund and the year the GP was founded. Preqin provides information on two performance measures: internal rate of return, and multiple of invested capital (total value to paid-in capital). Preqin also provides cash flow data for a more limited number of funds, which we use to calculate the public market equivalent with the S&P 500 equity index as a benchmark (Kaplan and Schoar, 2005). In the performance analysis, we limit our attention to VC funds raised in vintages before 2017, to ensure that they have a track record of more than 5 years and finished allocating the capital (the reporting date of our performance measures and cash flow data is at the end of 2022).

Our deal-level variables capture three characteristics of the underlying VC deals. First, based on the deal country, we split the deals into seven geographical regions. DFIs investing in developed economies primarily finance deals in Europe and North America, while DFIs investing in developing economies have substantial exposure to Asian countries. Second, the project stage variables measure whether the VC deals are in the early (angel, seed, and pre-seed), mid (series A and B), or late stage (series C, D, and beyond, as well as growth financing) of the firm's lifecycle. Third, based on the Preqin industry classification, we group the deals into six categories. 48% of the deals are in IT, Telecom & Networks, while 22% are in the healthcare industry. The remaining deals are in consumer discretionary, business service, industrials, and energy & natural resources industries.

We also use the more granular industry classification in Preqin to create indicators for high-externality and high-tech industries. Based on the public economics literature, we classify the following industries as high-externality: clean technology, health technology, education technology, agriculture technology, smart

urban planning, infrastructure, shared economy, payment technology, and research & AI support.[9] The high-tech indicator covers investments in firms producing cutting-edge technologies: artificial intelligence, blockchain, clean technology, internet of things, fintech, robotics & automation, augmented & virtual reality, advanced manufacturing, advanced computing, semiconductors, interactive technology, and nanotechnology.

Our dataset of DFIs' VC investments differs substantially from the coverage and objectives of prior research on impact investing in VC markets (e.g., Barber, Morse, and Yasuda, 2021; Cole, Jeng, Lerner, Rigol, and Roth, 2023) by focusing on impact investing at the limited partner level. For instance, Barber, Morse, and Yasuda (2021) identifies 159 impact VC funds based on their dual objective to generate social good as well as financial returns, and DFIs are frequent investors in these funds. However, our coverage is broader, and we show that impact VC funds with an explicit dual mission account for a small fraction of the VC funds that raise capital from DFIs. Cole, Jeng, Lerner, Rigol, and Roth (2023) identify 279 impact general partners (stand-alone impact funds and general partners with large impact funds). Our dataset focuses on DFIs acting as limited partners with broader objectives. The DFIs are important capital providers to the private general partner impact firms, as 90 out of 279 impact general partners are in our sample. Nevertheless, we show that DFIs invest in many other VC funds raised by general partners that do not have an explicit impact mission.

3.3 Venture Capital Deals Financed by DFIs

For our firm-level analysis, we match portfolio firms from Preqin to the Orbis Historical Database to obtain their financial information.[10] Orbis specializes in providing data on firms' financial information and provides broad coverage of private unlisted firms. We match firms between Preqin and Orbis based on company name, website, and city. We match 80% of the 21,667 firms financed by DFIs and 75% of the

[9]The following papers discuss the positive externalities of the above-mentioned industries: Caragliu, Del Bo, and Nijkamp (2011); Foley, Ramankutty, Brauman, Cassidy, Gerber, Johnston, Mueller, O'Connell, Ray, West, et al. (2011); Borenstein (2012); Jamison, Summers, Alleyne, Arrow, Berkley, Binagwaho, Bustreo, Evans, Feachem, Frenk, et al. (2013); Jack and Suri (2014); Lipper, Thornton, Campbell, Baedeker, Braimoh, Bwalya, Caron, Cattaneo, Garrity, Henry, et al. (2014); Escueta, Quan, Nickow, and Oreopoulos (2017); Donaldson (2018); Varian (2018); Frenken and Schor (2019).

[10]We use the historical version of the Orbis dataset to obtain a comprehensive coverage over time (Kalemli-Ozcan, Sorensen, Villegas-Sanchez, Volosovych, and Yesiltas, 2015). The underlying data is primarily obtained through national and regional company registries where businesses are legally required to file financial statements and other corporate information.

111,105 firms financed by other non-DFI conventional investors.

However, Orbis does not provide financial information for all firms that are covered in the dataset. Table 3 Panel A, shows that we obtain information on assets and operating revenue for 6,976 out of 21,667 firms that receive capital from DFIs. A primary reason for the data attrition is that private firms in North America do not disclose financial information and are not covered by the Orbis dataset. The summary statistics show that VC deals in developing countries financed by DFIs tend to be larger in terms of assets, employment, and turnover than VC deals in developed countries financed by DFIs.

To examine firms' innovation, we collect data on patenting activity from the Orbis Intellectual Property dataset. The dataset provides global coverage, containing the number of patents at the year-firm level, as well as the number of citations and patent granting status. In line with prior literature, we only include patents that are eventually granted (Kelly, Papanikolaou, Seru, and Taddy, 2021). Panel B of Table 3 shows the number of matched firms and deals are very close to those in Panel A because firms with patenting information tend to overlap with firms with financial information in Orbis. We observe that firms backed by DFIs in developing countries have significantly more patents than those in developed countries, but the reverse is true for citation numbers.

Finally, to study portfolio firm exits, we match the deals from Preqin to the SDC Platinum dataset. SDC Platinum provides two datasets on global M&A and IPO activities. We match these two datasets at the deal level based on a portfolio firm name, website, city, and investment years. Panel C of Table 3 shows that we match more than half of the deals backed by DFIs, and the matching is more successful for firms in developed economies. The exit statistics cover only deals executed over the 1995–2017 period, as many deals executed from 2018 to 2021 have not been exited yet. We document that less than half of the firms achieve successful exits, proxied by M&A or IPO, which is comparable to statistics in other VC studies (Hochberg, Ljungqvist, and Lu, 2007; Ewens and Sosyura, 2023). It takes a shorter time to exit in developing countries than in developed countries. DFI-backed firms in developing economies rely more on IPO exits while the reverse is true for those in developed economies.

4 Objective 1: Building VC Ecosystem

In this section, we examine whether DFI investments in VC funds contribute to their objective of developing the VC ecosystem. A developed VC ecosystem is characterized by the availability of capital whose owners are willing to bear substantial risk, and a well-functioning network of general partners, limited partners, entrepreneurs, and supporting institutions that collectively enable the growth of new companies. Information frictions and coordination failures can hinder the development of a VC ecosystem. For example, information frictions occur when promising fund managers or entrepreneurs struggle to raise capital due to a lack of track records. Coordination failures occur when private investors hesitate to invest until a robust VC infrastructure, such as a mature exit market, is already in place.

If DFIs address their objective to develop the VC industry, we hypothesize that they will invest relatively more in first-time VC funds raised by general partners without a prior track record. First-time funds struggle to raise capital from limited partners because the informational asymmetries are larger (Lerner, Hardymon, and Leamon, 2011). Conditional on successfully raising capital, these funds are frequently undersubscribed (Sensoy, Wang, and Weisbach, 2014). DFI investments in first-time funds can increase the total number of VC funds that manage to complete the fundraising stage and broaden the local VC industry. In our analysis, we use two proxies to test the hypothesis that DFIs invest more in inexperienced managers without a prior track record. Our first proxy, *First Fund*, equals one if a VC fund is the first fund within a specific series of funds. Our second proxy, *New GP*, is more conservative and equals one if the fund is raised by a new general partner established in the last five years.

An additional way DFIs could help develop the VC system is by providing capital commitments to underrepresented groups of VC managers. Female and minority general partners tend to experience more difficulties during the fund raising process. Cassel, Lerner, and Yimfor (2022) show that the limited representation of minority general partners stems primarily from challenges at entry to raise the first fund, so DFI investments could alleviate these challenges and broaden the spectrum of active VC managers.[11] In

[11]This hypothesis relates also to the literature discussing the challenges faced by female and minority entrepreneurs when raising capital (e.g., Younkin and Kuppuswamy, 2018; Ewens and Townsend, 2020; Zhang, 2020; Raina, 2021; Ewens, 2022;

our analysis, we use indicator variables for general partners managed by women and minorities as proxies for underrepresented groups that DFIs may prefer to support by capital commitments. *Woman* is an indicator equal to one if a fund is managed by at least one female general partner, while *Minority* equals one if a fund is managed by at least one minority general partner.

In Table 4, we estimate the following logit specifications with four different dependent variables:

$$\text{Logit}(Y_i) = \beta_1 \text{DFI-invested}_i + \beta_2 \text{Fund Size}_i + \eta_r + \nu_j + \zeta_t, \tag{1}$$

where DFI-invested$_i$ is an indicator if fund i received capital commitment from at least one DFI. Fund Size is the natural log of the VC fund size. The last three terms represent region, industry, and vintage year fixed effects, respectively. We double cluster the standard errors by general partner and vintage year.[12]

In Columns (1) and (5), the dependent variable Y_i is an indicator for first-time funds, while in Columns (2) and (6), it captures investments in funds raised by new general partners. We find that DFIs are less likely than conventional VC investors to provide capital to first-time funds and funds of new general partners in both developed and developing economies. Based on Column (5), DFIs have a 9.6 percentage points lower probability to invest in first-time funds in developing funds, which is a substantial decrease relative to the baseline probability of 71% that a VC fund is a first-time fund.

In Columns (3) and (7), the dependent variable is an indicator for women's funds, while in Columns (4) and (8), it captures investments in funds raised by minority general partners. We find some evidence that DFIs are more likely to invest in VC funds with female partners. The economic magnitude is similar in developed and developing economies as DFIs have around 2.6 percentage points higher probability of investing in VC funds managed by at least one female general partner. The results are economically substantial, as only 6.2% and 3.5% of the funds in developed and developing economies are managed by women. The results for minority funds are statistically insignificant, but one caveat is that the baseline

Fairlie, Robb, and Robinson, 2022; Hebert, 2023; Gornall and Strebulaev, 2024; Bennett and Robinson, 2024).

[12]Our double clustering approach is conservative as one potential concern is that the standard errors are correlated within the same GP, and that vintage year fixed effects might not eliminate all within-year correlation of errors (e.g., Cameron and Miller, 2015; Abadie, Athey, Imbens, and Wooldridge, 2023).

probability is close to zero, especially in developing countries.

Overall, the results on fund selection provide limited support to the objective of DFIs to develop the VC ecosystem. While DFIs seem to support relatively more underrepresented groups of general partners, they do not provide more capital to new funds and new general partners which is essential for the growth of the VC industry. DFIs display higher risk aversion than conventional investors in fund selection.

An alternative way DFIs can contribute to the development of the VC ecosystem is by crowding in capital. DFI investments in VC funds can encourage other conventional VC investors to increase their capital commitments by mitigating information frictions and signaling confidence (Lerner, 1996). Under this hypothesis, general partners that have DFIs as limited partners in the current VC fund will be more likely to raise a follow-on VC fund. The follow-on funds will raise capital from a broader set of limited partners and provide continuity in the VC industry.

In Table 5, we estimate the following Poisson regression to examine the number of follow-on funds raised by the same general partner under the same series:

$$\#\text{FollowonFunds}_i = exp(\beta_1 \text{DFI-invested}_i + \gamma \text{X}_i + \eta_r + \nu_j + \epsilon_t). \tag{2}$$

where DFI-invested$_i$ is an indicator if fund i received capital commitment from at least one DFI. The last three terms represent region, industry, and vintage year fixed effects, respectively. X_i include the natural log of fund size, the first-time fund indicator, and performance. The performance measures, such as IRR and multiple of invested capital, are available only for a subset of the VC funds, but they are highly relevant controls. Prior performance is one of the most important predictors of successful follow-on fund raising, in part due to performance persistence (Kaplan and Schoar, 2005; Sensoy, Wang, and Weisbach, 2014).

We find that DFI-invested funds have fewer follow-on funds. Based on Columns (1) and (5), DFI-invested funds have 0.23 and 0.21 fewer follow-on funds under the same series in developed and developing markets, respectively. The coefficients translate into a reduction of 14% to 18% percentage points in

the number of follow-on funds for DFI-backed funds. In developed economies, the negative effect of DFI-backing on follow-on funds remains even after controlling for performance. A higher performance of the current VC funds positively affects future fund-raising, but the negative effect of DFI investments remains statistically and economically significant. In developing economies, DFI-invested funds do not seem to have fewer follow-on funds after controlling for performance. One concern is that conditioning on the availability of performance measures substantially reduces the sample size. In Columns (2) and (6), we show that the availability of investment performance is unrelated to follow-on financing in our sample.

Finally, DFIs can address a significant source of information friction in the VC market by promoting the disclosure of investment performance data. Private market funds are often criticized for lacking transparency in their investment performance, which can hinder investors from accurately evaluating the risk and return of their fund investments. If DFIs were to address this challenge, we hypothesize that DFI-backed funds are more likely to report any of the following performance measures: the multiple of total value to paid-in capital (TVPI), the net internal rate of return (IRR), and the public market equivalent (PME).

Columns (1) and (5) of Table 6 show that DFI-backed funds in developed economies are not significantly more financially transparent. In developing countries, however, DFIs are 4.5 percentage points more likely to report any of the three performance measures. The economic significance of this result is substantial, given that the unconditional probability of reporting is only 8.4 percentage points.

Overall, our findings on fund selection, follow-on funds, and return disclosure jointly demonstrate that DFI investments in VC funds stimulate relatively more the development of the VC ecosystem in developing countries but have a limited effect in developed economies.

5 Objective 2: Supporting Entrepreneurship and SMEs

In this section, we examine whether DFI VC investments contribute to their objective of fostering the growth of entrepreneurship and SMEs. While SMEs disproportionally contribute to innovation, job

creation, and broad economic growth (Haltiwanger, Jarmin, and Miranda, 2013; Akcigit and Kerr, 2018), they are also more likely to face difficulties in raising external capital due to information frictions and incomplete contracting (Holmstrom, 1989). Moreover, the positive social externality of SMEs rising from tax revenue, job creation, and knowledge spillover are not fully internalized by the market itself. DFI can address these issues by investing early to crowd in private capital, selecting into high-externality industries, and connecting SMEs to other investors and business-supporting institutions.

If DFIs invest in VC to address this objective, we hypothesize that DFIs will be more likely than conventional investors to invest in firms seeking early stage financing. Firms in their early stage face greater financing challenges due to information frictions and the lack of collateral. DFIs and DFI-backed funds can conduct due diligence to support promising projects, act as anchor investors, and signal confidence to other investors. To test the hypothesis, we use the indicator *Early Stage* to as an proxy, which takes value one if the deal is either pre-seeds, seeds, or angels investments, where financing constraints are most binding and uncertainty is highest. The literature suggests that angel investments are highly risky and not easily stimulated by government policies such as tax-credit schemes, yet they are instrumental in spurring firm productivity growth and enabling access to later-stage capital (Kerr, Lerner, and Schoar, 2014; Hellmann and Thiele, 2015; Lerner, Schoar, Sokolinski, and Wilson, 2018; Denes, Howell, Mezzanotti, Wang, and Xu, 2023; Karlsen, Kisseleva, Mjøs, and Robinson, 2024).

We estimate a Logit model to understand the characteristics of deals financed by DFIs:

$$\text{Logit}(\text{Early Stage}_{ij}) = \beta_1 \text{DFI-invested}_i + \beta_2 \text{Lag Total Assets}_{ij} + \eta_r + \nu_j + \zeta_t, \tag{3}$$

where Early Stage_{ij} is an indicator equal to one if the deal i for firm j is in early stage and DFI-invested_{ij} is an indicator if the deal i for firm j receives investment from at least one DFI, either directly or through funds. $\text{Lag Total Assets}_{ij}$ denotes the log total assets of firm j one year before deal i took. The last three terms represent region, industry, and vintage year fixed effects, respectively.

Contrary to our hypothesis, Columns (1) and (4) of Table 7 show that DFIs are less likely to provide

capital to early stage deals. In both developed and developing economies, DFIs are three percentage points less likely than conventional investors to invest in firms seeking early financing. The magnitude is highly significant, particularly for developing countries where only 12% of the deals are in the early stage. This is surprising both in positive and normative senses. In the positive sense, many DFIs publicly communicate their support for early stage projects and willingness to act as anchor investors. In the normative sense, DFIs are expected to take risks that conventional investors are unwilling to take to address information frictions and coordination failures discussed earlier.

Our second hypothesis is that DIFs will be more likely than conventional investors to invest in firms in high-externality industries. To test this hypothesis, we leverage Preqin's granular industry classification to construct an indicator *High Externality* equal to one if the firm is in one of the following industries: clean technology, health technology, education technology, agriculture technology, smart urban planning, infrastructure, shared Economy, payment technology, and research & AI support.

We use similar logit specifications and report the results in Columns (2) and (5) of Table 7. In developing economies, DFIs are 4.5 percentage points more like to invest in high-externality industries than conventional investors. The magnitude is economically significant compared to the unconditional probability that 30% firms receiving VC financing are in high-externality industries. In developed countries, however, we do not find any difference between DFIs and conventional investors in investing in high-externality firms.

The first two hypotheses above focus on the stage and industry selection of DFIs, while the following tests examine whether firms financed by DFIs grow differently than similar firms financed by conventional investors. Given data availability, we proxy firm growth by their employment and asset turnover. Asset turnover measures the efficiency in generating profit, defined as the ratio of operating revenue to total assets.

To operationalize the test, we first match each DFI-backed firm with a firm invested by conventional investors. We require exact matching for investment year, deal stage, industry, and country, and match

with the firm closest in lagged total assets. We then apply the stacked difference-in-difference (DID) method of Cengiz, Dube, Lindner, and Zipperer (2019) by stacking treated (DFI-backed) and matched untreated (conventional investor-backed) firms within a time period in the same year.[13] The stacked DID approach addresses the forbidden comparison issue inherent in standard two-way fixed effects estimators, and accounts for treatment heterogeneity across time and firms (e.g., Callaway and Sant'Anna, 2021; Baker, Larcker, and Wang, 2022).

Specifically, the estimating equations for the stacked DiD read:

$$y_{i,t,g} = \alpha + \beta_1 Treat_{i,g} \times Post_{i,t} + \mathbb{X}_{i,t,g}\beta_2 + \epsilon_{i,t,g};$$
$$y_{i,t,g} = \alpha_{i,g} + \lambda_{t,g} + \sum_{k=\kappa_{min}}^{\kappa_{max}} \delta_k \mathbf{1}_{t-T_i=k} + \mu_{i,t,g},$$

where the first equation gives the aggregate estimates while the second equation gives the event-study results. The dependent variables $y_{i,t,g}$ are either asset turnover or employment. $Treat_{i,g}$ is an indicator variable equal to one if firm i is invested by DFIs in year g and $Post_{i,t}$ is an indicator variable equal to one if year t is bigger or equal to g. The specifications are estimated using a stacked dataset. In our context, investment year g captures the cohort of all firms that are treated in the same year. In each cohort g, we keep the treated firms and *matched* control firms in an unbalanced event window of three to ten years, i.e. $t \in [g-3, g+10]$. The event window is shorter in the pre-period because VC-backed firms are generally young and their financial information is often available only for a few years before the VC investment. The fixed effects $\alpha_{i,g}$ and $\lambda_{t,g}$ are also cohort-specific. We discuss this in Appendix Section , together with the detailed matching procedure, the formal formulation of the stacked difference-in-difference estimator, and alternative estimators.

While stacked difference-in-differences (DID) designs are often used to identify causal effects, our primary goal is to use the approach to generate parametric comparisons between firms backed by DFIs

[13] Our setup is similar to Chemmanur, Loutskina, and Tian (2014), which applies both matching and DiD to study the differential effects of investments by corporate VC and independent VC on firm innovation and profitability.

and by conventional VCs, without asserting a strong causal interpretation. Our setup is similar to that of (Chemmanur, Loutskina, and Tian, 2014) who study how corporate VCs differ from conventional VCs. The results can only be interpreted causally if two key identifying assumptions hold: (1) the absence of anticipation effects, and (2) the conditional parallel trends assumption.

In our context, both assumptions are plausibly satisfied. Regarding anticipation, although firms may adjust behavior in expectation of future investment, the no-anticipation assumption only requires that firms eventually funded by DFIs do not differ systematically in their pre-treatment growth trajectories from those that would have been funded by traditional investors. We assess this visually through event plots and formally via a pre-trend F-test.

The conditional parallel trends assumption requires that, absent DFI investment, treated firms would have followed similar growth paths as matched firms that received traditional investment. This assumption is commonly justified by observing parallel trends prior to treatment and extrapolating them forward. A potential threat in our case is that firms selected by DFIs may have unobserved differences in growth potential at the time of investment, even if their pre-investment trends appear similar.

Figure 5 visualizes the results for the stacked DiD regression. The dynamic coefficients show the difference between a firm invested by DFI and a matched firm invested by traditional investors on asset turnover and employment. The coefficients are generally insignificant at the 5 percent level, both for firms in developed and developing countries. This suggests that DFI-invested firms grow similarly to conventionally invested firms since the investment.

There are two ways to interpret results. DFIs actively communicate their investment strategies to provide technical assistance, training programmes and management advice to SMEs (see Figure 1). In this sense, firms backed by DFIs may achieve better growth, but we do not see this from the results. Another way to interpret the result is that if DFIs were to support firms unattractive to conventional investors, then achieving similar growth patterns is already a satisfactory result. We find no pre-trends in these figures, suggesting that DFIs do not seem to select into firms with worse employment or asset turnoevers once the

matching characteristics mentioned above are taken taken into account. In the discussion section, we also demonstrate that DFIs do not seem to be concessional in general. While these results are interesting, we leave them open to interpretation and do not include firm growth in impact measurement.

Next, we examine whether DFI-invested firms are more likely to achieve successful exits and do so more quickly. The absence of a mature exit market presents a coordination failure: investors hesitate to commit capital because the exit avenues are underdeveloped, yet the exit market cannot mature without sufficient VC investment to start with. Early movers are at a disadvantage as they face higher risks and uncertain exit opportunities, leading to a bad equilibrium of underinvestment. DFIs can help portfolio firms exit by connecting them to local involvement, reducing perceived risks, and encouraging private investors to participate, which collectively contributes to the development of a more robust exit market.

To test the hypothesis, we employ a logit model to examine whether DFI-backed firms are more likely to achieve successful exits, defined as either IPO or M&A. We then examine whether DFI-backed firms have shorter exit duration, defined as the time between exit and investment, conditional on successful exits.

Columns (1) and (3) of Table 8 show that there is no significant difference in exit probability between firms backed by DFIs and conventional investors, in both developed and developing countries. However, Column (2) suggests that, conditional on successful exits, it takes 0.25 years (a quarter) longer for DFI-backed firms to exit. Note that the economic and statistical magnitude are both moderate.

Finally, we examine the follow-on investments in DFI-backed firms. One the on hand, DFIs can identify promising projects and signal confidence to other investors (Cole, Melecky, Mölders, and Reed, 2020). On the other hand, investors and firms may have a distaste for government involvement due to factors like political interference (Colonnelli, Li, and Liu, 2024). We investigate the likelihood of follow-on investments using a logit model similar to the ones described above, the time it takes until a firm raises a follow-on financing using a Hazard model, and the composition of follow-on investors using a standard regression model.

Table 9 shows that DFI-backed firms in developing countries are 4.3 percentage points more likely to raise another round of VC financing than firms backed by conventional investors, when controlling for deal year, stage, industry, and country. The economic magnitude is moderate, given that the baseline probability of receiving a follow-on investment is 56%. Moreover, the Hazard model in Column (6) shows that DFI-backed firms in developing countries are also faster in securing follow-on investments. However, in developed countries, Columns (1) and (2) show that DFI-backed firms are neither more likely to receive follow-on financing nor faster in securing follow-on investments.

We break down the follow-on investments in Columns (3)–(4) and (7)–(8). The results show that in both developed and developing countries, DFI-backed firms receive more financing from DFIs and less financing from conventional investors. This result is consistent with the notion that DFIs can signal confidence in firms to other DFIs, but not necessarily to private investors.

Overall, the results indicate that DFIs have a stronger preference to invest in more mature projects and do not seem to help firms grow faster than conventional investors. The selection of DFIs into later-stage deals is in line with their preference to invest in experienced VC funds. Both results suggest that DFIs seem to be more risk-averse than conventional investors. Our interpretation for the similarities in form growth is that, despite the stated objectives and provision of technical assistance, connections, and support by DFIs to their targets, DFIs do not seem to provide substantially different support to their targets than conventional VC investors.

6 Objective 3: Fostering Innovation

In this section, we examine whether DFI investments in VC funds contribute to their objective of fostering innovation. Policymakers and academics increasingly acknowledge the importance of innovative technologies in economic development (Fuest, Gros, Mengel, Presidente, and Tirole, 2024; Draghi, 2024). Innovative technologies spill over to the broader economy, generating positive externalities by creating new markets and increasing productivity (Romer, 1986), even in the presence of 'negative spillover' from product market

rivals (Aghion, 1990; Bloom, Schankerman, and Van Reenen, 2013).

To the extent that DFIs invest in line with their stated objective to foster innovation, we hypothesize that DFIs will be more likely to invest in cutting-edge industries. The firms in these industries often have longer research and development cycles before commercialization and are considered to be riskier due to the uncertainty around the technology itself rather around market competition. The delays in cash flow generation can make them unattractive to conventional VC funds. In line with the path dependence of innovation and industrial development (Aghion, Dechezleprêtre, Hemous, Martin, and Van Reenen, 2016; Acemoglu, 2023), DFIs can direct funds into disruptive innovations rather than improving existing technology to stimulate innovation (Fuest, Gros, Mengel, Presidente, and Tirole, 2024). DFIs can fulfill the role of providing risk capital to crowd in conventional investors as well as connecting these firms to scientific and engineering resources.

To test the hypothesis, we use the Preqin granular industry classification and construct an indicator *High Tech* equal to one if the firm operates in high-tech industries, such as artificial intelligence, robotics & automation, semiconductors, and nanotechnology. Contrary to the innovation hypothesis, Figure 4 suggests that there is almost no difference between DFIs and other conventional investors in their allocation to deals in high-tech industries. In Table 7, we perform a more formal conditional test that incorporates control. The Logit regression results show that DFIs are not more likely than conventional investors to invest in firms in high-tech industries. In developed countries, DFIs even seem to be 2 percentage points less likely to invest in high-tech firms.

The previous test focuses only on the selection of deals by DFIs, but it does not examine whether the firms that receive financing from DFIs become more innovative. To examine the effect of DFI financing on innovation, we test whether DFI-backed firms become more innovative than peers within the same industry using firms' patenting activity as a proxy for their innovation capacity (e.g., Kelly, Papanikolaou, Seru, and Taddy, 2021). The data on firms' patenting activity comes from the Orbis Intellectual Property dataset. We consider four yearly patenting metrics to assess firms' innovation capacity: an indicator of

whether a firm has a patent, the log number of patents, the log number of citations, and the log number of citations per patent.[14]

We test the hypothesis that DFIs stimulate innovative activity because they have broader objectives in a stacked difference-in-difference framework, as described in the previous section. This framework allows us to dynamically compare the patenting activities of DFI-financed firms with matched counterparts in the same country, industry, investment year, and financing stage, and closest in total assets one year before the investment.

Figure 6 presents the estimation results in an event plot. Across all four innovation metrics, we see limited differences between DFI-invested firms and matched firms both before and after the investment. The insignificant coefficients prior to time 0 validate the no-pre-trend assumption, and also indicate that DFIs do not select into firms with better or worse existing innovation track record at the time of investment. In both developed and developing economies, DFI-invested firms do not increase their innovation activity after receiving the DFI financing.

Overall, even though DFIs discuss innovation as one of their main objectives when committing capital to VC funds and deals, we find that DFIs do not seem to foster innovation more than conventional VC investors, which typically have only financial objectives.

7 Objective 4: Promoting Sustainable Business

In this section, we examine whether DFI investments in VC funds contribute to their objective of promoting sustainable business conduct. Firms can cause negative externality to society by engaging in environmentally harmful projects or labor exploitation. DFIs can address these by enforcing sustainability criteria, providing technical support, and signaling the value of sustainable practices to other investors. This helps firms adopt better governance and reduces harmful market behaviors. We hypothesize that DFI-invested firms have better environmental management and fewer unethical business practices. These

[14]The number of citations is measured at the end of 2023, while the sample covers investments over the 1995–2019 period.

two topics should broadly reflect firms' sustainability profiles and they are relatively more objective than aggregate ESG ratings.[15]

Our empirical proxy for environmental management is whether a portfolio firm discloses environmental information. We use Trucost data to examine the environmental disclosure on a firm-year level. Trucost collects data from both regulatory filings and voluntary reporting. We exploit the fact that firms within the same industry-country pair should face the same regulatory requirement to disclose. Controlling for country and industry fixed effects should then delineate voluntary reporting from regulatory reporting to a large extent.

Our empirical proxies for ethical business practice focuses on corporate scandals, measured by the RepRisk rating. RepRisk screens over 150,000 public sources to identify the emergence and severity of negative corporate news. This proxy has two main advantages: it is less prone to reporting bias as the source is mainly from news articles; and it has global coverage of private companies across developed and developing countries. We follow Abraham, Olbert, and Vasvari (2024) and consider the full sample period of RepRisk from 2007 to 2023.

Table 10 shows that DFI-backed firms are not more likely to disclose emissions than firms backed by conventional investors, controlling for lagged firm total assets, deal year, industry, and country. The results hold for firm in both developed and developing economies and are highly consistent with additional controls of firm type (e.g., listed firms, private firms, corporate investment arms) and interaction between country and industry.

As reporting probabilities are similar, we can ask whether DFI-backed firms have better environmental damage free of reporting bias. Figure IA.1 shows little difference in terms of environmental impact between firms backed by DFIs and the matched samples, using the stacked DiD model described in previous sections. The result is robust to four measures: the dollarized overall environmental impact, the Greenhouse Gas Emissions level, and the intensity measures of these two by dividing by the total revenues of the firm.

[15]We do not use aggregate ESG ratings since the firms considered in this paper are unlisted and generally too small to be rated, though the private equity firms are increasingly providing more disclosure (Abraham, Olbert, and Vasvari, 2024). There is also a caveat that ESG ratings can be confusing, even for large firms (Berg, Koelbel, and Rigobon, 2022).

Figure 7 shows that DFI-backed firms do not have fewer corporate scandals than matched firms invested by conventional investors.[16] One potential explanation is that DFIs do not have direct monitoring or influence on firms and mostly rely on general partners to exercise monitoring. Another explanation is that conventional VC investors and managers are also incorporating sustainability issues into investment decisions (Abraham, Olbert, and Vasvari, 2024)

Overall, it seems that DFI investment does not lead to better sustainability outcomes. We caution that this result suggestive rather than conclusive. The first reason is the poor data quality and availability for private firms discussed above. The second reason is that the incorporation of sustainability issues into investment management is more recent than other themes considered earliers. Moreover, some domestic DFIs do not have sustainability-related mandates yet.

8 Discussion on Financial Performance and Heterogeneity of DFIs

8.1 VC Fund Returns

Being concessional is an important channel through which impact-driven investors can generate social impact (Kölbel, Heeb, Paetzold, and Busch, 2020; Flammer, Giroux, and Heal, 2024). The underlying argument is that deals with commercially attractive returns will be picked up by private investors, regardless of the social impact of these projects. Thus, impact investors can create impact by investing in deals with positive social impact but subpar expected returns.

However, delineating concessionality from underperformance is difficult. Investors may claim to be concessional if their investment returns are subpar, regardless of actual intent. Thus, we only analyze the performance of DFI-backed funds in the sequel but do not use concessionality to determine DFIs' economic impact.

Table 6 uses three proxies for fund performance: the total value to paid-in capital (multiple of invested capital), internal rate of return (IRR), and public market equivalent (PME) of Kaplan and Schoar (2005).

[16]The average rating is 3.1 on a 0-10 scale with a standard deviation of 1.8.

The PME measure has the advantage of controlling for market movements, but the cash flow data coverage is limited and primarily available for North America based funds. Therefor, we also include the IRR and multiple measures in our analysis, despite their known limitations (Phalippou and Gottschalg, 2009; Phalippou, 2019), since they are available for a broader set of funds.

We find that DFI-backed funds in developing countries do not underperform other funds. Conditional on fund size, an indicator for at least one known limited partner, and region, vintage, and industry fixed effects, DFI-backed funds deliver similar performance as conventional funds across all three measures. However, in developed countries, the results suggest that DFI-backed funds deliver lower performance than conventional funds. Columns (3) and (4) show that DFI-invested funds deliver 3.28 percentage points lower IRR and 0.17 lower PME.

There are two more caveats related to data availability. The first caveat is that not all funds have known investors; however, DFI funds are constructed to have at least one known investor. If having known investors is associated with fund performance, we would have an omitted variable bias. We address this problem in two ways. The first is to include the indicator *known LPs* described above, while the second is to only analyze the sample funds with at least one known investor. Online Appendix Table IA.6 shows that the results are robust to this subsample analysis.

The second caveat is that differences in reporting probability may drive any differences in investment performance. That is, DFI-backed funds may be more likely to report performance, regardless of the ranking relative to other VC funds, because one of their investors is a governmental entity potentially subject to FOIA requests. To address this potential issue, we analyze the probability of disclosing any performance measure in Columns (1) and (5) of Table 6. In developed countries, DFI-backed funds are not more transparent in terms of investment performance. In developing countries, however, DFIs are 4.5 percentage points more likely to report any of the three performance measures. This result further confirms that the performance of DFI-backed funds in developing countries does not seem to be worse than the performance of funds backed by conventional investors.

Overall, the underperformance of DFIs-backed VC funds seems to be smaller than the underperformance documented for a subset of VC impact funds with an explicit dual objective. To put our results into perspective, Barber, Morse, and Yasuda (2021) show that impact VC funds underperform non-impact VC funds by 4.6 percentage points lower IRR.

The performance analysis implies that DFIs' are in general not concessional. In line with this interpretation, we show in Online Appendix Table IA.2 that only a limited number of DFIs state that they accept concessional returns (often only for certain investments), but the rest either do not mention this or explicitly state that they pursue commercial returns. Moreover, accepting concessionality in returns does not seem to align with the high risk aversion of DFIs when selecting funds and deals as discussed above.

Our performance results are consistent with Cole, Melecky, Mölders, and Reed (2020) that financial frictions are more severe in developing economies and that DFIs' better performance in developing economies may rely on identifying or creating new markets with weak access to capital. Moreover, the underperformance in developed economies may be driven by political targets of DFIs (Frigerio and Vandone, 2020).[17] This is in line with the fact that DFI-backed firms receive more financing from DFIs and less financing from conventional investors despite poorer exit results.

8.2 Heterogeneity and Mechanism

In this subsection, we explore the heterogeneity among DFIs to shed light on why DFIs fall short in fulfilling their stated investment objectives. Our focus is on the governance quality of DFIs and the broad hypothesis is that DFIs with higher governance quality select investments more in line with their objectives, and achieve better impact results. We collect data on two aspects of DFIs to proxy for their governance quality: their organizational structure and whether they are bank-based DFIs.

For organizational structure, we classify DFIs into four types of DFIs. Table IA.4 presents the summary statistics of the four types of DFIs. First, international multilateral DFIs are formed and funded by

[17] More broadly, the literature shows that political forces can drive investment decisions of other public institutions such as sovereign wealth funds and public pension funds (Bernstein, Lerner, and Schoar, 2013; Andonov, Hochberg, and Rauh, 2018)

multiple countries and finance firms in multiple countries (e.g., Asian Development Bank, European Investment Fund, and International Finance Corporation). Second, international unilateral DFIs are funded by one country but invest broadly (e.g., British International Investment, German Investment Corporation (DEG), and Dutch Entrepreneurial Development Bank (FMO)). Third, domestic national DFIs are funded by one country and invest primarily domestically (e.g., Bpifrance, Brazilian Development Bank, Small Industries Development Bank of India). Fourth, domestic subnational DFIs are funded by one region within a country, such as a city, province, or state, and invest primarily in that region (e.g., Alberta Enterprise Corporation, Catalan Institute of Finance, and Oregon Growth Board). Our hypothesis is that international multilateral DFIs have the highest governance quality, whereas subnational ones have the lowest. For instance, international multilateral DFIs face much more public scrutiny (James and Anderton, 2023).

Figure 8 visualizes heterogeneity across DFI types. It plots the marginal effects from the six regressions presented earlier, but replaces the single regressor *DFI-invested* with four dummies (*XDFI-invested*), where X represents the four DFI types. Subnational DFIs stand out in several aspects. Their investment performance is significantly worse: funds they back earn internal rates of return (IRR) about five percentage points lower than those of conventional VCs, whereas the other three DFI types do not earn lower IRRs. Even after controlling for IRR, VC funds backed by subnational DFIs have fewer follow-on funds in the same series. At the deal level, firms financed by subnational DFIs take longer to exit and attract the least conventional VC capital in follow-on rounds.

Two factors may explain the weak performance of subnational DFIs. First, geographic restrictions shrink the investable universe, making it harder to achieve a good return or crowd in commercial capital (Lerner, 2009). Second, their governance quality is lower: they face less public scrutiny and disclose less information, such as details on their management teams.

Subnational DFIs also obscure the stronger performance of other DFI types in the aggregate statistics. For example, DFIs do not appear more likely to back high-tech industries or firms with better environmental

disclosure. However, the disaggregated results show that national DFIs invest more in high-tech and achieve faster exits, while multilateral DFIs do exhibit better environmental management.

Next, we split DFIs into bank-based and non-bank-based groups. We classify a DFI as bank-based if its core activity is loan origination (e.g., the Asian Development Bank) or it is a subsidiary of such banking institution (e.g., the VC arm of the Small Industries Development Bank of India). Because banking culture emphasizes limiting downside risk, we hypothesize that bank-based DFIs are more risk-averse. Although DFIs enter VC to supply capital that banks would not provide, more than half of the DFIs in our sample are development-bank-based.

Table 11 confirms that bank-based DFIs exhibit greater risk aversion than their non-bank counterparts. For instance, bank-based DFIs are less likely to finance first-time funds, new GPs, and early-stage deals. Along most other impact dimensions, however, the two groups are similar. Bank-based DFIs are, in fact, more likely to support industries with high positive externalities and tend to invest larger tickets, consistent with their deeper pools of capital.

9 Conclusion

We document that DFIs are increasingly invested in VC to fulfill development objectives. We identify that DFIs have four objectives when committing capital to VC investments: building a VC ecosystem, supporting entrepreneurship and SMEs, fostering innovation, and promoting sustainable business practices. In theory, DFIs could achieve these objectives and create impact by addressing market failures.

Our findings suggest that while DFIs do address certain market failures—particularly in developing countries—they have significant room to enhance the impact of their VC activities. To improve effectiveness, DFIs should consider reallocating capital toward projects that more directly address market failures, such as investing in early-stage deals where information friction is greater and targeting developing economies where access to capital is more constrained. Adopting a greater tolerance for risk could enable DFIs to support more innovative and socially valuable projects that may not attract private investment.

Several questions remain for future research. How do DFIs select deals and funds, and what factors drive their investment decisions? Through which channels can DFIs most effectively achieve their development mandates? How can the costs and benefits of venture capital investments be weighed against other investment vehicles, such as loans? Furthermore, apart from DFIs' organization structure and board members, how do other characteristics, such as funding sources and compensation schemes, shape their investment impact and effectiveness?

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Figure 1: DFI Mandates and Investment Strategies

This word cloud summarizes the mandates and investment strategies of the 30 largest DFIs. We collect the mission statements and investment policies of these DFIs from their websites and annual reports. Online Appendix Table IA.1 presents the list of the largest 30 DFIs and the number of their VC investments. The largest 30 DFIs account for almost two-thirds of the DFI investments and cover all four types of DFIs: international multilateral, international unilateral, domestic national, and domestic subnational.

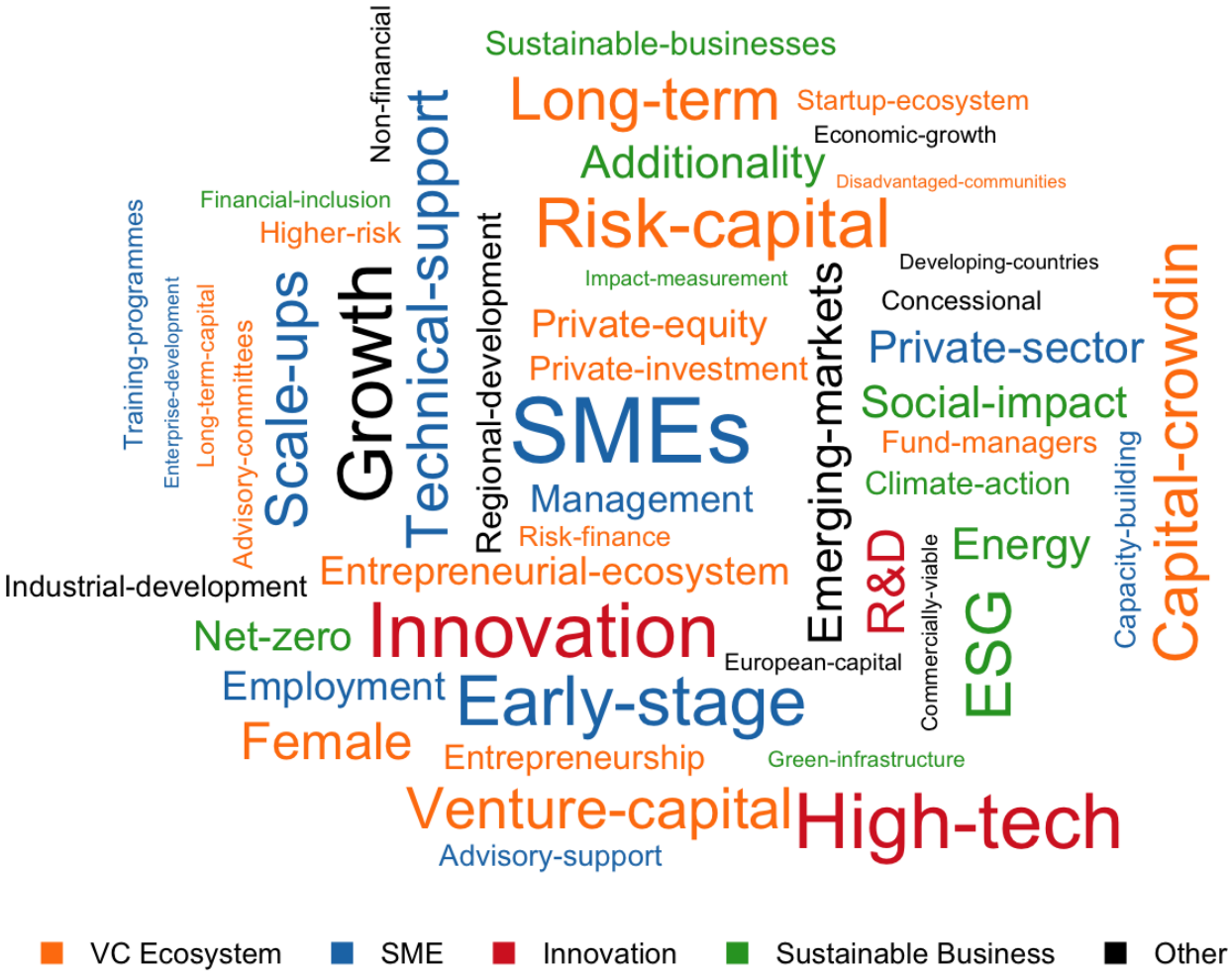

Figure 2: Global Distribution of DFIs

This figure shows the distribution of DFIs by economy. The figure does not include the 37 International-Multilateral DFIs (e.g., Asian Development Bank, European Investment Fund, and International Finance Corporation) because they are formed and funded by multiple countries so we do not assign them to one particular economy based on their headquarters.

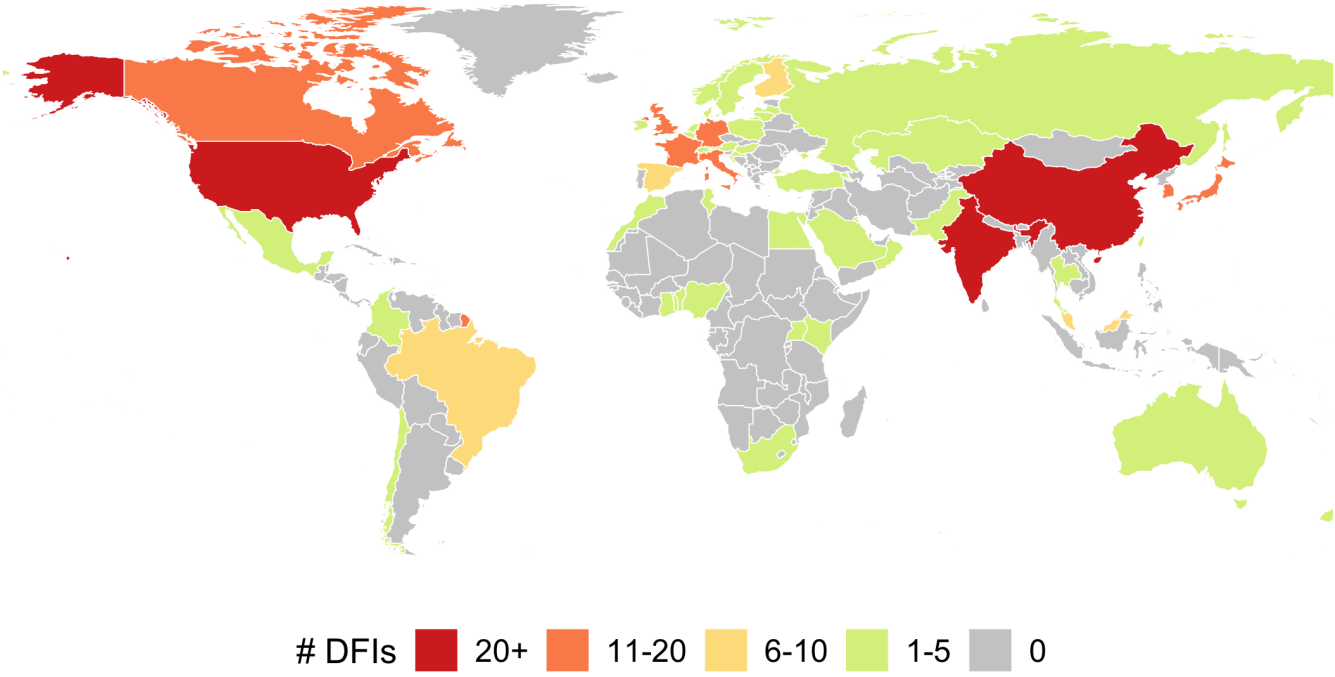

Figure 3: VC Deals Financed by DFIs

This figure presents the number of VC deals financed by DFIs per year from 1995 to 2021 in developed and developing countries, respectively. DFIs invest in VC deals primarily through their fund commitments and, to a lesser extent, through direct investments. The shaded areas represent the yearly number of VC deals financed by DFIs. The black lines present the proportion of VC deals that receive financing from DFIs.

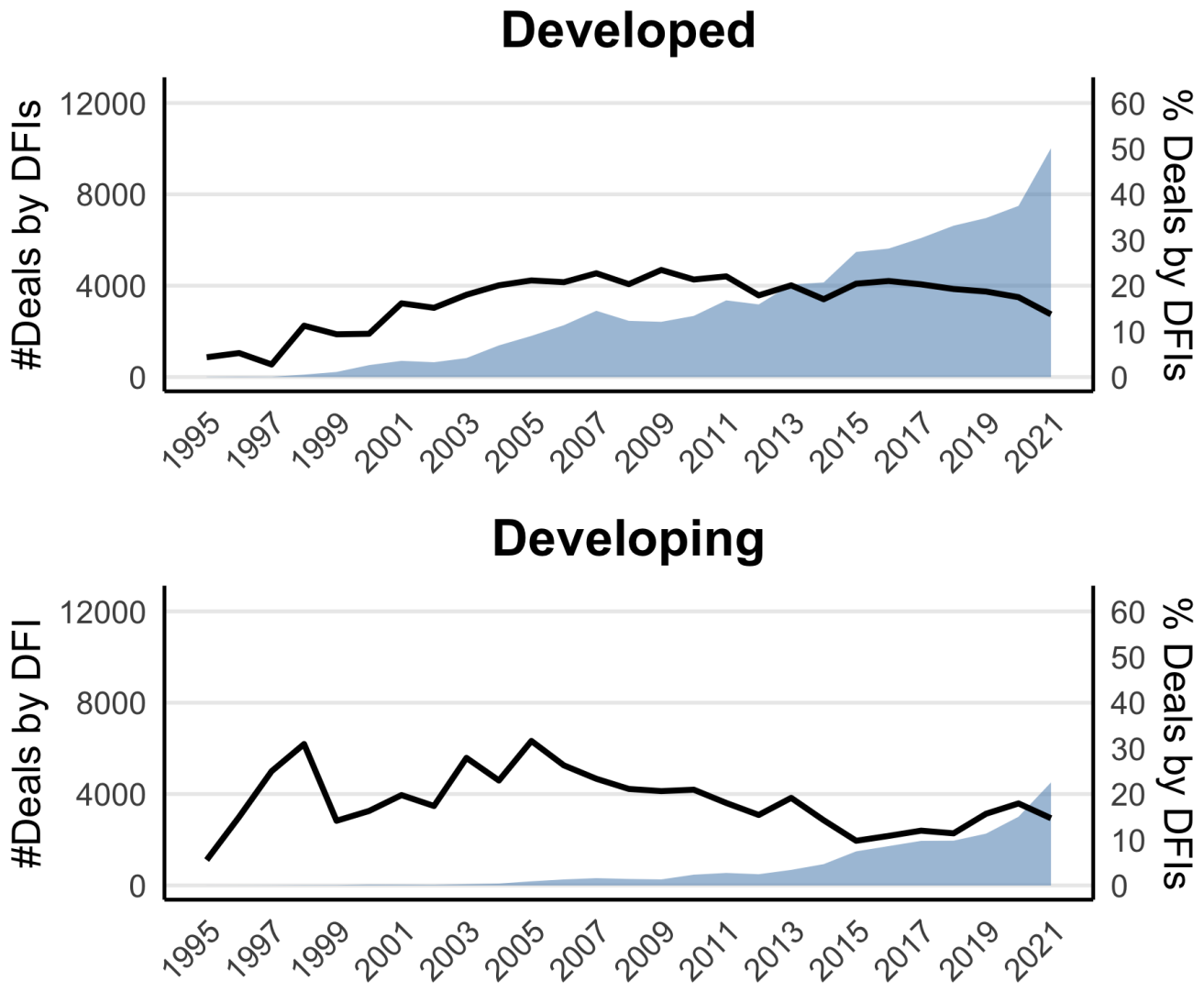

Figure 4: Characteristics of DFI Deals

This figure compares the deals made by DFIs and other investors in terms of firm region, firm countries' development level, deal stage, and industry classification. The total number of investor-deal observations is 103,605 for deals involving DFIs and 494,448 for deals not involving DFIs. 'Developing' refers to developing economies according to the World Bank classification. We classify firms into 'high-tech' and 'not high-tech' based on granular industry verticals.

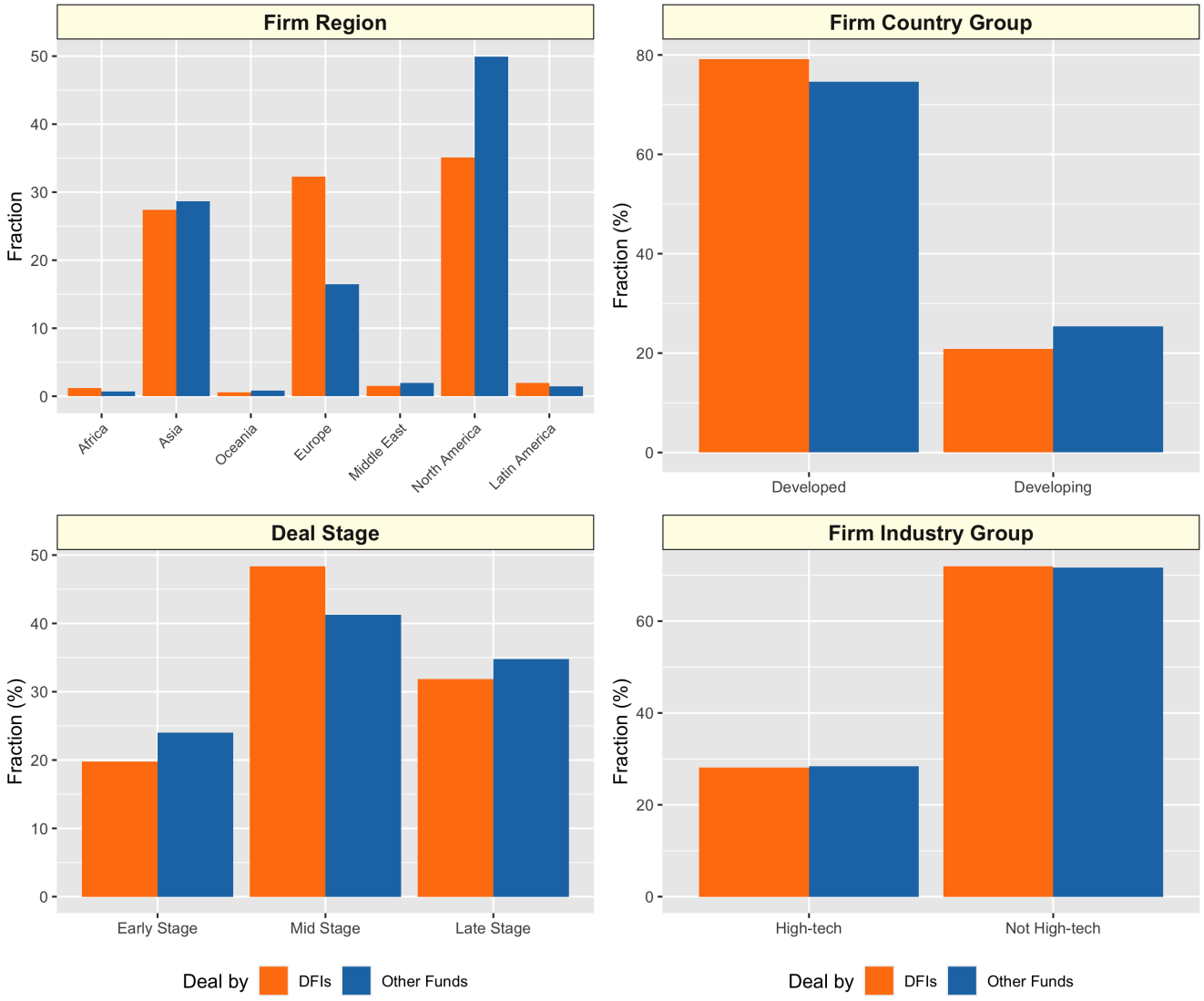

Figure 5: The Effect of DFI Investments on Firm Profitability and Employment

This figure shows the event plot associated with the stacked DiD estimation for the effect of DFI's investment on firm profitability and employment. We use asset turnover (the ratio of operating revenue to total assets) to measure firms' profitability. The dynamic coefficients represent the difference between a firm invested in by DFIs and a matched firm invested in by traditional investors. We match firms exactly based on country, industry, deal year, and deal stage, and nearest neighbor using the total assets one year before the deal. An insignificant coefficient indicates that DFI-invested firms have grown similarly to firms invested by conventional VC investors since the investment.

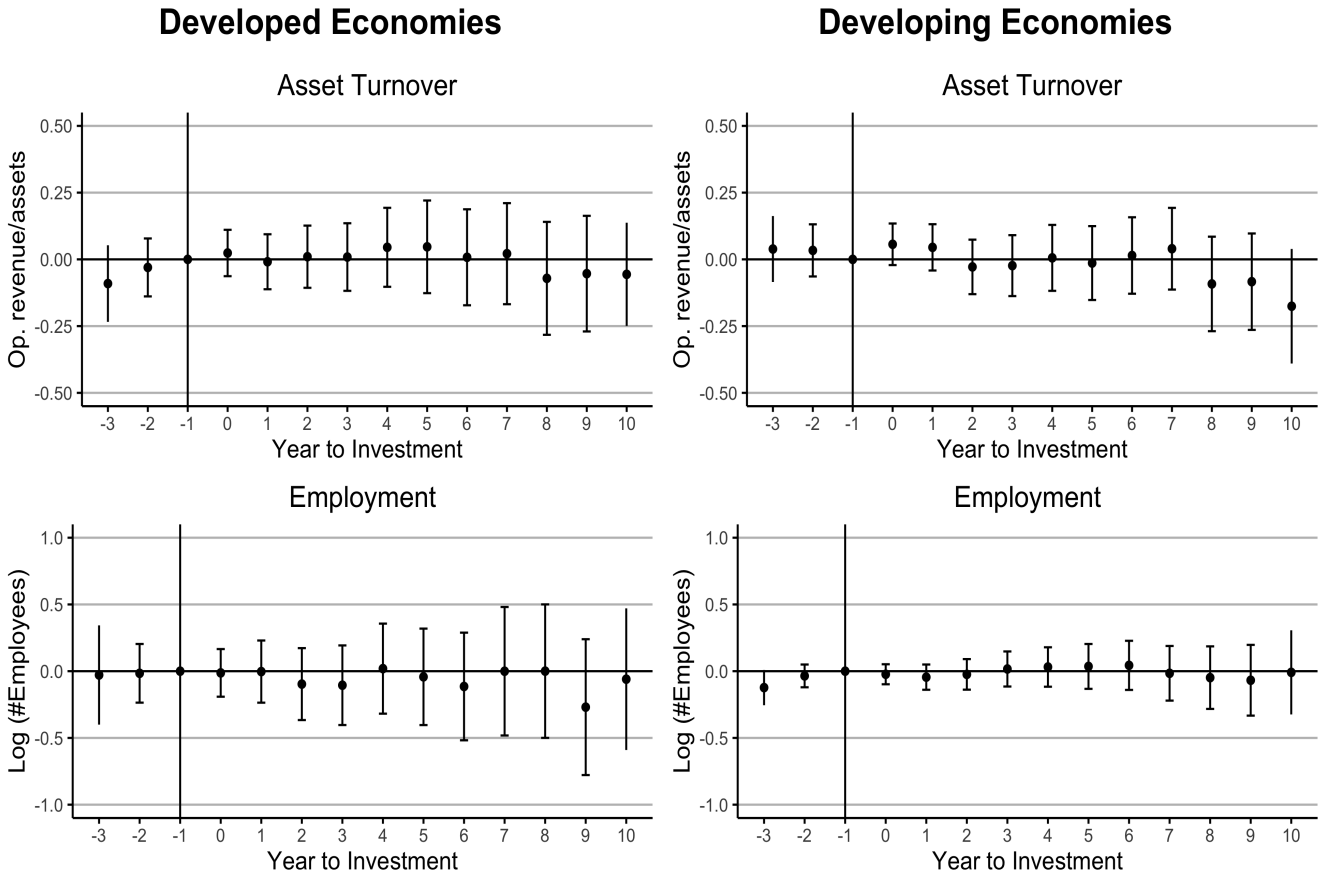

Figure 6: The Effect of DFI Investments on Firm Innovation

This figure shows the event plot associated with the stacked DiD estimation for the effect of DFI's investment on various metrics of firm innovation. The dynamic coefficients represent the difference between a firm invested in by DFIs and a matched firm invested in by traditional investors. Matching is based on country, industry, deal year, deal stage, and firm size one year before the deal. An insignificant coefficient indicates that DFI-invested firms perform similarly to traditionally-invested firms since the investment. The four innovation metrics are measured yearly rather than accumulative. We only include patents that are eventually granted. The number of citations is measured by the end of 2023. The sample period is from 1995 to 2019 for investment years and 1990 to 2023 for patents.

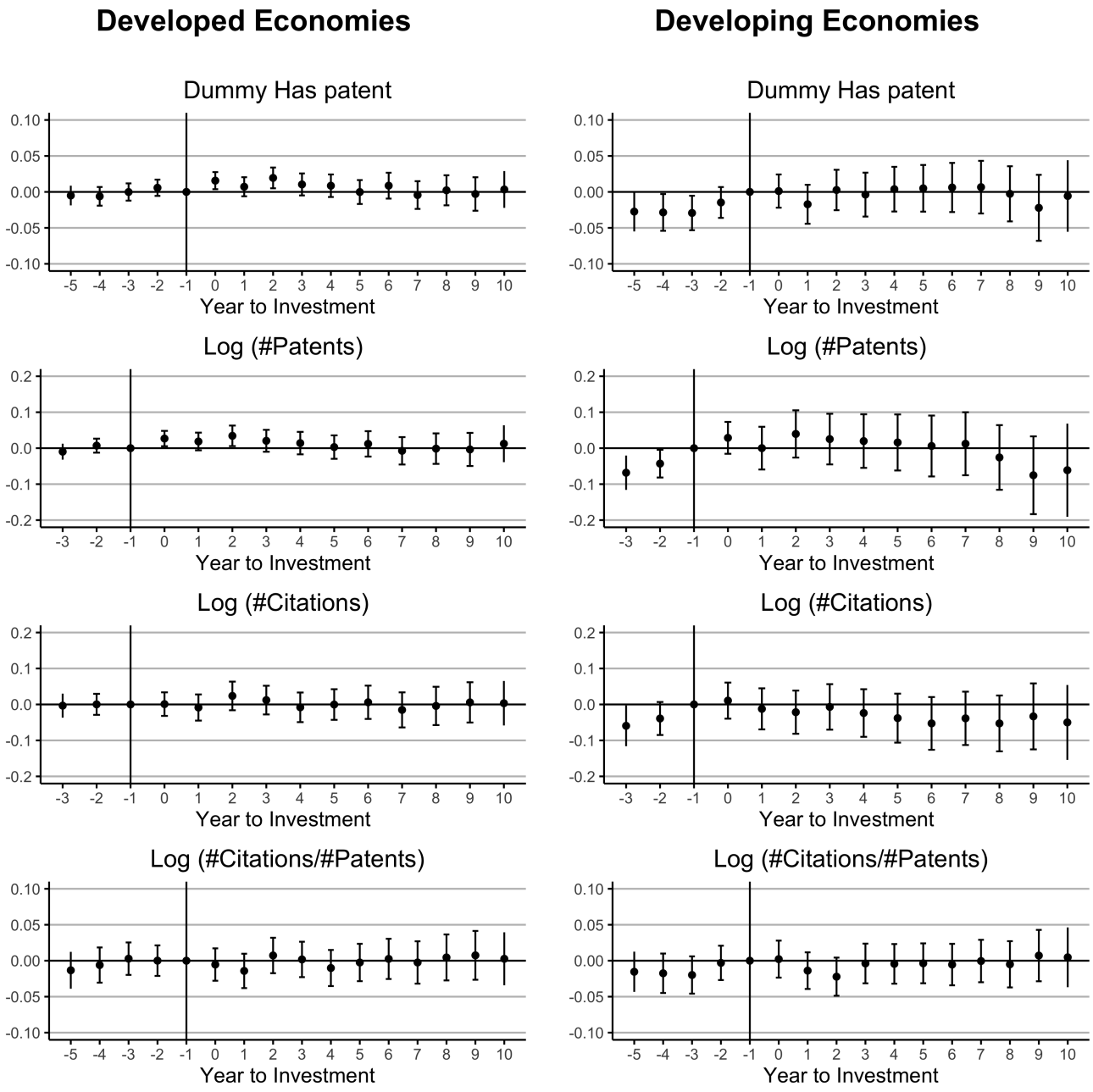

Figure 7: The Effect of DFI Investments on Firm Reputation Risks

This figure shows the event plot associated with the stacked DiD estimation for the effect of DFI's investment on firms' Reputation Risk Rating. The rating is sourced from RepRisk database. It is calculated based on the number and severity of corporate scandals, adjusting firms' sector and countries' average reputation risks. Higher numbers indicate worse reputation. The dynamic coefficients represent the difference between a firm invested in by DFIs and a matched firm invested in by traditional investors. Matching is based on country, industry, deal year, deal stage, and firm size one year before the deal. An insignificant coefficient indicates that DFI-invested firms perform similarly to traditionally-invested firms since the investment.

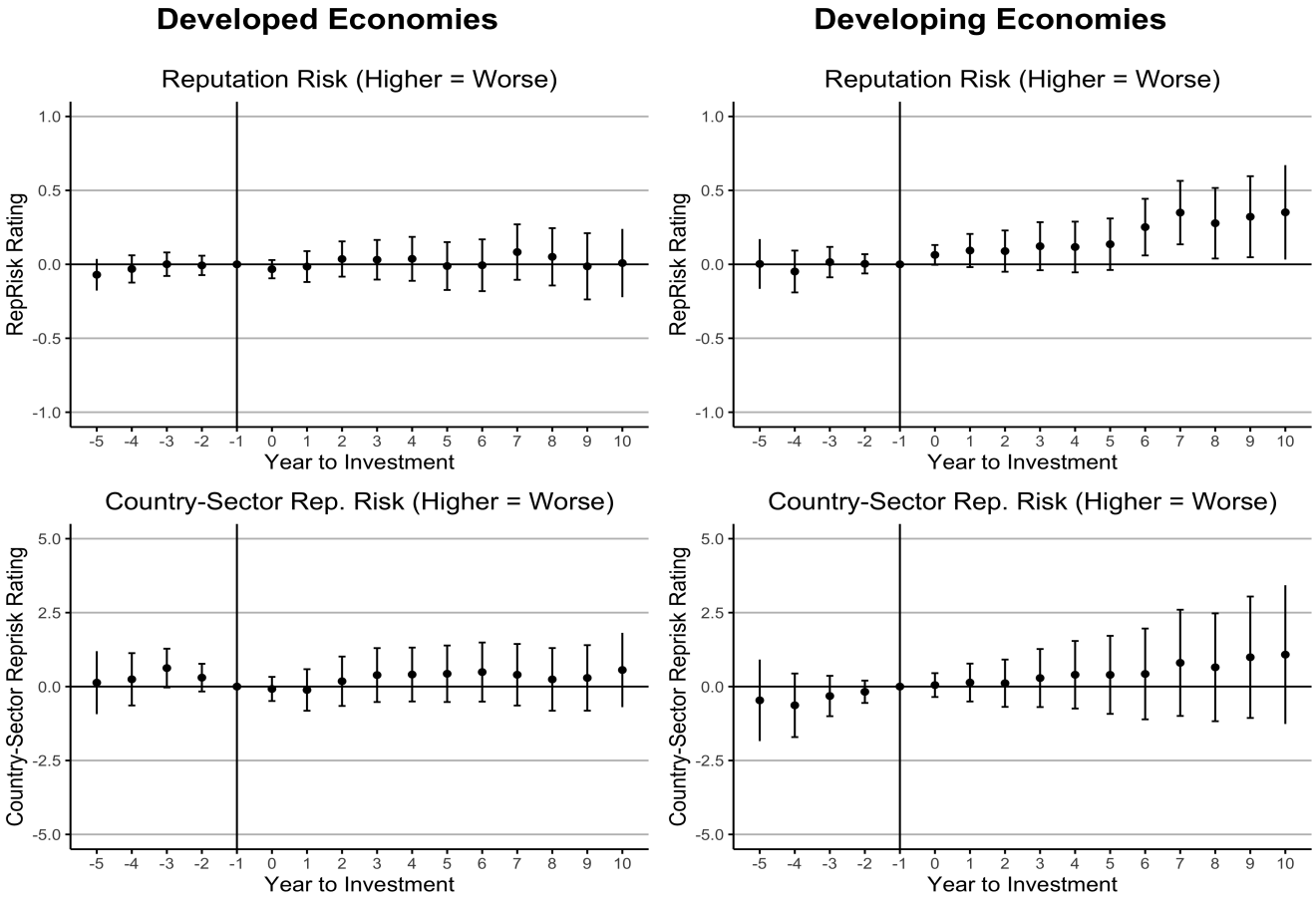

Figure 8: Heterogeneity by DFI types

This figure shows the heterogeneous marginal effects of six regressions across DFI types. Multilateral covers DFIs that are formed and funded by multiple countries and finance projects in multiple countries (e.g., Asian Development Bank, European Investment Fund, and International Finance Corporation). Unilateral DFIs are funded by one country but invest broadly in many other countries, predominantly in developing economies (e.g., British International Investment, German Investment Corporation (DEG), and Dutch Entrepreneurial Development Bank (FMO)). National DFIs are funded by one country and invest primarily domestically to foster economic development (e.g., Bpifrance, Brazilian Development Bank (BNDES), Small Industries Development Bank of India). Subnational DFIs are funded by one region within a country, such as a city, province, or state, and invest primarily in that region (e.g., Alberta Enterprise Corporation, Commonwealth Financing Authority of Pennsylvania, and Catalan Institute of Finance).

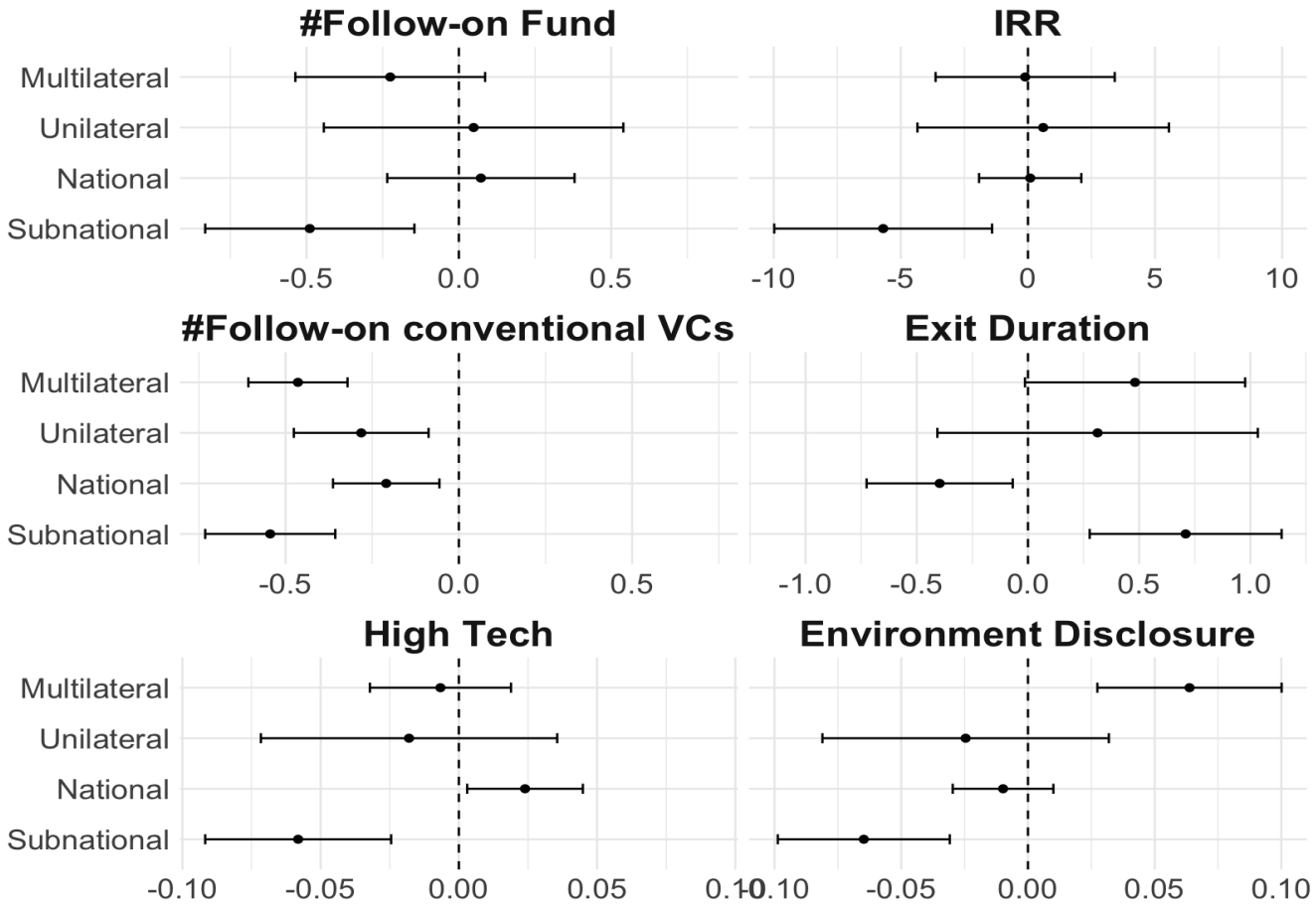

Table 1: Impact Indicators and DFIs' Performance

This table summarizes the impact indicators used to assess DFI VC investments. The second column links the indicators to market failures DFIs can potentially address, while the third lists empirical proxies for testing the indicators. The fourth column specifies whether tests are at the fund or firm level, and the fifth gives link to relevant results. The last two columns evaluate DFI performance in developed and developing countries, respectively. A plus sign "+" means DFIs contribute to solving market failure, "0" means we do not find evidence that DFIs contribute to solving the market failure, and "–" means that DFIs perform worse than conventional investors. For example, "–" for "Early Investor" shows DFIs' investment in developed countries is less likely to target early-stage (pre-seed and seed) deals than conventional investors. The definitions of high-externality and high-tech industries are in the Appendix. Some examples of the former include clean technology, agriculture technology, and urban planning, and some examples of the latter include semiconductor, advanced materials, and quantum computing.

Impact Indicator	**Market Failure**	**Empirical Proxy**	**Level**	**Results**	**DFI performance**	
					Developed	Developing
Mandate 1: VC Ecosystem						
Young Funds	Coordination; Information Friction	DFIs are more likely to invest in funds of new series/ younger GP	Fund	Table 4	–	–
Underrepresented Managers	Coordination; Information Friction	DFIs are more likely to provide capital to female or minority fund managers	Fund	Table 7	+	+
Capital Crowd-in	Coordination; Information Friction	DFI-backed funds have more follow-up funds under the same series or GP	Fund	Table 5	–	0
Return Disclosure	Information Friction	DFI-backed funds are more likely to disclose financial performance	Fund	Table 6	0	+
Mandate 2: SMEs						
Early Investor	Coordination; Information Friction	DFIs are more likely to invest in early-stage deals, such as seed stages.	Firm	Table 7	–	–
High-Externality Industry	Positive Externality	DFIs are more likely to invest in firms in high-externality industries	Firm	Table 7	0	+
Firm Exits	Information Friction, Coordination	DFI-invested firms are more likely / take shorter time to undergo IPO and M&A	Firm	Table 8	–	0
Firm Financing	Information Friction	DFI-invested firms rely less on DFIs for follow-on investments	Firm	Table 9	–	–
Mandate 3: Innovation						
High-Tech Focus	Positive Externality	DFIs are more likely to invest in firms in high-tech industries	Firm	Table 7	–	0
Firm Innovation	Positive Externality	DFI-invested firms have have more patents and patent citations over time	Firm	Figure 6	0	0
Mandate 4: Sustainable Business						
Firm Environment	Negative Externality	DFI-invested firms are more likely to have environmental disclosure	Firm	Table 10	0	0
Firm Reputation	Negative Externality	DFI-invested firms have fewer scandals	Firm	Figure 7	0	0

Table 2: Summary Statistics: DFI Investments in VC

This table shows summary statistics on DFI investments in venture capital (VC) deals over the 1995–2021 period. *Total Deals* is the total number of investor-deal observations, while *Unique Deals* is the number of unique deals. For fund performance measures, we take the sample from 1995 to 2018. *New GP* is an indicator equal to one if the fund is raised by a new general partner established in the last five years. *Woman* (*Minority*) equals one if at least one woman (minority) serves as general partner. The *high-externality* indicator captures investments in high-externality industries, such as clean technology, agriculture technology, shared economy, and urban planning. The *high-tech* indicator covers investments in the cutting-edge technologies, such as semiconductor and nanotechnology.

	All DFIs	**DFIs in Developed**	**DFIs in Developing**	**Not DFIs**
Panel A: VC Investments				
#DFIs	344	177	167	
#Funds	2,770	1,704	1,066	31,667
#Direct Investments	2,501	2,106	395	
#Total Deals	103,614	82,015	21,599	494,065
#Unique Deals	33,106	24,996	8,110	212,617
#Unique Firms	21,667	15,833	5,834	111,105
Panel B: VC Fund Characteristics				
First Fund	0.62	0.57	0.69	0.70
New GP	0.48	0.44	0.54	0.57
Woman	0.06	0.05	0.07	0.05
Minority	0.02	0.01	0.03	0.03
Fund Size	132.00	96.57	188.51	134.49
IRR	11.18	9.18	14.02	16.84
Multiple	1.66	1.54	1.83	2.06
PME (S&P 500 benchmark)	0.86	0.86	0.88	1.14
Panel C: VC Deal Characteristics				
Deal Size ($ million)	17.48	13.63	31.67	21.71
%Africa	1.17	0.00	5.62	0.63
%Asia	27.41	14.43	76.68	28.89
%Europe	32.27	39.28	5.67	13.15
%Latin America	1.95	0.03	9.23	1.32
%Middle East	1.52	1.18	2.79	2.04
%Northern America	35.12	44.37	0.00	53.06
%Oceania	0.56	0.70	0.01	0.91
%Early Stage (Angel, Pre-Seed, Seed)	15.48	15.53	15.26	19.45
%Mid Stage (Series A and B)	37.77	38.11	36.48	31.10
%Late Stage (Series C and later)	24.91	24.36	26.99	27.68
%Unknown Stage	21.85	22.00	21.27	21.77
%IT, Telecom & Network	47.90	50.12	39.49	52.26
%Healthcare	22.11	24.48	13.10	16.03
%Consumer Discretionary	10.28	8.50	17.02	11.64
%Business Service	10.39	8.49	17.60	12.12
%Industrials	4.52	3.94	6.73	4.44
%Energy & Natural Resources	4.78	4.45	6.04	3.48
%High Externality Industry	29.89	27.40	39.33	26.98
%High Tech Industry	28.11	29.19	23.97	28.42

Table 3: Summary Statistics: Firm-Level Characteristics

This table shows summary statistics on firms receiving VC investments. *Asset Turnover* is defined as the ratio between operating revenue and total assets. *Patent Citations* are calculated at the end of 2023. In Panel C, the exit statistics cover only deals executed over the 1995–2017 period. *Duration* measures the time between exit and investment in years.

	All DFIs	**DFIs in Developed**	**DFIs in Developing**	**Not DFIs**
Panel A: Firm Financial Information (Deal-Year Level)				
#Firms	6,976	5,620	1,356	30,471
#Deals	14,391	11,327	3,064	94,937
#Deal-Year Obs.	84,146	67,675	16,471	354,935
Assets ($ Million)	91.43	69.61	174.31	249.00
Asset Turnover	1.12	1.00	1.41	6.78
Employment	253.71	134.57	969.27	467.75
Panel B: Firm Patents (Deal-Year Level)				
#Firms	5,552	4,283	1,269	39,507
#Deals	14,239	11,192	3,047	94,256
#Deal-Year Obs.	555,321	436,488	118,833	3,676,062
#Yearly Patents	0.73	0.55	1.41	0.69
#Yearly Citations	1.29	1.39	0.92	1.85
Panel C: Firm Exit Outcomes (Deal Level)				
#Firms	6,924	5,454	1,470	37,954
#Deals	19,121	15,686	3,435	96,155
%Exit	0.43	0.44	0.36	0.45
%IPO	0.13	0.12	0.19	0.13
%M&A	0.30	0.32	0.16	0.32
Duration	7.50	7.69	6.13	7.22

Table 4: The Characteristics of VC Funds Selected by DFIs

This table examines the characteristics of VC funds that receive capital commitments from DFIs. Columns (1) to (4) focus on VC funds investing in developed economies, while Columns (5) to (8) examine VC funds investing in developing economies. We present the marginal effects of logit specifications where the dependent variables are indicators for four fund characteristics. *First fund* is an indicator equal to one if the fund is the first fund raised in the series. *New GP* is an indicator equal to one if the fund is raised by a new general partner established in the last five years. *Woman* equals one if a woman serves as general partner. *Minority* is equal to one if minority representatives serve as general partners. *DFI-invested* is an indicator equal to one if a VC fund has at least DFI as a limited partner. *Fund Size* is the natural logarithm of the VC fund size. We control for region, industry, and vintage year fixed effects. We double cluster the standard errors by general partner and vintage year, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

	Developed				**Developing**			
	First Fund (1)	New GP (2)	Woman (3)	Minority (4)	First Fund (5)	New GP (6)	Woman (7)	Minority (8)
Mean Dep. Var.	0.548	0.502	0.062	0.038	0.708	0.552	0.035	0.005
DFI-invested	-0.030*	-0.036**	0.027**	0.004	-0.096***	-0.096***	0.026**	0.009
	[0.017]	[0.016]	[0.013]	[0.012]	[0.019]	[0.020]	[0.012]	[0.008]
Fund Size	-0.068***	-0.057***	-0.008***	0.001	-0.053***	-0.039***	-0.003	0.000
	[0.007]	[0.008]	[0.002]	[0.002]	[0.004]	[0.005]	[0.002]	[0.001]
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,814	15,505	16,173	15,908	10,939	11,245	11,297	10,396

Table 5: The Number of Follow-On VC Funds

This table shows the results of a Poisson specification where the dependent variable captures the number of follow-on funds raised by the same GP under the same series. We report the marginal effects at the means of the independent variables. *DFI-invested* is an indicator equal to one if a VC fund has at least DFI as a limited partner. *Fund Size* is the natural logarithm of the VC fund size. *IRR* is the internal rate of return of the VC fund. *Multiple* is the multiple of the total-value-to-paid-in-capital (TVPI) of the VC fund. *Report Financial* is an indicator equal to one if the fund's financial performance is known (either IRR, TVPI, or PME(public market equivalent)). We control for region, industry, and vintage year fixed effects. We double cluster the standard errors by general partner and vintage year, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

	Developed				**Developing**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean Dep. Var.	1.669	1.669	1.669	1.669	1.198	1.198	1.198	1.198
DFI-invested	-0.233***	-0.238***	-0.321**	-0.217*	-0.213**	-0.227***	0.023	-0.058
	[0.083]	[0.082]	[0.133]	[0.122]	[0.084]	[0.083]	[0.175]	[0.162]
Fund Size	0.071	0.063	0.282***	0.288***	0.080*	0.072	0.030	0.046
	[0.058]	[0.055]	[0.066]	[0.082]	[0.044]	[0.045]	[0.087]	[0.077]
First Fund	0.229	0.234	0.652***	0.637***	0.475***	0.482***	0.397***	0.399***
	[0.140]	[0.146]	[0.112]	[0.118]	[0.056]	[0.058]	[0.118]	[0.115]
Report Financial		0.081				0.140		
		[0.117]				[0.095]		
IRR			0.006***				0.002	
			[0.002]				[0.005]	
Multiple				0.115***				0.056**
				[0.020]				[0.026]
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,898	6,898	2,134	2,232	1,761	1,761	476	509

Table 6: Fund Performance and Reporting

This table examines the characteristics of firms that are financed by DFIs. Columns (1) to (4) focus on funds targeting developed economies, while Columns (5) to (8) examine funds targeting developing economies. We present the results of specifications where the dependent variables are three performance measures. In Columns (1) and (5), we examine the probability of disclosing any performance measure using Logit specifications. In the other columns, the dependent variables are three performance measures: the multiple of the total value to paid-in capital; the net internal rate of return (IRR); and the public market equivalent with the S&P500 index as a benchmark. *DFI-invested* is an indicator equal to one if a VC fund has at least DFI as a limited partner. *Known LPs* is an indicator equal to one if a VC fund has at least one known limited partner (investor) in the Preqin dataset. *Fund Size* is the natural logarithm of the VC fund size. We double cluster the standard errors by general partner and vintage year, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$

	Developed				**Developing**			
	Report (1)	Multiple (2)	IRR (3)	PME (4)	Report (5)	Multiple (6)	IRR (7)	PME (8)
Mean Dep. Var.	0.257	1.857	14.871	1.108	0.084	2.179	16.948	0.907
DFI-invested	-0.020	-0.133	-3.281***	-0.165***	0.045***	-0.081	2.104	-0.054
	[0.017]	[0.081]	[1.094]	[0.056]	[0.016]	[0.163]	[1.478]	[0.109]
Known LPs	0.152***	-0.214**	-4.818***	0.293**	0.043***	-0.006	-3.548	0.326*
	[0.013]	[0.081]	[1.319]	[0.138]	[0.011]	[0.179]	[2.181]	[0.167]
Fund Size	0.060***	-0.017	-0.010	0.047**	0.026***	-0.198***	-2.416***	0.065
	[0.004]	[0.021]	[0.373]	[0.022]	[0.004]	[0.053]	[0.680]	[0.054]
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,693	2,603	2,421	989	9,306	745	711	129
Adjusted R^2		0.159	0.203	0.220		0.154	0.182	0.354

Table 7: The Characteristics of Deals Financed by DFI VC Funds

This table examines the characteristics of deals that are financed by DFIs. Columns (1) to (3) focus on DFI investments in firms located in developed economies, while Columns (4) to (6) examine DFI investments in developing economies. We present the results of logit specifications where the dependent variables are indicators for three firm characteristics. We report the marginal effects at the means of the independent variables. *Early Stage* deals include pre-seeds, seeds, and angel investments. The *high-externality* indicator captures investments in high externality industries, such as clean technology, agriculture technology, shared economy, and urban planning. The *high-tech* indicator covers investments in the cutting-edge technologies, such as semiconductor and nanotechnology. *DFI-invested* is an indicator equal to one if a firm has received financing from DFIs. *Lag Total Assets* is the natural logarithm of the lagged firm assets. We double cluster the standard errors by firm and year of the investment, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$

	Developed			**Developing**		
	Early	HighExt	HighTech	Early	HighExt	HighTech
	(1)	(2)	(3)	(4)	(5)	(6)
Mean Dep. Var.	0.200	0.303	0.314	0.116	0.299	0.262
DFI-invested	-0.029***	-0.011	-0.021*	-0.029***	0.045**	0.016
	[0.009]	[0.010]	[0.012]	[0.007]	[0.021]	[0.020]
Lag Total Assets	-0.028***	0.002	-0.006***	-0.024***	-0.004	-0.010***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.004]
Firm Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Deal Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes			Yes		
Observations	17,318	17,508	17,512	6,883	7,184	7,172

Table 8: Exit Outcomes and DFI Investments

This table examines the exit outcomes of venture capital investments by DFIs. We define successful exits as IPO or M&A. In Columns (1) and (3), the unit of observation is on a deal level and we present the results of logit specifications where the dependent variable is an indicator for a successful exit. The coefficients represent average marginal effects. In Columns (2) and (4), the unit of observation is on a deal level, and the dependent variable captures the duration in years between investment and exit. The baseline category for the deal stage variables is the early stage, which includes pre-seed, seed, and angel investments. *Mid Stage* is an indicator equal to one if the deal is in series A or series B, where as *Late Stage* is equal to one if the deal is in series C and beyond. We double cluster the standard errors by firm and year, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

	Developed		**Developing**	
	Exit	Duration	Exit	Duration
	(1)	(2)	(3)	(4)
Mean Dep. Var.	0.440	7.686	0.360	6.131
DFI-invested	-0.005	0.248*	-0.004	0.246
	[0.011]	[0.133]	[0.037]	[0.372]
Mid Stage	0.118***	1.082***	0.084***	0.997**
	[0.010]	[0.136]	[0.011]	[0.428]
Late Stage	0.179***	2.145***	0.206***	0.835
	[0.025]	[0.213]	[0.033]	[0.518]
Unknown Stage	0.086***	1.465***	0.134***	1.190*
	[0.027]	[0.204]	[0.036]	[0.648]
Deal year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	74,782	35,270	10,803	3,569
R-squared		0.091		0.224

Table 9: Follow-on Investments at the Deal Level

This table examines follow-on investments defined as another round of venture capital financing. In Columns (1) and (5), we examine the probability of receiving any follow-on investments using logit specifications. Columns (2) and (6) present the hazard ratios of a survival analysis using the Cox proportional hazard model. The event of interest is a follow-on investment. In Columns (3) and (7), we condition on firms that receive follow-on investments and measure the number of VC funds with DFI limited partners participating in the follow-on financing round. In Columns (4) and (8), we condition on firms that receive follow-on investments and measure the number of VC funds without DFI limited partners participating in the follow-on financing round. *DFI-invested* is an indicator equal to one if a firm has received financing from DFIs. We double cluster the standard errors by firm and year, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

	Developed				**Developing**			
	Follow-on	Hazard	#DFI VC Funds	#nonDFI VC Funds	Follow-on	Hazard	#DFI VC Funds	#nonDFI VC Funds
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean Dep. Var.	0.672		0.390	3.708	0.562		0.210	2.495
DFI-invested	0.007	0.999	1.652***	-0.488***	0.043***	1.068**	1.378***	-0.681***
	[0.005]	[0.013]	[0.034]	[0.061]	[0.013]	[0.033]	[0.068]	[0.050]
Deal Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal Stage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	92,310	91,795	62,020	62,020	44,110	44,172	24,870	24,870
Adjusted R^2			0.433	0.425			0.512	0.520

Table 10: Environmental Disclosure and DFI Investments

This table examines the environmental disclosure of firms financed by DFIs. We measure the environmental disclosure by whether the Trucost dataset provides emission data for the firm in at least one year. The coefficients represent average marginal effects. *DFI-invested* is an indicator equal to one if a firm has received financing from DFIs. *Lag Total Assets* is the natural logarithm of the lagged firm assets. *Firm type* is a variable from Trucost indicating whether a firm is listed, private firms, or of special form such as corporate investment arms. We double cluster the standard errors by firm and year of the investment, and report standard errors in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

	Developed			**Developing**		
	(1)	(2)	(3)	(4)	(5)	(6)
Mean Dep. Var.	0.278	0.278	0.278	0.156	0.156	0.156
DFI-invested	0.003	0.003	0.001	-0.011	-0.006	-0.010
	[0.010]	[0.011]	[0.011]	[0.015]	[0.016]	[0.017]
Lag Total Assets	0.042***	0.048***	0.048***	0.040***	0.034***	0.037***
	[0.006]	[0.006]	[0.007]	[0.004]	[0.004]	[0.005]
Deal Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm type FE		Yes	Yes		Yes	Yes
Country × Industry FE			Yes			Yes
Observations	17,288	14,958	14,777	7,063	6,219	5,997

Table 11: Heterogeneity: bank versus non-bank DFIs

This table examines the fund (Panel A) and Deal (Panel B) selection of bank-based DFIs. In Panel A, the main regressor of interest, *%Bank-based LP*, is the fraction of DFI-limited partners of the fund that satisfy one of the following two conditions: a) the DFI's main line of business is loan origination (e.g. Asian Development Bank), or b) the DFI is affiliated with a DFI whose main line of business is loan origination (e.g. The venture capital arm of Small Industries Development Bank of India). As this regressor is only defined for funds with at least one DFI, the marginal effects reported in the table is evaluated at *DFI-invested* = 1, where *DFI-invested* is an indicator equal to one if a VC fund has at least DFI as a limited partner. *First fund* is an indicator equal to one if the fund is the first fund raised in the series. *New GP* is an indicator equal to one if the fund is raised by a new general partner established in the last five years. We double cluster the standard errors by firm and year of the investment, and report standard errors in brackets. In Panel B, *Avg. %Bank-based LP* is defined the average of the measure *%Bank-based LP* of participating funds of a deal. *DFI-invested* is an indicator equal to one if a firm has received financing from DFIs. *Fund Size* is the natural logarithm of the VC fund size. *Early Stage* deals include pre-seeds, seeds, and angel investments. The *high-externality* indicator captures investments in high externality industries, such as clean technology, agriculture technology, shared economy, and urban planning. The *high-tech* indicator covers investments in the cutting-edge technologies, such as semiconductor and nanotechnology. *Lag Assets* is the natural logarithm of the lagged firm assets. We double cluster the standard errors by general partner and vintage year, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$

Panel A: Fund level	Fund Size	First Fund	First Fund	New GP
	(1)	(2)	(3)	(4)
DFI-invested	0.157*	-0.085***	-0.075***	-0.087***
	[0.087]	[0.022]	[0.017]	[0.020]
DFI-invested × %Bank-based LP	0.247**	-0.043**	-0.023	-0.048*
	[0.090]	[0.019]	[0.015]	[0.026]
Fund Size			-0.058***	
			[0.004]	
Region FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Vintage Year FE	Yes	Yes	Yes	Yes
Observations	27,820	29,055	25,757	30,346

Panel B: Deal level	Lag Assets	Early	HighExt	HighTech
	(1)	(2)	(3)	(4)
DFI-invested	-0.314***	-0.020**	-0.016	0.007
	[0.072]	[0.009]	[0.014]	[0.012]
DFI-invested × Avg. %Bank-based LP	0.691***	-0.021*	0.066***	-0.023
	[0.147]	[0.011]	[0.023]	[0.020]
Lag Assets		-0.027***	-0.002	-0.008***
		[0.001]	[0.001]	[0.002]
Firm Region FE	Yes	Yes	Yes	Yes
Deal Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes		
Observations	24,504	24,347	24,499	24,503

Internet Appendix

Do Development Financial Institutions Create Impact through Venture Capital Investments?

Table IA.1: The largest 30 DFIs based on fund investments

This table shows the 30 largest DFIs based on the number of fund investment. The second column shows the classification of the DFI: Multilateral International DFI (Multilateral), Unilateral International DFI (Unilateral), Domestic National DFI (National), or Domestic Subnational DFI (Subnational). The third column shows the number of fund investments. Direct deals are investments made without funds involved.

DFI Name	**Type**	**#Funds**	**#Direct Deals**
European Investment Fund	Multilateral	457	8
International Finance Corporation	Multilateral	268	73
Organization for SMEs and Regional Innovation	National	203	0
British International Investment	Unilateral	178	12
Korea Venture Investment Corporation	National	156	37
CDC Entreprises	National	109	2
DEG	Unilateral	108	10
European Investment Bank	Multilateral	85	81
SIDBI Venture Capital	National	83	2
KDB Bank	National	80	18
Netherlands Development Finance Company (FMO)	Unilateral	80	8
European Bank for Reconstruction and Development	Multilateral	79	10
Finnish Industry Investment Tesi	National	74	30
Proparco	Unilateral	70	13
Small Industrial Development Bank of India	National	69	8
Swiss Investment Fund for Emerging Markets	Unilateral	58	0
U.S. International Development Finance Corporation	Unilateral	54	29
Norfund	Unilateral	54	9
KfW Banking Group	Unilateral	51	83
Bpifrance	National	50	285
Asian Development Bank	Multilateral	49	8
Development Bank of Japan	National	46	12
Finnish Innovation Fund (Sitra)	National	46	0
British Business Bank	National	45	31
BDC Capital	National	43	86
Commonwealth Financing Authority of Pennsylvania	Subnational	37	0
African Development Bank	Multilateral	35	1
European Regional Development Fund	National	32	20
Oregon Growth Board	Subnational	32	0
Enterprise Ireland	National	30	196

Table IA.2: DFI Mandates and Investment Policies

This table shows the mandates and investment policies in VC of the 30 largest DFIs based on the number of fund commitments. The information is extracted from DFIs' websites. The second column (Target) shows the main operating region of these DFIs.

Name	Target	Innovation Mandates	Investment Strategy
African Development Bank	International	Foster enterprise development. Improve investment and business ecosystem. Promote economic growth through innovation and private sector.	Focus on access to energy, food, and industrialization. Provide concessional financing in certain cases. Provide technical assistance programmes. Support young and female business people.
Asian Development Bank	International	Promote private sector development in emerging markets. Broaden local capital markets.	Maintain regular contact with invested firms on performance and ESG matters. Commit long-term capital to funds until their end. Use blended finance to crowd-in private capital and serve as a risk absorber. Prioritize disadvantaged communities and regions vulnerable to climate change.
Organization for Small & Medium Enterprises and Regional Innovation	Japan	Revitalizing the Japanese economy by supporting growth-oriented SMEs and startups. Fostering regional development. Strengthening management capabilities to help SMEs adapt to a changing business environment.	Focus investment on SMEs. Provide extensive support programs and consultation. Invest in funds with a risk of loss as a limited partner to crowd-in private investment. Also support overseas Japanese corporations to expand.
International Finance Corporation	International	Support the creation and growth of tech ecosystems across emerging markets. Promote innovation. Provide risk capital lacking in these markets.	Focus on tech-driven business models in high-impact sectors. Support early-stage startups in emerging markets. Act as a first-mover to pave the way for other private equity firms in challenging markets.
British International Investment	UK / Developing Countries	Grow early-stage innovative firms. Develop venture ecosystems in Africa and South Asia. Design investment projects with higher risk tolerance.	Use concessional investments for certain deals. Provide technical support facilities. Recognize that impact measurement is highly project-specific. Monitor investment progress and assess each deal's additionality.
European Investment Bank	Europe	Support innovative SMEs to accelerate their growth. Boost cutting-edge technological innovation. Support climate action, social impact, and private sector growth. Foster European capital market union. Finance European scale-ups to prevent them from being sold due to lack of capital.	Stimulate and catalyze private capital. Provide minority stakes in funds with a cap of 25%. Offer flexible tenors for long-term commitment. Delegate investment decisions to fund managers. Crowd-in further investment by signaling the quality of the investee.
European Investment Fund	Europe	Foster entrepreneurship, research, and development. Promote employment and regional development. Generate an appropriate return for shareholders.	Proactively tackle market gaps. Improve the availability of risk capital for high-growth and innovative SMEs. Facilitate innovators in critical industries (e.g., space, chips, biotech, defense, industrial tech). Strengthen digital independence.
Finnish Industry Investment (Tesi)	Finland	Develop the venture capital and private equity markets. Fulfill industrial policy mission.	Invest in a market-driven and profitable manner alongside private investors. Provide long-term support. Invest both directly and in funds. Focus on high-tech/deep-tech, clean tech, defence, and life science.
European Bank for Reconstruction and Development	Europe	Support the growth of the venture capital ecosystem. Foster a robust and competitive private equity market.	Act as an anchor investor. Participate on advisory committees of all funds. Support funds to raise consecutive follow-on funds and become successful franchises. Invest in commercially viable funds to crowd-in private investors and generate attractive returns. Take on higher-risk projects and provide longer-term finance. Support firm governance by appointing a non-executive board director.
Norfund	Norway / Developing Countries	Build sustainable businesses and industries in developing countries by providing equity and risk capital. Create jobs and support the transition to net zero.	Focus on investments with additionality. Invest where capital is scarce and risks are high. Act as an active minority stake investor. Focus on energy, green infrastructure, and financial inclusion. Prefer direct equity investments over funds and loans.
U.S. International Development Finance Corporation	U.S. / Developing Countries	Address the shortfall of private equity capital in developing countries. Provide better access to long-term growth capital, management skills, and financial expertise.	Conduct pre-investment ESG reviews and post-investment monitoring. Ensure investments have additionality. Crowd-in private capital.

Continued...

Name	Target	Innovation Mandates	Investment Strategy
Korea Venture Investment Corporation	South Korea	Thrive the future of South Korea by creating a better startup ecosystem. Drive innovation. Expand innovation investment in SMEs.	Invest in projects that have social impact and create jobs. Invest in socially important industries. Act as both general partner and limited partner. Extensive engagement and monitoring when investing as a limited partner. Create an ESG venture finance environment and improve the operation of mother funds.
Bpifrance	France	Propel the start-up ecosystem. Position France as a major player in disruptive innovation by supporting R&D and strengthening the capital of innovative companies. Facilitate easier and faster exits. Create French unicorns and decacorns. Promote entrepreneurship and the spirit of enterprise.	Focus on deeptech and greentech. Bring in university technology transfers. Provide non-financial technical support and training programmes for businesses. Support limited partners and general partners in their development. Provide long-term financing, potentially exceeding 7 years. Act as an active minority stakeholder.
British Business Bank	UK	Provide small businesses with easier financial access.	Crowd-in capital from private investors and public pension funds. Offer guidance and tools on supply chain, financing, staffing, and ESG matters. Support the advancement of female entrepreneurship.
Innovation Fund for Technology Based Firms	China	Support technological innovation among SMEs. Encourage technological advancements and commercialization of scientific results into industry-scale applications.	Provide grants for seed-stage and early-stage SMEs' innovation projects. Crowd-in and guide private investment. Particularly target startups founded by overseas returnees or based in tech incubators. Focus on projects with significant economic or social impact and strong R&D foundation.
Office of Hawaiian Affairs	U.S.	NA	NA
Oregon Growth Board	U.S.	Establish an innovation environment and infrastructure. Help SMEs grow.	Support emerging fund managers. Crowd-in private capital. Emphasize underrepresented communities.
Swiss Investment Fund for Emerging Markets (SIFEM)	Switzerland	Strengthen economic development of developing countries by financing SMEs. Enrich local capital markets.	Focus on investments with additionality. Take risks that private investors are unwilling to take. Crowd-in private capital through co-investment. Invest in diversified funds. Invest in financial intermediaries to enrich the local financial sector. Provide capacity building through tailored advice to investees. Help fund managers with local expertise. Act as an active investor by taking seats on investee boards. Generate an adequate financial return.
Enterprise Ireland	Ireland	Support innovative start-ups with international growth potential and enterprises growing abroad. Promote regional economic growth through jobs created by Irish firms. Increase the opportunities for women entrepreneurs. Further develop the Irish venture capital sector.	Provide capacity building through customized leadership, innovation, and business support programmes. Offer guidance to Irish businesses on climate change, deglobalization, and digitalization. Build commercially viable funds and attract private investors.
Catalan Institute of Finance	Spain	Foster innovation. Foster the creation and growth of enterprises.	Focus on Series A and B rounds. Concentrate on firms in high-tech industries.
Clean Energy Finance Corporation	Australia	Foster net-zero transition by backing new opportunities in climate tech and clean energy.	Invest on commercial terms. Prioritize emission reduction opportunities. Engage on ESG issues at the fund and investee level.

Continued...

Name	Target	Innovation Mandates	Investment Strategy
Fondazione Cassa di Risparmio di Padova e Rovigo	Italy	Promote innovation-oriented community.	Support projects with positive impact on the local community.
Netherlands Development Finance Company (FMO)	Netherlands	Foster the maturity of the venture capital sector in emerging markets.	Focus on early-stage, tech-enabled direct investments. Invest in funds and follow a lead investor for direct deals. Only invest in business applying disruptive technologies. Provide technical assistance and guidance on sustainability related issues. Improve services of incubators, accelerators, and other entrepreneurial support organizations. Enable more early-stage financing for ventures. Require invested funds to report and communicate in case of ESG risks. Create development impact by being additional in financing in developing countries. Scale impact by crowding-in commercial investors.
Cassa Depositi e Prestiti Spa	Italy	Make the venture capital ecosystem a cornerstone of Italy's economic development and innovation. Help SMEs in strategic sectors grow.	Focus on high-tech and innovative firms. Adhere to ESG principles.
Swedfund	Sweden	Boost financial inclusion through venture capital provision to small businesses and entrepreneurs.	Act additionally and catalytically. Crowd-in private capital for investments by taking risks and showcasing opportunities. Lay the foundation for more investable infrastructure projects. Work closely with fund managers to develop ESG management systems. Increase turnover, gender equality, number of employees, and tax revenue in a majority of portfolio companies. Act as a minority shareholder. Take seats on the company's Board of Directors.
Beijing E-Town International Investment & Development	China	Promote scientific and technological innovation in Beijing. Promote rapid industrial development. Actively assist SMEs in innovation and development. Act as general partner. Invest directly or through self-managed funds.	Focus on important industries such as new generation information technology, biotechnology and healthcare, new energy intelligent vehicles, robotics, and smart manufacturing. Adopt long-term strategic investment. Provide comprehensive financial services including M&A.
Japan Bank for International Cooperation	Japan	Support foreign startups collaborating with Japanese companies and Japanese startups expanding into global markets. Connect Japan's startup ecosystem with global startup ecosystems. Provide financial and non-financial support to SMEs. Help developing countries address challenges imposed by climate change.	Invest in mid and late stages. Focus on industrial development and sustainability-related sectors. Invest primarily in ASEAN countries. Provide technical assistance to SMEs. Connect Japanese firms with overseas governments by signing memorandums of understanding. Act as a minority-stake investor. Help investees assess ESG risks of their projects.
Oklahoma Capital Investment Board	U.S.	Support the venture capital ecosystem by bringing professional talents and crowding-in outside capital to serve diverse opportunities within Oklahoma. Create jobs and diversify and stabilize the state's economy. Support the growth of a diversified financial industry capable of providing necessary risk capital to entrepreneurial companies.	Invest from early-stage startups to later-stage expansions. Create financial solutions for SMEs by engaging a broad range of bankers. Finance indirectly by investing in funds as a limited partner.
The Overseas Students Pioneer Park	China	Support the growth of innovation-based startups. Attract overseas students to build enterprises in Beijing. Refine the entrepreneurial ecosystem to foster innovative, high-growth SMEs.	Focus on emerging and high-tech industries. Provide technical assistance such as industrial platform support, high-tech laboratories, and branding services. Offer early-stage incubation financing through self-managed funds.
DEG	Germany	Promote private entrepreneurial initiatives in future markets. Promote industrialization, infrastructure, and innovation.	Provide support to funds at the very early stage. Offer stable capital and signaling to crowd-in other investors. Provide minority stakes (20%). Take seats on the fund's advisory committee.

Table IA.3: Public availability of DFIs' VC investment.

This table summarizes the availability of the 30 largest DFIs' VC investment (based on the number of fund investments). Columns 5 to 7 report whether the institution's website has information on VC fund investment, loan extensions, and the deals made by VC funds, respectively. 'Yes' means available, 'No' means not available, 'Partial' indicates partial information, and 'FOIA' indicates information available through requests according to the domicile country or state's law, such as Freedom of Information Act requests.

Name	Fund Info	Loan Info	Deal Info	Website
Organization for Small & Medium Enterprises and Regional Innovation	FOIA	FOIA	FOIA	https://www.smrj.go.jp/org/disclosure/ir/index.html
International Finance Corporation	Yes	Yes	Partial	https://disclosures.ifc.org/
British International Investment	Yes	Yes	Yes	https://www.bii.co.uk/en/our-impact/search-results/
European Investment Bank	Yes	Yes	Partial	https://www.eib.org/en/products/equity/funds/index
European Investment Fund	Yes	No	No	https://www.eif.org/news_centre/press_releases/index.htm
Finnish Industry Investment (Tesi)	Yes	NA	Yes	https://tesi.fi/en/portfolio/funds/
European Bank for Reconstruction and Development	Yes	Yes	No	https://www.ebrd.com/project-finder
Norfund	Yes	Yes	No	https://www.norfund.no/our-investments/all-investments/
U.S. International Development Finance Corporation	Yes	Yes	Partial	https://www.dfc.gov/what-we-do/active-projects
Asian Development Bank	Yes	Yes	Yes	https://www.adb.org/projects
African Development Bank	Yes	Yes	Yes	https://projectsportal.afdb.org/dataportal/?lang=en
Korea Venture Investment Corporation	FOIA	FOIA	FOIA	https://www.kvic.or.kr/open/open4_1
Bpifrance	Yes	No	Partial	https://www.bpifrance.fr/catalogue-offres
British Business Bank	Yes	Partial	Partial	https://www.british-business-bank.co.uk/finance-options/equity-finance
Innovation Fund for Technology Based Firms	NA	NA	NA	NA
Office of Hawaiian Affairs	UIPA	UIPA	UIPA	Request in accordance with the Uniform Information Practices Act (UIPA) in Hawaii.
Oregon Growth Board	Yes	No	No	https://www.oregon.gov/biz/programs/Pages/default.aspx
Swiss Investment Fund for Emerging Markets (SIFEM)	Yes	No	Partial	https://sifem.ch/portfolio/
Catalan Institute of Finance	Yes	No	No	https://www.icf.cat/en/productes-financers/index.html?BotoOp=capital
Fondazione Cassa di Risparmio di Padova e Rovigo	Yes	NA	No	https://fondazionecariparo.it/activity-status/concluse/
Netherlands Development Finance Company (FMO)	Yes	Yes	Partial	https://www.fmo.nl/ventures-program
Cassa Depositi e Prestiti Spa	Yes	Yes	Partial	https://www.cdp.it/sitointernet/it/venture_capital.page
Swedfund	Yes	Yes	Partial	https://www.swedfund.se/en/investments-and-projects?projectType=investment&investmentType=equity&page=1
Beijing E-Town International Investment & Development	Yes	NA	Partial	https://www.en.etowncapital.com/industrialinvestment.html
Japan Bank for International Cooperation	FOIA	FOIA	FOIA	FOIA
Oklahoma Capital Investment Board	Yes	Partial	Partial	https://www.ocib.org/ocib/web.nsf/pages/support.html
The Overseas Students Pioneer Park	No	NA	No	NA
DEG	Yes	Yes	No	In annual reports

Table IA.4: Classificaiton of DFIs and Summary Statistics

Based on their location and geographical investment focus, we classify the DFIs into four categories: multilateral international, unilateral international, domestic national, and domestic Subnational DFIs. International multilateral covers DFIs that are formed and funded by multiple countries and finance projects in multiple countries (e.g., Asian Development Bank, European Investment Fund, and International Finance Corporation). International unilateral includes DFIs that are funded by one country but invest broadly in many other countries, predominantly in developing economies (e.g., British International Investment, German Investment Corporation (DEG), and Dutch Entrepreneurial Development Bank (FMO)). Domestic national includes DFIs that are funded by one country and invest primarily domestically to foster economic development (e.g., Bpifrance, Brazilian Development Bank (BNDES), Small Industries Development Bank of India). Domestic Subnational includes DFIs that are funded by one region within a country, such as a city, province, or state, and invest primarily in that region (e.g., Alberta Enterprise Corporation, Commonwealth Financing Authority of Pennsylvania, and Catalan Institute of Finance).

	DFIs	**International**		**Domestic**	
		Multilat	**Unilat**	**National**	**SubNat**
#DFIs	344	29	25	160	130
#Fund Investments	4,194	1,085	785	1,821	503
#Direct Investments	2,501	259	211	1,551	480
#Total Deals	103,605	34,973	11,238	67,892	20,733
#Unique Deals	33,106	10,933	4,016	20,670	6,291
#Unique Firms	21,670	6,943	2,813	13,763	4,263

Table IA.5: Aggregate Stacked Diff-in-Diff Results

This table reports the aggregate Stacked Diff-in-Diff regression results at the deal-time level to complement the event-study results presented in Figures. The coefficients indicate whether and how much firms financed by DFIs evolve differently compared to matched firms financed by conventional investors across a range of variables. *Turnover* is the ratio of operating revenue to total assets, *Empl* is the log of the number of employees, and *#Patents* is the log of the number of patents granted in a year. *RepRisk* is a sector-country-adjusted measure of firms' reputation risk based on the number and severity of corporate scandals. Higher numbers indicate worse reputation. Columns (1) to (4) focus on DFI investments in firms located in developed economies, while Columns (5) to (8) examine DFI investments in developing economies. *Post* equals one if the observation year is greater than or equal to the deal year. *DFI-invested* is an indicator equal to one if a deal has received financing from DFIs. We follow the literature to add cohort-specific fixed effects and cluster at the firm level. Standard errors are in brackets. $^{*}p < .10$; $^{**}p < .05$; $^{***}p < .01$

	Developed				**Developing**			
	Turnover (1)	Empl (2)	#Patents (3)	RepRisk (4)	Turnover (5)	Empl (6)	#Patents (7)	RepRisk (8)
Post × DFI-invested	-0.009	0.025	0.022	-0.009	0.040	0.010	0.059*	-0.011
	[0.045]	[0.055]	[0.014]	[0.401]	[0.054]	[0.136]	[0.032]	[0.660]
Cohort × Deal FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,447	17,508	182,033	15,955	13,786	8,382	56,221	8,852
R-squared	0.613	0.874	0.539	0.773	0.564	0.814	0.573	0.605

Table IA.6: Fund Performance and Reporting: Robustness

This table provides robustness checks to the performance of funds that are financed by DFIs. In this table, we restrict sample to funds with at least one known limited partners. Columns (1) to (4) focus on funds targeting developed economies, while Columns (5) to (8) examine funds targeting developing economies. We present the results of specifications where the dependent variables are three performance measures. In Columns (1) and (5), we examine the probability of disclosing any performance measure using Logit specifications. In the other columns, the dependent variables are three performance measures: the multiple of the total value to paid-in capital; the net internal rate of return (IRR); and the public market equivalent with the S&P500 index as a benchmark. *DFI-invested* is an indicator equal to one if a VC fund has at least DFI as a limited partner. *Known LPs* is an indicator equal to one if a VC fund has at least one known limited partner (investor) in the Preqin dataset. *Fund Size* is the natural logarithm of the VC fund size. We double cluster the standard errors by general partner and vintage year, and report standard errors in brackets. $*p < .10$; $**p < .05$; $***p < .01$

	Developed				**Developing**			
	Report	Multiple	IRR	PME	Report	Multiple	IRR	PME
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean Dep. Var.	0.395	1.746	12.540	1.109	0.155	1.919	13.458	0.957
DFI-invested	0.031	-0.135*	-3.949***	-0.157***	0.080***	-0.084	0.294	-0.005
	[0.021]	[0.078]	[1.091]	[0.055]	[0.015]	[0.118]	[1.692]	[0.116]
Fund Size	0.101***	0.019	0.153	0.056**	0.029***	-0.199***	-2.765***	0.085
	[0.007]	[0.023]	[0.442]	[0.023]	[0.004]	[0.054]	[0.647]	[0.055]
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,720	2,073	1,868	948	9,306	745	711	129
Adjusted R^2		0.169	0.209	0.230		0.154	0.176	0.326

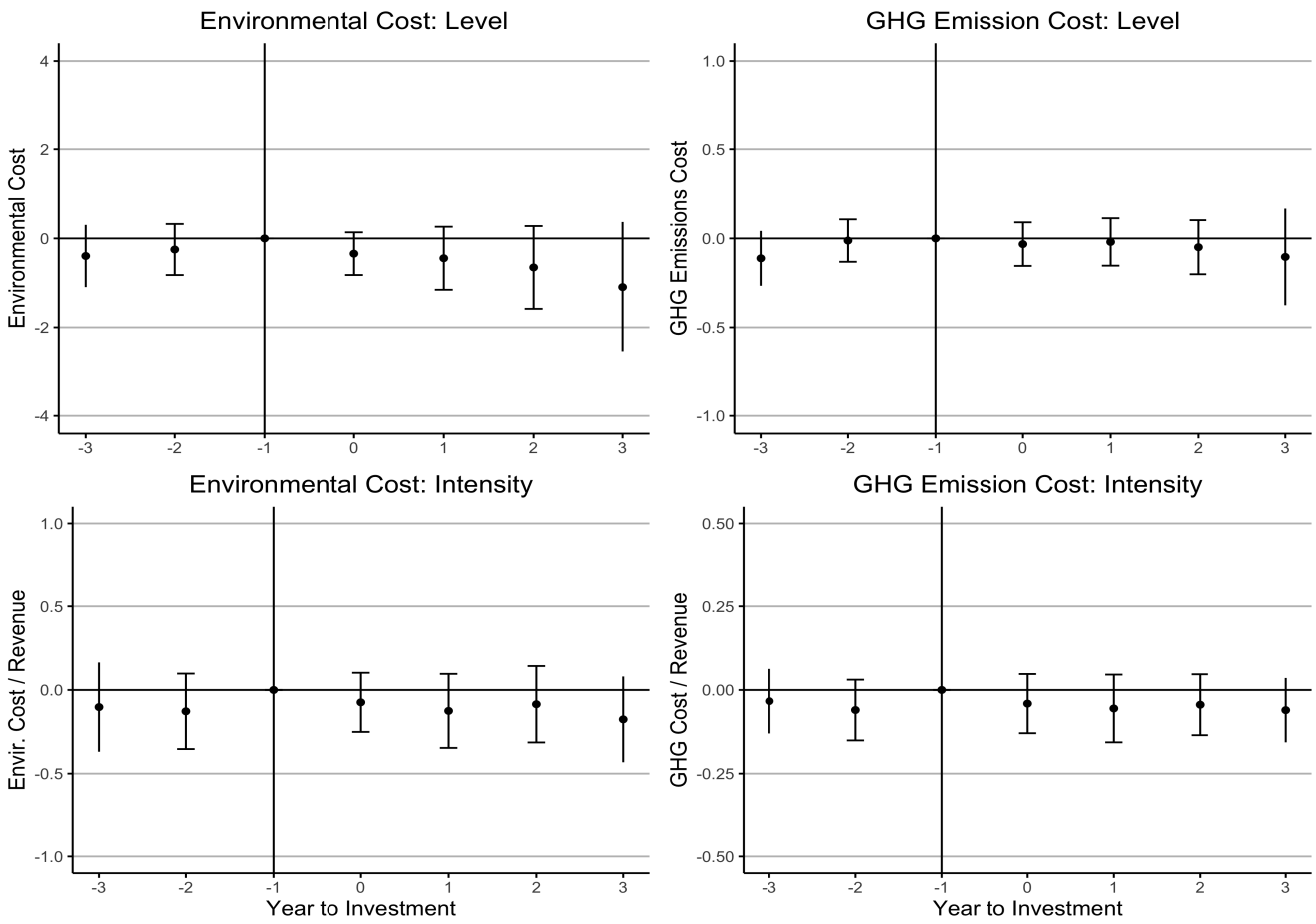

Figure IA.1: Dynamic effects of DFI investment on firm environmental impact.
This figure shows the event plot associated with the stacked DiD estimation for the effect of DFI's investment on various metrics of firm environmental impacts sourced from the Trucost database. We follow Abraham et al. (2024) to consider the sample period from 2002 to 2023. The environmental costs are dollar-valued costs of firms' emissions derived from Trucosts. The intensity measures adjust the costs by the firms' total revenues. The dynamic coefficients represent the difference between a firm invested in by DFIs and a matched firm invested in by traditional investors. Matching is based on country, industry, deal year, deal stage, and firm size one year before the deal. An insignificant coefficient indicates that DFI-invested firms perform similarly to traditionally-invested firms since the investment. This figure should be viewed in conjunction with Table 10, which shows that DFI-invested firms are more likely to report emissions, ceteris paribus. The Trucost data is too limited in developing countries to run heterogeneity analysis in a stacked difference-in-difference framework.

Online Appendix: Matching and Stacked Difference-in-Difference

In Sections 5, 6, 7, we use the stacked Difference-in-Difference method (Cengiz et al., 2019) to compare firms backed by DFIs with matched firms backed by conventional investors in terms of financial performance, patenting, and corporate scandals. While DiD designs are often used to establish causal effects, we mainly use it to provide parametric comparison between firms. However, the results might be interpreted as the causal impact of DFI investments on firm outcomes if the parallel trend and no-anticipation assumptions are considered plausible. We discuss them here formally.

The matching procedure goes as follows: for each firm invested by DFI, we find a pool of candidate firms invested by conventional investors in the same year, industry, country, and stage. For each DFI with at least two candidates, we match it with the one closest in total assets one year before the investment.

Our main parameter of interest is the dynamic treatment effect $ATT(k)$ defined as the average effect of DFI investment on firm-level outcome such as employment growth $k \in \{0, 1, .., K\}$ periods after the investment took place. We can take a simple average of the dynamic effect to form the aggregate parameter ATT that captures the overall effect of investment. In light of treatment heterogeneity across treatment timing, we need to estimate $ATT(k)$ by aggregating the average treatment effect for firms invested by DFIs in cohort k periods after the investment, i.e. $ATT(g, g+k)$. Specifically,

$$ATT(g, g+k) = E[Y_{g+k}(g) - Y_{g+k}(0) \mid \textit{firm invested by DFIs in year } g],$$
$$ATT(t) = \sum_{g \in \mathbf{g}} \omega(g,k) ATT(g, g+k)$$

where $Y_{g+k}(g)$ is the potential outcome k periods after investment in year g and $Y_{g+k}(0)$ is the potential outcome k periods after g had investment not occurred. $\mathbf{g}$ is the whole set of years when there are enough investment made by DFIs (this includes all years after 1995). $\omega(g,k)$ is some weighting parameters. We weight by the number of firms invested by DFIs in each year for benchmark results and apply other weighting functions proposed in the DiD literature for robustness checks.

The estimating equations for the stacked DiD read:

$$y_{i,t,g} = \alpha + \beta_1 \mathbf{Treat}_{i,g} \times \mathbf{Post}_{i,t} + \mathbb{X}_{i,t,g}\beta_2 + \mathbf{Other\ Fixed\ Effects} + \epsilon_{i,t,g};$$
$$y_{i,t,g} = \alpha_{i,g} + \lambda_{t,g} + \sum_{k=\kappa_{min}}^{\kappa_{max}} \delta_k \mathbf{1}_{t-T_i=k} + \mathbf{Other\ Fixed\ Effects} + \mu_{i,t,g},$$

where $\mathbf{Treat}_{i,g}$ is an indicator variable equal to 1 if and only if firm i is invested by DFIs in year g and $\mathbf{Post}_{i,t}$ is an indicator variable equal to 1 if and only if year t is bigger or equal to g. In principle, there is no need to specify any controls $\mathbb{X}_{i,t,g}$ when the parallel assumption holds, and adding them in a stacked DiD regression does *not* make the parallel assumption more plausible. We observe that it is still a common practice in the literature to add controls, and we still report our results when controls are added. Note that the fixed effects $\alpha_{i,g}$ and $\lambda_{t,g}$ are cohort-specific.

The estimating equations are applied to a stacked dataset , where treated (DFI-backed) and matched untreated (conventional-investor-backed) firms within a time period in the same year horizontally. In each stack/year cohort g, we keep the treated units and *matched* control units in the event window of five years, i.e. $t \in [g-5, g+5]$. The 'stacking' addresses the 'forbidden comparison issue' of standard two-way fixed effects estimators, where the estimators are inconsistent in the presence of treatment heterogeneity across time and/or units (see, e.g., Baker, Larcker, and Wang, 2022; Callaway and Sant'Anna, 2021). Wing et al. (2024) shows that estimating δ_k (β_1) is equivalent to estimating $ATT(k)$ (ATT) under a set of standard DiD assumptions. We examine them below.

We use investment year as cohort to capture the idea that the effect of investment can depend on which year the investment is made.

Assumption 1 (No anticipation): $\forall g \in \mathbf{g}; t < g$,

$$E[Y_t(g) \mid X, \text{invested by DFIs in year } g] = E[Y_t(0) \mid X, \text{invested by DFIs in year } g]$$

Assumption 2 (conditional parallel trend): $\forall g; t \geq g$,

$$E[Y_t(0) - Y_{g-1}(0) \mid X, \text{invested by DFIs in year } g] =$$
$$E[Y_t(0) - Y_{g-1}(0) \mid X, \text{invested by traditional investors in year } g]$$

Two key identifying assumptions of the stacked difference-in-difference estimators are the absence of anticipation effect and the conditional parallel trend assumption. For the former, although it is likely that firms adjust behavior if they expect an investment in the near future, the no anticipation assumption in our context requires only that there is no systematic difference between how fast firms invested by DFIs grow before the investment and the counterfactual scenario where they receive investment from traditional investors instead. We test this assumption both visually by an event plot and a pre-trend F test.

The conditional parallel trend assumption requires that had firms invested by DFIs received investment from traditional investors instead, they would have grown similarly to those matched firms that receive traditional investment. The classic way to justify the assumption is to extrapolate the parallel trend before treatment to periods after the treatment. One potential threat to this strategy in our case is that firms invested by DFIs could have different growth potentials than matched firms at the time of investment, even they have grown similarly before the investment.

Alternative Estimator. In principle, the parameters of interests above can be estimated by most modern dynamic DiD procedures. The literature proposes a number of alternative estimators other than the stacked DiD estimator. Our choice of stacked DiD rather than other estimators such as Callaway and Sant'Anna (2021) (CSDiD) is motivated by its flexibility and transparency. Stacked DiD allows one to carefully choose controls in each cohort in a transparent way. This is a clear advantage in our case as we apply matching to construct control groups. CSDiD, on the other hand, has stronger theoretical support especially for the estimation of standard errors. CSDID allows one to apply conditional parallel trend assumption more generally, whereas matching can be seen as a special method to create such an assumption. In our view, one method does not dominate the other; we thus use stacked DiD as the default model, which is much more common in the finance literature) Baker et al. (2022) shows in simulation studies that stacked DiD and many other forms of stacked DiD share similar degree of consistency and robustness against treatment heterogeneity. For a general discussion on stacked DiD and its connection with CSDiD, see Wing et al. (2024).