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Direct lenders in the U.S. middle market☆

Tetiana Davydiuk [a], Tatyana Marchuk [b,c,*], Samuel Rosen [d]

[a] Carey Business School, Johns Hopkins University, 100 International Drive, 21202, Baltimore, MD, USA
[b] BI Norwegian Business School, Nydalsveien 37, 0442, Oslo, Norway
[c] CEPR, London, UK
[d] Fox School of Business, Temple University, 1801 Liacouras Walk, 19122, Philadelphia, PA, USA

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ABSTRACT

This paper studies the rise of direct lending using a comprehensive dataset of investments by business development companies (BDC). We exploit three exogenous shocks to credit supply, including new banking regulations and a major finance company collapse, to establish that BDC capital acts as a substitute for traditional financing. Using firm-level data, we further document that firms' access to BDC funding stimulates their employment growth and patenting activity. Beyond credit provision, BDCs contribute to firm growth through managerial assistance.

1. Introduction

Firms' access to credit plays an essential role in generating economic growth. In periods when credit becomes scarce, firms that are risky may have difficulty qualifying for conventional forms of financing. This issue has become particularly germane after the Financial Crisis of 2007–2008, which triggered the tightening of regulation in the banking sector and subsequently impeded credit supply. These changes in the credit environment contributed to a surge in direct lenders and, in particular, business development companies (BDCs) — yet understudied players in the financial system.

BDCs are a special type of closed-end investment company that provide funding directly to businesses with annual revenues between $10 million and $1 billion — so-called middle-market firms. Over the past two decades, the BDC sector has grown rapidly, with asset growth close to 35% per annum, reaching almost $100 billion in total assets by the end of 2017 (Fig. 1). The size of the BDC sector is comparable to the size of the well-established venture capital sector (VC), with deployed assets under management of about $250 billion at the same date.[1] While the existing literature has extensively studied the importance of early-stage financing for entrepreneurship and economic growth, the understanding of the direct lending space and middle-market segment funding is limited.[2] In this paper, we investigate whether BDC capital can act as a substitute for traditional financing and whether the availability of private debt capital contributes to firm growth and innovation.

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* Corresponding author at: BI Norwegian Business School, Nydalsveien 37, 0442, Oslo, Norway.
E-mail addresses: tetianav.davydiuk@jhu.edu (T. Davydiuk), tatyana.marchuk@bi.no (T. Marchuk), sir@temple.edu (S. Rosen).

[1] Preqin reports that the assets under management of VC funds is $342.9 billion as of the end of 2017, including $96 billion of dry powder. According to OECD (2020), the deployed venture and growth capital constitutes $82 billion.

[2] See, e.g., Rin et al. (2013) and Metrick and Yasuda (2021) for reviews of the literature studying the VC space.

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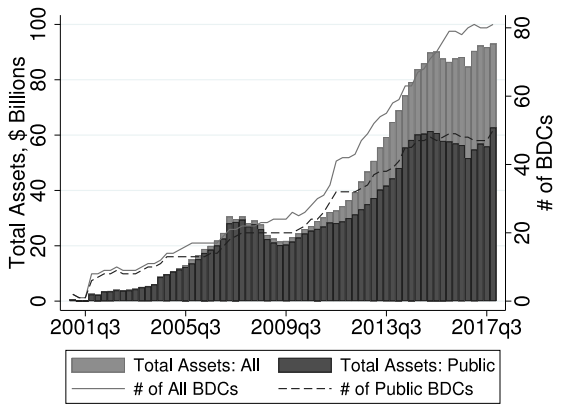


Fig. 1. Size of the BDC sector. The figure depicts the aggregate total assets of publicly traded and privately held BDCs along with their count as reported by SNL Financial. BDCs with missing total assets are excluded from the count. The data on total assets are real quarterly observations from 2001:Q1 to 2017:Q4, expressed in billions of December 2017 dollars.

For our analysis, we construct a novel database of BDC investments to assess the role of direct lenders in financing the middle market and their importance in fostering firm growth. First, we provide a systematic analysis of BDCs and identify the key properties of their investment model. Second, we investigate the factors that determine the propensity of BDCs to enter specific lending markets. To this end, we exploit three contractionary shocks to credit supply: the introduction of stress tests for bank holding companies, the 2009 collapse of a major finance company, and the adoption of the new accounting standards regarding the consolidation of off-balance items for banks. In a difference-in-differences setting, we show that BDCs invest in areas with a shortage of financing by traditional lenders, indicating that their capital can act as a substitute.[3] Furthermore, leveraging a new dataset of private debt deals from Preqin, we find that PD funds follow similar investment strategies as BDCs and enter areas subject to contractionary credit supply shocks. These similarities suggest that we can gain insights into an opaque private debt space through the lens of BDC investment allocations.

Finally, firm-level data reveal that BDC-funded firms experience higher employment growth and file more patents following BDC investment. Beyond the credit provision, BDCs contribute to firm employment growth through managerial assistance. Our findings indicate that BDC capital plays an essential role in the growth of middle-market firms.

Our analysis relies an extensive database of BDC investments hand-collected from publicly available filings. Our quarterly database covers the period 2001 through 2017 and it includes 69 BDCs, about 10,000 portfolio firms, and over 20,000 individual debt investments. For each debt investment, we record such characteristics as debt type, deal size, industry, interest rate, and maturity date. Importantly, we determine the geographic areas in which BDCs concentrate their investment activity by hand collecting the exact addresses of their portfolio firms from BDCs' capital registration statements. This level of data granularity is unique in the space of private debt investments, which is typically characterized by limited disclosure due to lack of regulatory oversight.

As the first step of our investigation, we describe the institutional background and assess the investment model of BDCs, which provides the necessary context for our subsequent analysis. This paper is the first to conduct a comprehensive study of these direct lenders in the academic literature.[4] Business development companies were created in the 1980s with the goal to stimulate the flow of capital to small- and mid-sized private firms. However, the BDC sector began to grow significantly only in the early 2000s. BDCs represent a hybrid of traditional banks and private equity funds: similar to a bank, they extend term loans and lines of credit to middle-market firms, but much like a private equity fund, they provide equity financing along with managerial assistance. In exchange for charging a premium of 4%–5% on their debt securities relative to bank loans (Chernenko et al., 2022), BDCs offer their borrowers significant flexibility, loan tailoring, quick deal execution, and loose covenants. To sustain their investment activities, BDCs rely on capital markets to secure both equity and debt financing. Apart from that, they borrow from banks through revolving credit facilities and term loans. Even though their minimum equity-to-assets ratio permitted by regulation is 50% during our period of analysis, BDCs maintain on average a ratio of 60%–70%, given the high riskiness of their portfolios. Overall, BDCs have established themselves as a growing segment within the space of private debt funds, constituting a quarter of the total private debt investments by the end of 2017.

We next aim to understand the factors driving the growth of the BDC sector. To this end, we exploit three exogenous negative shocks to the supply of capital to middle-market firms by traditional banks and finance companies. Specifically, we rely on (i) the first implementation of regulatory stress tests for bank holding companies under the Supervisory Capital Assessment Program in 2009 (*SCAP shock*), (ii) the collapse of one of the largest finance companies the CIT Group (*CIT shock*), and (iii) the changes in accounting standards related to the consolidation of variable interest entities (VIEs) for bank holding companies according to the FAS 166/167 regulation (*FAS 166/167 shock*). Both the SCAP and FAS 166/167 shocks prompted banks to recapitalize and employ a flight-to-quality strategy, thereby reducing the credit supply available to risky borrowers such as middle-market firms. Since debt markets feature borrower segmentation, with finance companies serving riskier firms compared to banks (Carey et al., 1998), the CIT Group failure also constitutes a contractionary capital supply shock in the middle market. We therefore expect that BDCs are more likely to enter counties with a shortage of funding by affected traditional lenders due to BDCs' specialization in funding the middle-market firms. For all shocks, we identify treated counties as those with the presence of affected lenders.

In a difference-in-differences setting, we provide evidence that BDC capital acts as a substitute to financing provided by traditional lenders. Specifically, we document that treated counties have a 2%–6% higher presence of BDCs than counties in the control group following the capital supply shock. In dollar terms, we find that BDCs allocate on average $5.3–$41.4 million more debt capital to a treated county relative to a control one. To corroborate our identification strategy, we demonstrate that there were no significant differences in the entry of BDCs and BDC debt investment amounts between the treated and control groups of counties prior to the shocks. Our findings are in line with the views of BDC investment managers, who often claim to target middle-market firms precisely because they are "underserved". Repeating this difference-in-differences analysis for PD funds, we find similar evidence. For example, treated counties have a 5%–19% higher presence of PD funds than counties in the control group. Finally, we show that among affected counties BDCs are more likely to enter those largely served by the national banking institutions, where they face less competition from incumbent local banks.

In a manner similar to VC funds, we find that BDCs target firms with high growth potential and, in particular, innovative firms. In a triple difference specification, we show that among treated counties BDCs allocate on average $8.7–$48.4 million more debt capital to a high-tech county that to a non-high-tech county following the shocks.

[3] Even though a finance company can be classified as a shadow bank, many finance companies provide financing to small- and middle-market segments. By traditional lenders, we therefore understand banking institutions and finance companies.

[4] Boehm et al. (2004) study the legal aspects of BDCs as investment vehicles, while Beltratti and Bock (2018) and Munday et al. (2018) provide institutional background on the BDC sector and analyze the performance of BDC stocks.

The comparable estimates for a high-R&D-intensive county relative to a low-R&D-intensive county are $8.2–$49.9 million.[5] These findings suggest that BDC debt investments can be particularly well-suited for firms active in high-tech and high-R&D-intensive industries and as such can promote innovation.

Using firm-level data, we analyze the effects of firms' access to BDC financing on their employment growth and patenting activity. In an event study, we document that BDC debt investments enable firms to increase their employment growth by 0.8%–1.2% per annum relative to their employment growth in the pre-investment period. We continue to find similar effects on the employment growth in a staggered difference-in-differences design (Borusyak et al., 2024), where we compare the employment growth for firms that received BDC investment relative to firms that have not yet received BDC funding. Additionally, we show that firms experience an even higher employment growth following the BDC investment if they receive more managerial assistance from their lenders. Importantly, our findings extend to a set of middle-market firms financed by PD funds implying that our insights apply to the broader and more opaque private debt space. Finally, we find a positive effect of BDC funding on firms' patenting activity. BDC-funded firms file 2% more patents per quarter after obtaining funding, representing about a 10% increase from the average patenting frequency.

Next, we estimate the causal effect of BDC funding on firms' employment growth by exploiting our three capital supply shocks. We document that BDC-funded firms located in counties with low shortages of traditional financing experience a 0.9% higher employment growth following the shock. By contrast, the employment growth of firms located in counties with high exposure to the shocks is 1.1% lower relative to firms in counties with low shock exposure. The sum of these estimates implies that BDC-funded firms were merely able to substitute loss of funding from traditional lenders with BDC capital.

Overall, our findings are consistent with the view that small and risky firms have been credit rationed in the debt markets in the period after the 2007–2008 Financial Crisis. We not only provide empirical support that BDCs are filling in this lending gap by extending funding to middle-market firms, but also that their financing plays an important role in promoting firm growth and innovation. To assess the importance of nonbank financing for the growth of the middle-market sector overall, one needs to extend the analysis beyond BDCs and private debt funds to other middle-market lenders such as finance companies, FinTech lenders, and middle-market CLOs (see, e.g., Gopal and Schnabl, 2022).

Related Literature. Our paper contributes to the emerging literature on the role of nonbank institutions in the financial sector. As the share of nonbank financial intermediation continues to increase both in the U.S. and worldwide policymakers have become concerned about potential risks originating in this less-regulated segment of the economy.[6] From the macro-financial stability perspective, it is crucial to distinguish between bank and nonbank credit due to strong nonsynchronicities in their dynamics throughout the business cycle as it allows to sustain the availability of capital to borrowers (Herman et al., 2017; Kemp et al., 2018; Elliott et al., 2024). Though the BDC sector is still relatively small compared to the entire financial sector in the U.S. and thus is unlikely to pose substantial systemic risks, it is a rapidly growing segment within the space of private debt investments, and BDC capital constitutes an important source of financing for middle-market firms.

The tightening of regulation in the banking sector after the Financial Crisis of 2007–2008 has impeded the flow of credit to borrowers, thereby causing them to substitute away from traditional banks to less-regulated financial institutions.[7] In the U.S. mortgage market, Buchak et al. (2018) and Fuster et al. (2019) find a significant shift towards mortgage originations by shadow bank lenders and, in particular, FinTech lenders. In contrast, we focus on the role of nonbank institutions in the corporate debt markets. Using novel data from Uniform Commercial Code, Gopal and Schnabl (2022) document that finance companies and FinTech lenders offset the contraction of credit supply to small businesses by banks following the Financial Crisis. Our analysis contributes to this literature by providing evidence of the substitution of bank credit with BDC and PD financing. Irani et al. (2020) and Neuhann and Saidi (2016) highlight the importance of nonbank intermediaries in the U.S. corporate syndicated loan market as ultimate holders of loans originated by banks. In our paper, we document that nonbank lenders act as both originators and holders of loans in the middle-market segment.

Since BDCs are a growing part of the larger private debt sector, our analysis complements the study by Munday et al. (2018), who provide an overview of the performance of private credit funds in the U.S. Furthermore, our paper is closely connected to Loumioti (2022), who analyzes the institutional composition of direct lending space and links the rise of direct lending to recent changes in the regulation of the banking industry. Novel to the literature, our study provides a systematic analysis of business development companies and their investment activities. More importantly, we establish causal evidence on how the contraction in credit supply from traditional lenders leads to the entry and growth of nonbank capital providers.

Our paper also provide insights into the middle market — an understudied yet important part of the U.S. economy. In this context, our study is closely related to the analysis of Chernenko et al. (2022), who examine the terms of nonbank loans for a large set of *publicly traded* middle-market firms. Due to the eligibility requirements for portfolio firms, BDCs primarily specialize in financing *private* firms and, as a result, constitute only a small share of the lenders considered by Chernenko et al. (2022). The contribution of our paper therefore is to analyze capital provision within less transparent segment of the middle market and highlight the importance of the private debt for the employment growth of middle-market firms.

Our firm-level analysis complements the existing literature that assesses real effects of credit expansion. While we focus on funding provided by BDCs, Samila and Sorenson (2011), Puri and Zarutskie (2012), and Gonzalez-Uribe and Paravisini (2019) analyze real effects from equity investments by venture capital and private equity funds. Similar to Gopal and Schnabl (2022), we investigate the entry of nonbank lenders and provide evidence that BDC debt investments act as a substitute to funding provided by traditional lenders. In a broader sense, our study is related to literature on real effects from small business lending. While Craig et al. (2007), Brown and Earle (2017) and Greenstone et al. (2020) argue that the impact of Small Business Administration (SBA) guaranteed lending on growth is either economically small or negligible, we find a positive effect of BDC funding on firms' employment growth and patenting activity.

2. Systematic analysis of the BDC sector

2.1. Institutional background

Business development companies (BDCs) were created through the *Small Business Investment Incentive Act of 1980* ("1980 Amendments"),

[5] We designate a county to be high-tech if its employment share in high-tech industries as defined by Hecker (2005) is above the cross-sectional median. We similarly identify a county as high-R&D-intensive based on the definition in Galindo-Rueda and Verger (2016).

[6] Among recent papers investigating the rise of shadow banking sector are Claessens et al. (2023), Cucic and Gorea (2024) and Aldasoro et al. (2023). Jiang et al. (2020) studies the characteristics of nonbank financial intermediaries.

[7] Chen et al. (2017), Bord et al. (2021), Cortés et al. (2020), and Begley and Srinivasan (2022) document a significant decrease in funding extended to small firms following the tightening of regulation in the banking sector.

which aimed to relieve many restrictions in the *Investment Company Act of 1940* (the "1940 Act") and facilitate the flow of capital to small- and mid-sized private firms. After their initial appeal in the 1980s, however, the popularity of BDCs was rather modest until the early 2000s, when we see that the number of BDCs and their assets under management begin to significantly increase (see Fig. 1).

A BDC is a special category of closed-end investment company. Under the 1980 Amendments, BDCs benefit from relaxed requirements on external debt issuance and greater flexibility with respect to investor compensation than typical closed-end funds. In return, BDCs are subject to a number of restrictions on their activity. Specifically, BDCs are required to hold at least 70% of their investments in eligible assets, which primarily consist of cash, government securities, and investments in *eligible portfolio firms*. The latter in turn include all private firms and public U.S. firms with equity market capitalization of up to $250 million.[8] Aside from the eligible asset requirement, a unique feature of BDCs is that they are required to provide substantial managerial assistance to their portfolio firms. BDCs typically provide significant guidance and counsel concerning the management, operations, or business objectives and policies of their portfolio firms (Boehm et al., 2004). In this regard, BDCs adopt the key features of both commercial banks and private equity funds.

BDCs fund their investments in eligible portfolio firms by raising capital both in public and private markets. After the initial round of investment using private funding, most BDCs decide to become publicly traded and raise equity through an initial public offering (IPO). For their debt funding, BDCs do not rely on short-term funding such as deposits but rather borrow long term through senior secured debt, convertible bonds and other hybrid securities. In terms of leverage, BDCs are less restricted than other closed-end funds but more than traditional banks. By regulation prior to 2018, BDCs had a maximum allowable debt-to-equity ratio of 1:1 compared to 1:2 for other investment companies. Meanwhile, banks must maintain a capital ratio – a ratio of regulatory tier 1 equity capital to average total assets – of at least 4% and above 5% in order to be considered well-capitalized by regulators. The BDC debt-to-equity ratio of 1:1 translates into a minimum capital ratio of 50%. In March 2018, the restriction on BDC leverage was further relaxed to a minimum of a 2:1 debt-to-equity ratio or a 33% minimum capital ratio.[9]

For tax purposes, BDCs can elect to be treated as a regulated investment company (RIC). By doing so, they can avoid double taxation by passing through their net income and capital gains to shareholders free of tax. The key prerequisite for qualifying as a RIC is distributing at least 90% of taxable income to debt- and equityholders. Further requirements include income and diversification tests for sources of income. Since most of the BDC income is distributed as dividends and capital gains, shareholders end up holding high-yielding stocks in addition to enjoying a sizable tax advantage.

Another important advantage of BDCs is that they provide retail investors with the access to illiquid investments in private firms. Historically, this risk exposure was only available to institutional investors and wealthy individuals through private funds. By being publicly traded, BDCs provide their investors with similar risk exposure and substantial liquidity at the same time. In this sense, BDCs are similar to publicly held private equity or venture capital funds. Moreover, investors benefit from regulatory disclosures by having access to the information on the BDCs portfolio strategy and end-use of funds. When electing to be treated as a BDC, a company must have a class of its equity securities registered under the *Securities Exchange Act of 1934*. Consequently, BDCs file periodic and current reports (i.e., Forms 10-Q, 10-K and 8-K) as well as proxy statements with the SEC like those filed by public companies.

[8] See the Section 55(a) of the 1940 Act as amended by the 1980 Amendments for a more detailed definition of eligible assets.

[9] Balloch and Gonzalez-Uribe (2021) investigate this regulatory change and its effect on the BDC sector.

2.2. Data

Our analysis of the BDC sector relies on a variety data sources. The BDC universe is constructed from the list of companies that file a Form N-54A with the Securities and Exchange Commission (SEC).[10] The number of companies making a BDC election has been steadily increasing since 2001 and has reached over 90 as of 2017:Q4.[11]

First, to understand the business model of BDCs, we analyze financial statements data from S&P SNL Financial, debt capital structure data from S&P Capital IQ, and ownership structure data from WRDS SEC Analytics Suite (13F Holdings Data). SNL Financial collects financial statements data both for publicly traded and privately held BDCs. For our analysis of the private debt space, we supplement the BDC data with data on private debt deals from Preqin.

Second, we construct a comprehensive database of BDC investments by hand collecting data from the SEC filings. As part of their regulatory status, publicly registered BDCs have to disclose their individual investments in the 10-Q and 10-K filings, within the so-called schedule of investments (SOI) tables.[12] Our database covers the period 2001:Q1 through 2017:Q4 and includes 69 BDCs providing funding to about 10,000 portfolio firms. It includes key investment-level variables such as industry, instrument type, deal amount, rate, and maturity date.

Finally, to establish the geographic areas in which BDCs concentrate their investment activity, we augment our investment-level data by collecting location data on the BDC-funded firms. The majority of BDCs file Forms N-2 — a registration statement submitted to the SEC when issuing new debt and equity securities. Importantly, these forms record the exact addresses of portfolio firms, which allows us to hand collect location data (city, state and ZIP code) for over 7500 firms. We manually track firm name changes and account for mergers and acquisitions. In nearly every quarter, we obtain the location data for over 80% of portfolio firms and around 90% if we measure the share of portfolio firms with location information in terms of their investment fair value (see Appendix A for more details).

We augment our BDC- and investment-level data with data from a variety of other sources. We rely on the Call Reports to measure asset holdings of consolidated VIEs for bank holding companies, on the Federal Deposit Insurance Corporation (FDIC) Summary of Deposits to identify banks' presence in local markets, and on Refinitiv DealScan (thereafter, DealScan) syndicated loan data to construct counties' exposure to the CIT Group collapse. We collect the county-level data on total, middle-market, and industry-level employment, job creation, and job losses from the Bureau of Labor Statistics (BLS); gross output from the Bureau of Economic Analysis (BEA); number of establishments from the Internal Revenue Service (IRS); house price index from the Federal Housing Finance Agency (FHFA). We also collect firm-level employment from Preqin and number of patent applications from the United States Patent and Trademark Office (USPTO). Throughout our analysis, we deflate all nominal quantities to obtain real measures using the consumer price index (CPI) from the BLS. In particular, we normalize the price level to 1 in December of 2017.

2.3. BDC business model

Fig. 1 demonstrates that BDCs have expanded rapidly over the past two decades with asset growth close to 35% per annum. BDC total assets reach almost $100 billion by the end of 2017. Despite the growing prominence of BDCs, there has been no systematic study of

[10] Form N-54A is a notification of election to be subject to Sections 55–65 of the 1940 Act.

[11] Balance sheet information available through SNL Financial is reported only for 81 BDCs as of 2017:Q4 (see Fig. 1).

[12] Publicly registered BDCs include both those with publicly-traded equity and those with non-traded equity, that is, privately held.

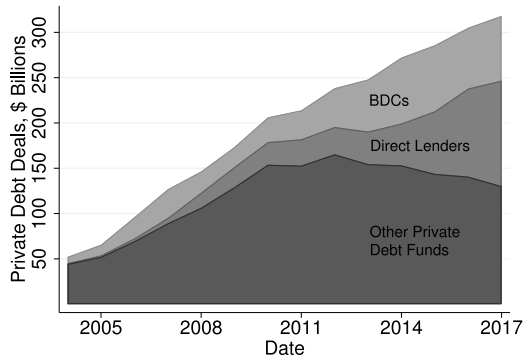


Fig. 2. Size of private debt market. The Figure depicts the aggregate amount of investment deals originated by BDCs, direct lenders and other private debt funds. Other debt funds include mezzanine, distressed debt, special situations and venture debt funds. The numbers for BDCs represent the fair value of investments from our hand-collected dataset. The numbers for direct lenders and other private debt funds represent the assets under management net of the dry powder from Preqin. The data are real annual observations for the period 2004 to 2017, expressed in billions of December 2017 dollars.

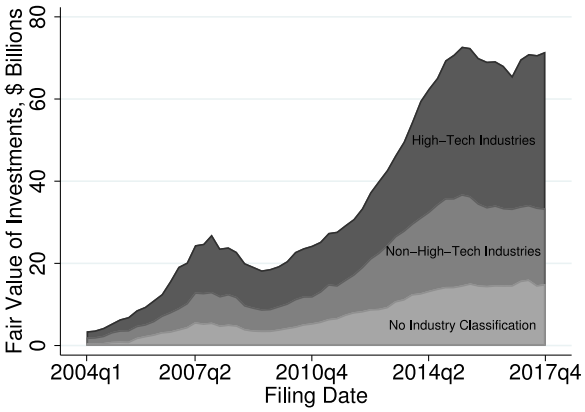
these direct lenders in the academic literature. We therefore carry out a detailed analysis of the BDC market using our newly constructed database. This empirical exercise allows us to provide the necessary context for our further analysis.

BDCs as a Private Debt Provider. In the U.S., business development companies established themselves as a rapidly growing segment in the market of private debt investments. However, it is difficult to assess their share in the market. The data on financing deals executed between private capital providers and portfolio firms are scarce due to the lack of regulatory oversight. To address this question, we rely on a new dataset of private debt deals provided by Preqin, which allows us to study the deals arranged by direct lenders other than BDCs.

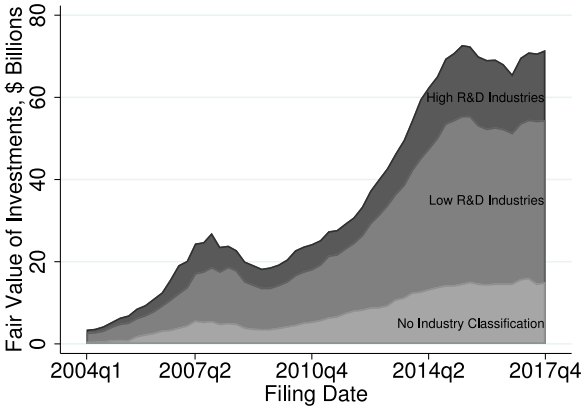
Even though the BDC sector may seem to be relatively small compared to the aggregate banking industry, BDCs play an important role in providing financing to small and medium-sized enterprises (SMEs). As of 2017 year end, the fair value of outstanding debt investments by BDCs constitutes $57 billion, while outstanding bank loans to SMEs reach $619 billion according to OECD (2020). Moreover, within the private debt space, BDC investments comprise a quarter of the total deal volume as of 2017 year end (see Fig. 2). Specifically, we compare the aggregate value of BDC investments with the assets under management of direct lenders as identified by Preqin and other private debt funds (including mezzanine, distressed debt, special situations and venture debt funds). Preqin only tracks a small subsample of BDCs and does not account for their investments in the direct lending category. We therefore rely on our hand-collected dataset to estimate the aggregate fair value of BDC deals. Fig. 2 further shows that the private debt sector has expanded drastically over our sample period growing on average by 15% per annum, and more than 50% of the private debt deals in the U.S. are originated by direct lenders.

It is also important to note that BDCs are often associated with large asset management companies managing other funds that target similar market segments as BDCs, including other direct lending and private equity funds. In Appendix B, we estimate that BDC-affiliated asset management companies deploy between $75 and $149 billion in related capital alongside BDC investments.

Role of BDCs in the Middle Market. Financing middle-market firms is intrinsic to the BDC business model. BDCs specialize in providing these firms with large capital infusions, helping them to scale and grow, often with the goal of taking a firm public through an initial public offering, selling a firm through a strategic acquisition, or negotiating a management buyout. According to the National Center for the Middle Market (NCMM), middle-market firms are defined as firms



(a): High-Tech Composition of BDC Investments



(b): R&D Composition of BDC Investments

Fig. 3. BDC investments in high-tech and high-R&D-intensive industries. The figures depict the industry composition of the BDC investments over time. Panel (a) depicts the fair value of investments allocated to firms in high-tech and non-high-tech industries according to the classification of Hecker (2005). Panel (b) depicts the fair value of investments allocated to firms in low- and high-R&D-intensive industries according to the classification of Galindo-Rueda and Verger (2016). The sample covers the period from 2004:Q1 to 2017:Q4.

with annual revenues ranging between $10 million and $1 billion. An alternative definition of a middle-market firm is based on the employment level — a firm with the number of employees between 50 and 500. BDCs' strategy to target the middle-market segment is reflected in the management discussion in their SEC filings (see Appendix C).

The middle market is a critical sector of the U.S. economy fueling job creation, yet relatively understudied in the academic literature. As of 2017, the NCMM estimates that the middle-market sector comprises nearly 200,000 firms and accounts for a third of private-sector employment and GDP. Survey evidence however suggests that one of the key impediments to the growth in this sector is lack of funding under advantageous terms (Makhija, 2011). Middle-market firms are relatively large and mature to qualify for small business or venture capital financing, but they are at the same time not large enough to directly tap public capital markets. As such, they predominantly rely on financing from banks, PE funds, PD funds, and more recently from business development companies. The BDC presence has been steadily growing with the number of portfolio firms exceeding 4300 as of 2017:Q4 and reaching close to 10,000 firms in total during our sample period.

BDC Investment in Innovation. Among middle-market firms, BDCs target high-growth and, in particular, innovative firms. First, we find that many BDC-funded firms previously received venture capital and private equity financing. Specifically, we are able to identify about

Table 1
Investment portfolio of BDCs.

(a) 2010:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Portfolio firms, Count	30	50.93	41.71	42.50	11.50	18.00	67.00	121.50
Allocation top 1 portfolio firms, %	30	16.21	18.33	10.58	4.31	6.22	20.12	30.91
Allocation top 3 portfolio firms, %	30	32.68	22.97	25.21	11.22	16.64	42.53	64.78
Allocation top 5 portfolio firms, %	30	43.69	24.72	34.93	17.22	26.14	57.45	82.32
Allocation top 10 portfolio firms, %	30	61.99	24.89	55.63	28.85	43.08	87.09	97.10
Outstanding deals, Count	30	87.07	76.46	67.50	14.00	36.00	111.00	172.50
Outstanding debt deals, %	30	55.51	26.82	63.08	6.61	47.46	75.00	84.73
Outstanding equity deals, %	30	38.67	25.69	33.45	13.42	18.18	50.00	80.48
Outstanding structured products, %	30	3.84	7.58	0.00	0.00	0.00	3.70	14.28

(b) 2017:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Portfolio firms, Count	59	94.00	183.08	56.00	20.00	31.00	93.00	161.00
Allocation top 1 portfolio firms, %	59	13.04	15.83	8.06	3.98	5.05	14.82	23.40
Allocation top 3 portfolio firms, %	59	25.61	19.23	19.49	8.65	13.28	33.77	45.84
Allocation top 5 portfolio firms, %	59	34.69	21.11	28.41	13.71	19.05	44.60	63.52
Allocation top 10 portfolio firms, %	59	50.86	23.08	46.60	24.25	32.74	63.64	82.60
Outstanding deals, Count	59	151.49	228.82	95.00	34.00	55.00	165.00	214.00
Outstanding debt deals, %	59	64.08	21.17	65.12	32.92	52.78	78.82	88.46
Outstanding equity deals, %	59	32.43	21.95	29.93	6.45	17.39	44.78	67.08
Outstanding structured products, %	59	3.15	8.06	0.00	0.00	0.00	3.45	6.52

The tables report summary statistics for portfolio of BDC investments. Allocations to portfolio firms are recorded in terms of their fair values. The figures represent the cross-sectional statistics across BDCs as of 2010:Q4 and 2017:Q4. Allocations in collateralized loan obligations, collateralized debt obligations, venture capital funds, mutual funds and other funds are excluded when computing the portfolio concentration statistics.

3200 BDC portfolio firms as previously funded by PE and VC funds according to the Thomson VentureXpert, which is about 30% of portfolio firms in our dataset. Second, through a manual review of portfolio firms' names, we find that BDCs have provided financing to large and successful tech firms such as Facebook, Dropbox, Lyft, and Twitter.[13] Third, we explore the industry composition of BDC investment portfolios. We rely on Hecker (2005) to identify high-technology industries and based on this classification we define a BDC portfolio firm as high-tech if it belongs to a high-tech industry.[14] Panel (a) of Fig. 3 documents that BDCs allocate a significant portion of their capital to high-tech industries. Alternatively, we categorize BDC portfolio firms as high- and low-R&D-intensive using the classification of Galindo-Rueda and Verger (2016). They identify five industry groups based on industries' R&D investment intensity, from low to high. For our analysis, we define a firm as high-R&D-intensive if its industry code is among high and medium-high categories. Even though the share of BDC capital allocated to high-R&D-intensive industries is not as large as for high-tech industries, it is increasing over time (see Panel (b) of Fig. 3).

BDC Portfolio Composition. Given that BDCs are required to provide substantial managerial assistance to their portfolio firms, we find that BDCs investment portfolios are highly skewed to a few large firms. Table 1 documents that as of 2010:Q4 the capital allocation to the top 10 firms in a BDC portfolio ranges between 29% and 97%, while the largest allocation to a single firm is 16% on average. Portfolio concentration of BDC investments only moderately declines between 2010:Q4 and 2017:Q4. Even though the high concentration of the portfolio increases BDCs risk exposure, it allows them to provide a higher quality managerial assistance to their portfolio firms and gives them a more powerful role when negotiating distress situations. Anecdotal evidence further suggests that large-scale deals carry a prestige premium and can help BDCs to secure their position in the competitive market of private debt investments and scale up in the future. Though we observe a skewed portfolio composition when analyzing capital allocations in terms of their fair values, BDCs originate investment deals across numerous firms. For example, a typical BDC as of 2017:Q4 holds 95 securities extended to 56 distinct portfolio firms (see Table 1). While the largest BDCs sponsor more than 200 deals, the smallest — finance less than 35 deals.

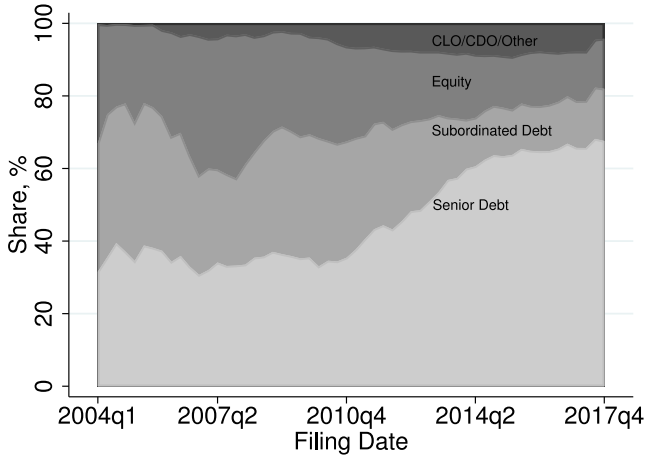


Fig. 4. BDC investment instruments. The Figure depicts the shares of different investment instruments employed by BDCs. The investment instruments include senior debt, subordinated debt, equity, structured products, and other investments. The shares are calculated based on the fair values of investments. The data are quarterly observations from 2004:Q1 to 2017:Q4.

Within the corporate structure of their borrowers, BDCs issue most commonly debt securities. As shown in Fig. 4, the share of debt investments is relatively stable throughout 2004 and 2017, fluctuating

[13] We also find the names of many firms previously funded by BDCs that are not necessarily household names. Examples of such firms are Hologic Inc (innovative medical technology firm); Celanese Corp (chemical and specialty materials); Rocket Pharmaceuticals Inc; Albany Molecular Research Inc; Novavax Inc (clinical-stage biotechnology firm); Life Technologies Corp; Alion Science and Technology Corp; Infoblox Inc (cybersecurity); InterCloud Systems Inc; Roku Inc; Amgen Inc (bio-pharmaceuticals); NRG Energy; XTO Energy; Solar City Pure Storage; and B/E Aerospace Inc.

[14] According to the definition of Hecker (2005), "[a]n industry is considered high tech if employment in technology-oriented occupations accounted for a proportion of that industry's total employment that was at least twice the 4.9–percent average for all industries".

between 60% and 80%. However, after the Financial Crisis there has been a shift in composition towards debt deals with higher seniority. Senior secured debt investments by BDCs can be viewed as an equivalent to loans originated by traditional banks. The growth in senior debt investments was predominantly at the expense of sponsoring junior and subordinated debt.

To a lesser extent, BDCs make and hold equity investments, which include common stock, preferred shares, warrants, membership and limited partnership interests. Fig. 4 shows that equity securities constitute less than 25% of all issued financial securities in terms of their fair values. When considering the number of deals, equity investments on average represent 39% of all outstanding deals as of 2010:Q4 and 32% as of 2017:Q4 (see Table 1). One of the risk-management strategies implemented by BDCs is offering a debt security bundled with a warrant. In periods when a portfolio firm defaults on its obligations, a BDC can exercise a warrant to receive a stake in the firm and acquire the control rights, thereby offsetting some of its losses on debt securities. In our sample, BDCs implement this financing strategy with around 13% of portfolio firms.

Finally, BDCs invest in structured products such as collateralized loan obligations (CLOs) and collateralized debt obligations (CDOs). However, investments through these structured products constitute only a small share of BDCs investment portfolio. Table 1 further shows that a typical BDC holds only 3%–4% of its portfolio capital in CLOs and CDOs in terms of the number of originated deals. These numbers are in line with the business objective of BDCs — to facilitate the flow of capital to middle-market firms.

Terms of BDC Debt Securities. Even though BDCs offer various financing solutions, their main investment instrument is debt securities. Examining the terms of BDC debt securities, we find that a median loan originated by BDCs is $4 million with a maturity of 5 years. BDC borrowers typically face interest rates of 8%.[15] When benchmarked against the aggregate rate on bank C&I loans, the spread comprises about 4%–5% on average.[16] This comparison is subject to a caveat that this spread does not take into account the difference in the risk profile of bank and BDC borrowers and, as such, does not necessarily imply that BDCs loans are relatively more expensive. These magnitudes are consistent with findings of Chernenko et al. (2022), who document that public middle firms face about 4%–5% higher interest rates when borrowing directly from nonbank financial intermediaries relative to traditional banks. In their analysis, the spread reduces to 2% after controlling for firm and loan characteristics. Among possible reasons why middle-market firms choose to borrow from BDCs despite the higher cost are greater flexibility in loan tailoring, quicker deal closure, and looser covenants. Since BDCs do not face any restrictions on their borrowers' loan-to-earnings ratios, they are able to provide larger loan amounts to firms with low earnings relative to banks.

BDC Capital Structure and Ownership. Unlike deposit-financed commercial banks, BDCs raise debt capital in public markets to fund their portfolio investments. First, they have access to cheap government sponsored debt financing such as SBA debentures. Second, BDCs can borrow through public debt instruments. They specialize in issuing so-called baby-bonds (i.e., bonds with face values of $25) and exchange traded notes with yields ranging from 5% to 7% per annum. Apart from the public markets, BDCs borrow from banks through revolving credit facilities and term loans (see Panel (a) of Fig. 5). Importantly, BDCs do not face a high degree of the maturity mismatch between their assets and liabilities. While a median loan originated by BDCs has a maturity of 5 years, the maturity of their liabilities fluctuates around 6–8 years for bonds and notes, 4–6 years for revolving credit, and 4 years for term loans (see Panel (b) of Fig. 5).

BDCs also raise capital in public equity markets, providing investors with the access to illiquid investments in middle-market firms. Since BDCs offer high returns on their capital allocations, the sector has attracted a large number of institutional investors. Using the 13-F disclosures, we find that among key institutional shareholders are private equity firms, mutual funds, and financial intermediaries. In a companion paper, Davydiuk et al. (2023) study the importance of BDCs' access to public equity markets for sustaining their investment activity. Panel (c) of Fig. 5 shows that a typical BDC maintains a book equity-to-assets ratio of 60%–70%, which is above 50% prescribed by the regulation prior to 2018.

3. Capital supply shocks and BDC entry

In this section, we investigate the factors that explain geographic variation in the BDC presence and drive the growth of the BDC sector. We observe in Fig. 6 that there is a substantial heterogeneity across regions in the amount of credit supplied by BDCs. For example, as of 2017:Q4 counties such as New York (NY), Harris (TX), Cook (IL), and Los Angeles (CA) received over $1.8 billion each in financing from BDCs, while firms located in South Dakota, Montana, and West Virginia had very limited access to this funding form.

In our analysis, we rely on the conjecture that BDCs filled a gap in credit supply by offering funding solutions to firms who were credit rationed by traditional banks and finance companies. Within their annual filings, BDCs often describe investing in the middle market as an attractive opportunity because the firms in this segment are "underserved" by banks and other competitors. For example, FS Investment Corporation states in their 2012 annual report:

> *"Despite the size of the [U.S. middle] market, we believe that financial difficulties and a widespread consolidation in the U.S. financial services industry have substantially reduced the number of investment firms and financial institutions lending to middle market companies".*

BDCs specifically identify stricter bank regulation as an important factor behind the reduction in bank credit supply to the middle market. This belief is also shared by investment analysts covering the BDC sector. For instance, the 2014 Wells Fargo Securities report states that "banks are showing signs of being pushed out of the market with regulation". We provide more excerpts from the BDC filings and analyst reports supporting this narrative in Appendix C.

3.1. Identification strategy

Our identification strategy relies on three contractionary shocks to the credit supply by traditional financial institutions: the introduction of stress tests for bank holding companies; the collapse of a major finance company, the CIT Group; and the introduction of new accounting standards on the consolidation of off-balance items for banks. While the CIT Group bankruptcy represents an idiosyncratic shock to lenders specializing in middle-market financing, the other two regulations constitute a sector-wide shock to the traditional banking industry. We rely on a difference-in-differences analysis to examine whether the presence of BDCs and PD funds more generally grew in counties subject to capital shocks.

The 2009 Bank Stress Tests. Following the 2007–2008 Financial Crisis, the Board of Governors of the Federal Reserve introduced new macroprudential policies to ensure that financial institutions are well-capitalized to withstand future potential economic downturns. Among the introduced measures were bank stress tests. The first test was conducted under the Supervisory Capital Assessment Program (SCAP) at the end of 2008 and was followed by the annual Comprehensive Capital Analysis and Reviews (CCARs) from 2011 onward. As a result of the SCAP, 10 out of 19 bank holding companies were required to

[15] More details on loan terms are reported in Appendix D.

[16] We compute the weighted average interest rate on C&I loans as the ratio of the aggregate sum of interest and fee income on C&I loans in domestic offices (*riad4012*) divided by the aggregate sum of average C&I loans in domestic offices (*rcon3387*).

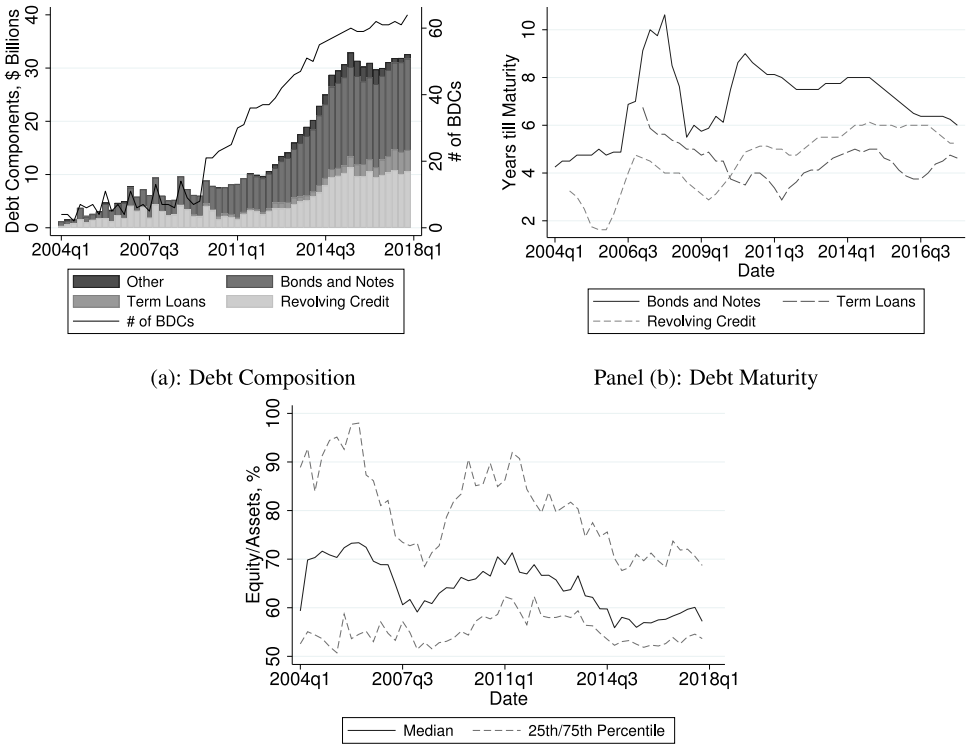


Fig. 5. Debt financing of BDCs. Panel (a) of the Figure depicts the composition of the BDC outstanding debt over time. The debt instruments include revolving credit, term loans, bonds and notes. The data on debt components are real quarterly observations expressed in billions of December 2017 dollars. For a subset of BDCs, prior to 2010 the data on outstanding debt are reported only annually. Panel (b) of the Figure depicts the cross-sectional median of the maturity of the BDCs outstanding debt securities over time. The data on debt maturity are smoothed using the four-quarter moving averages and are expressed in years. Panel (c) of The Figure depicts the cross-sectional median, 25th and 75th percentiles of a book equity-to-assets ratio across BDCs over time. The sample covers the period from 2004:Q1 to 2017:Q4.

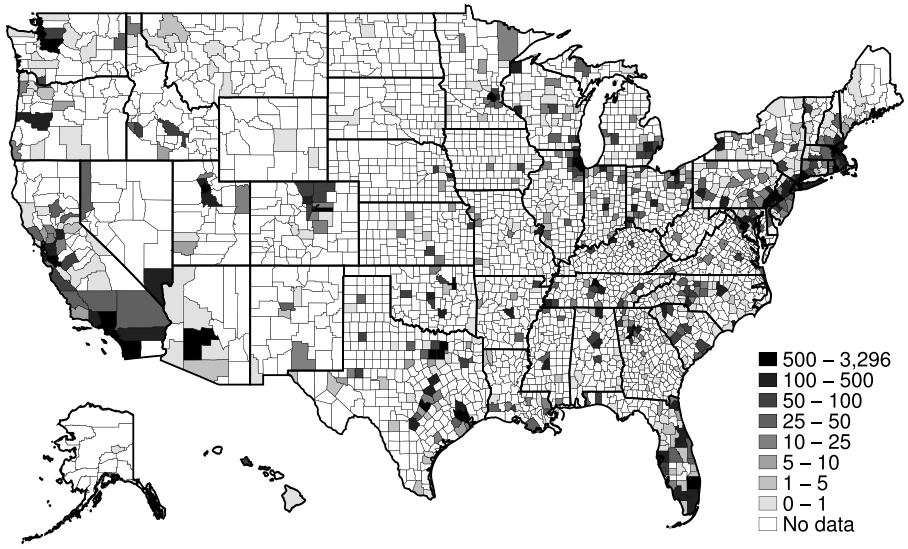


Fig. 6. Location of BDC portfolio firms. The Figure shows the snapshot of the geographical presence of BDCs' portfolio firms as of 2017:Q4. The darker areas correspond to counties with larger capital allocations and the lighter areas — with smaller capital allocations. Capital allocations are recorded at their fair values.

increase their regulatory capital (Acharya et al., 2014). Data on the SCAP results were released on April 24, 2009, while the recapitalization should have been implemented in November 2009.

Through stress tests, regulators impose a higher level of scrutiny on bank holding companies. Among other quantities, stress-tested banks are required to provide estimates of potential losses on their loan portfolios under two alternative macroeconomic scenarios and a set of indicative loss rate ranges. Under a threat of failing future stress tests, BHCs will retain more capital and choose investments with smaller regulatory risk-weights to lower loss rates under adverse scenarios. The outcome of the stress test therefore has a direct impact on BHCs' future loan originations. Acharya et al. (2018) and Gropp et al. (2018)

document that insufficient capital levels led banks to reduce their overall capital charges by shifting away from loans to risky borrowers. We argue that this contraction in bank credit provision led to a funding gap in particular for small and middle-market firms (see, e.g., Doerr, 2021). Traditionally loans to these firms are riskier than investments in large mature businesses since they are contracted with higher spreads, require more collateral, and have higher nonaccrual rates (see, e.g., Chodorow-Reich et al., 2022; Rosen and Vitanza, 2021). As a result, we conjecture that the recapitalization and loan portfolio adjustments of stress-tested banks constitutes a contractionary shock to middle-market lending.

In our analysis, we use the first implementation of the stress tests – the SCAP – as our shock, since the design and set of tested characteristics was not known to banks in advance. Even though the following CCARs included a larger group of tested institutions, the overall setup and test outcomes were more predictable. We define a bank to be treated if it participates in the SCAP, reports non-zero estimated losses on the C&I lending, and was required to recapitalize after the results' release.

To uncover the effects of this capital supply shock on the rise of private debt financing, we exploit variation in the geographical presence of treated banks across the U.S. and conduct our analysis at the county level. We rely on the FDIC Summary of Deposits to measure counties' access to financing from treated banks. Specifically, a bank is considered to be present in a given county if it has at least one branch located in this county with a strictly positive amount of deposits. We propose two measures of county-level exposure to the SCAP shock: (i) an indicator whether a county j has at least one treated bank, $D(SCAP\ Deposits_{j,2008} > 0)$, and (ii) the deposit market share of treated banks in a county j, measured as the total deposits of treated bank in a county j scaled by the total deposits of all banks in that county, $\frac{\sum_b SCAP\ Deposits_{b,j,2008}}{\sum_b Deposits_{b,j,2008}}$.

The Collapse of the CIT Group. Next, we propose to exploit a negative credit supply shock in spirit of Ivashina and Scharfstein (2010) and Chodorow-Reich (2014). Rather than using the failure of Lehman Brothers as a source of exogenous variation in the availability of credit, we tailor our identification strategy to the middle market by focusing on finance companies. Specifically, we analyze one of the largest bankruptcies among finance companies during the Great Recession — the failure of the CIT Group. The choice of the CIT Group is supported by the evidence in Edgerton (2012) and Gopal and Schnabl (2022). Using DealScan data, we further find that the share of middle-market loans among all loans originated by the CIT Group increased from about 40% to over 60% between 2001 and 2008. These figures together with the existing circumstantial evidence highlight the importance of the CIT Group financing for the middle-market firms and validates our choice of the shock.[17]

Because of its exposure to underperforming subprime mortgages and student loans and subsequent difficulties in securing short-term funding, the CIT Group had to file for bankruptcy protection on November 1, 2009. Even though it emerged from bankruptcy 38 days later, on December 10, 2009, the CIT Group lending activity started to contract much earlier in 2008. According to 10-K filings, its loan origination volume in commercial businesses was $7.0 billion in 2009, down from $18.6 billion in 2008 and well below $35.4 billion during 2007. Particularly dramatic was the drop in consumer and small business lending: $1.3 million in 2009, down from $1.4 billion in 2008 and well below $6.6 billion during 2007.[18] Importantly, even after its restructuring into a bank holding company, the CIT Group never resumed its lending activity at the pre-crisis levels: its new lending volume totaled $3.2 billion in 2011, $6.0 billion in 2012, and $7.1 billion in 2013.

Since debt markets feature borrower segmentation with finance companies serving riskier firms compared to banks (Carey et al., 1998), the bankruptcy of a finance company will have a direct effect on BDC portfolio firms.[19] Additionally, there could be an indirect effect through a capital reallocation channel: the funding that financial intermediaries could have provided to BDC portfolio firms is now reallocated to former CIT Group borrowers due to a limited credit supply. Admittedly, this indirect channel argument is applicable for our two other shocks to the banking industry as well. Overall, we expect counties with higher exposure to the CIT Group bankruptcy to experience a higher shortage of capital supply.

To capture the county-level exposure to the CIT Group failure, we propose two measures: (i) an indicator whether firms in county j have any outstanding loans from the CIT Group in the 2001–2005 period, $D(CIT\ Lending_{j,[2001,2005]} > 0)$, as reported in the DealScan syndicated loan data; and (ii) the natural logarithm of the average amount of outstanding loans to firms in county j from the CIT Group between 2001 and 2005, $Ln(\overline{CIT\ Lending}_{j,[2001,2005]})$.[20] We exclude 2006 and 2007 years when measuring the pre-crisis exposure in order to minimize the effect of the credit boom. To measure the county-level exposure, we consider all originated loans where the CIT Group is a member of the syndicate irrespective of its role.

FAS 166/167 Regulation. In 2010, the Financial Accounting Standards Board (FASB) instituted new accounting standards on the consolidation of variable interest entities (VIEs) for bank holing companies — so-called FAS 166/167. Starting from 2011:Q1, banks have been required to consolidate VIEs' off-balance sheet assets onto their balance sheets. Since the assets held by VIEs and associated loan loss reserves became treated as on-balance sheet items, the adoption of FAS 166/167 had a direct effect on the calculation of regulatory capital ratios such as leverage and risk-weighted capital ratios.

In line with previous studies, we argue that this new regulation constitutes an exogenous negative shock to bank credit supply. While Dou (2020) and Dou et al. (2018) show that VIE-consolidating banks reduced their small business lending and mortgage approval rates following the shock, we cannot document a similar decline in bank lending to middle-market firms due to the lack of the data. It is however very likely that FAS 166/167 had a negative effect on loans to middle-market firms as well. Middle-market loans are riskier than loans to large public firms and, as such, more costly in terms of risk-based capital. This conjecture aligns with the finding of Tian and Zhang (2016) that affected banks employ a flight-to-safety strategy in terms of credit card lending. VIE-consolidating banks have reduced their lending to risky borrowers, plausibly including middle-market firms, to offset the decline in the regulatory capital following the implementation of FAS 166/167 (Dou et al., 2018).

[17] For example, a November 2009 article in the New York Times noted that the CIT Group was arguing against bankruptcy because "being forced into Chapter 11 protection would spell disaster for its customers: a wide swath of the nation's small and midsize businesses who rely on the 101-year-old company for financing". (see Michael J. de la Merced, Creditors Back CIT's Bankruptcy, *New York Times*, Nov. 1, 2009). A CBS News article at the same time noted that the CIT Group was "trying to keep badly needed loans flowing to thousands of mid-sized and small businesses". (see CIT Group Files for Bankruptcy Protection, *CBS News*, Nov. 1, 2009).

[18] See Form 10-K for the fiscal year ended December 31, 2009 https://www.sec.gov/Archives/edgar/data/1171825/000089109210001036/e38085_10k.htm.

[19] Similar inferences have been drawn from the analysis of private debt placements (Denis and Mihov, 2003) and capital structure of the U.S. public firms (Colla et al., 2013). They conclude that nonbank private credit is essential in financing enterprises deemed too risky by traditional lenders.

[20] Admittedly, our measure of CIT Group exposure only serves as a proxy for their middle-market lending given that the DealScan database generally focuses on loans to large corporations. In the data, we observe that the size of a median loan extended by the CIT Group in 2001–2005 is about $100 million, which is substantially larger than a typical BDC loan of $10 million. However, there is substantial variation in loan size both for BDCs and the CIT Group, such that about 40%–50% of loans issued by the CIT are smaller than the largest BDC loan.

Table 2
Descriptive statistics: Treated vs. control counties.

(a): SCAP shock

	Treated			Control			Difference
	N	Mean	St.Dev.	N	Mean	St.Dev.	
Total employment growth, %	1621	0.30	3.23	807	0.13	2.64	0.174
Middle-market employment growth, %	1569	0.43	10.64	681	0.52	6.57	−0.090
Job creation/Total employment, %	1621	4.50	1.46	807	4.76	1.12	−0.262 ***
Job loss/Total employment, %	1621	4.41	1.34	807	4.64	1.02	−0.231 ***
Output growth, %	1600	0.56	5.16	800	1.05	3.74	−0.487 ***
Middle-market firms, %	1637	4.17	1.49	809	3.32	1.45	0.843 ***
# of bank branches per 1000 establishments	1637	16.62	11.61	801	23.91	6.49	−7.284 ***
Deposits HHI	1637	0.25	0.22	801	0.38	0.14	−0.131 ***
Average 2001–2006 HPI growth, %	1588	5.75	2.23	684	4.48	3.20	1.269 ***

(b): CIT shock

	Treated			Control			Difference
	N	Mean	St.Dev.	N	Mean	St.Dev.	
Total employment growth, %	231	−0.44	2.97	1872	−0.53	2.00	0.092
Middle-market employment growth, %	230	−0.81	8.67	1702	−0.25	3.81	−0.558
Job creation/Total employment, %	231	3.99	1.28	1872	4.56	0.58	−0.578 ***
Job loss/Total employment, %	231	4.04	1.18	1872	4.56	0.54	−0.519 ***
Output growth, %	232	−0.78	5.13	1846	−0.35	2.70	−0.430
Middle-market firms, %	236	5.34	1.46	1881	3.74	1.25	1.601 ***
# of bank branches per 1000 establishments	236	13.13	9.68	1873	19.98	3.81	−6.845 ***
Deposits HHI	236	0.19	0.18	1873	0.30	0.11	−0.102 ***
Average 2001–2006 HPI growth, %	236	6.69	2.93	1741	5.21	3.66	1.481 ***

(c): FAS 166/167 shock

	Treated			Control			Difference
	N	Mean	St.Dev.	N	Mean	St.Dev.	
Total employment growth, %	1837	−1.16	3.12	656	−1.09	2.51	−0.072
Middle-market employment growth, %	1767	−1.86	10.97	527	−1.38	6.18	−0.484
Job creation/Total employment, %	1849	4.43	1.54	658	4.68	1.17	−0.246 ***
Job loss/Total employment, %	1849	4.43	1.49	658	4.67	1.10	−0.249 ***
Output growth, %	1807	−0.10	6.04	654	0.91	3.75	−1.008 ***
Middle-market firms, %	1853	4.04	1.46	658	3.13	1.45	0.914 ***
# of bank branches per 1000 establishments	1853	17.58	12.11	650	25.60	7.37	−8.022 ***
Deposits HHI	1854	0.25	0.22	657	0.40	0.14	−0.157 ***
Average 2001–2006 HPI growth, %	1803	5.63	2.26	535	4.46	3.14	1.163 ***

The tables report the descriptive statistics for counties in the treated and control groups. The county-level outcomes are averages over the three years prior to the shock. The set of treated counties is defined in Section 3.1. The control group includes non-treated counties with BDC debt financing during the pre-shock period along with non-treated counties adjacent to them. Middle-market firms are defined as firms with the number of employees between 50 and 500. HHI stands for Herfindahl–Hirschman Index. HPI stands for House Price Index. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Using data on asset holdings of consolidated VIEs from Call Reports, we identify 53 bank holding companies that were subject to the FAS 166/167 regulation. There is a wide heterogeneity in the degree to which bank holding companies were exposed to this new regulation. While for a typical affected bank the VIEs' assets constituted 7.5% of total assets, the exposure of banks ranges between less than 1% to over 50%. Similar to the SCAP shock, we identify treated counties as those with presence of treated banks. Specifically, we construct the following two measures to capture the counties' exposure to the shock: (i) an indicator whether a county j have at least one treated bank, $D(Deposits_{j,2010} > 0)$, and (ii) the deposit market share of treated banks in a county j, measured as the total deposits of treated bank in a county j scaled by the total deposit of all banks in that county, $\frac{\sum_b FAS\ Deposits_{b,j,2010}}{\sum_b Deposits_{b,j,2010}}$.

3.2. BDC entry following capital supply shocks

The first step of our analysis is to establish that the growth of BDCs is concentrated in areas with the contraction in credit supply either by finance companies or traditional banks. Specifically, we estimate:

$$y_{j,t} = \beta Post_t \times Treated_j^{(k)} + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}, \qquad for\ k \in \{i, c\} \quad (1)$$

where the dependent variable is either $D(BDC\ Investment_{j,t} > 0)$, an indicator that equals one if a county j in quarter t has a non-zero debt investment amount by BDCs, or $BDC\ Investment_{j,t}$, the dollar amount of BDC debt investments in county j in quarter t expressed in millions.[21,22] $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, (ii) 2010:Q1 for the CIT shock, and (iii) 2011:Q1 for the FAS 166/167 shock. To capture the treatment effect, we restrict our sample period to three years before and five years after the shock. We use two measures of county-level exposure to treatment: an indicator variable $Treated_j^{(i)}$ and a continuous variable $Treated_j^{(c)}$ as defined in Section 3.1. Our control group is comprised of (i) non-treated counties with BDC debt financing; and (ii) non-treated counties adjacent to counties with BDC debt financing. Focusing on adjacent counties allows us to better account for differences in economic conditions across the U.S. geographical regions.

Our difference-in-differences approach captures the causal effect of the capital supply shock on the entry of BDCs provided that the

[21] We estimate our regressions using the BDC investment amount in levels rather than the natural logarithm or growth rate of the BDC investment amount. Provided that a large fraction of control counties have zero capital allocation by BDCs, the natural logarithm and growth rates of the BDC investment amount are not well defined.

[22] In our analysis, we focus on debt investments by BDCs. We continue to find nearly identical results if we include both equity and debt investments (untabulated for brevity).

Table 3
BDC entry following credit supply shock.

(a): BDC presence

	SCAP		CIT		FAS 166/167		Stacked
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × Treated$^{(i)}$	0.023***		0.055***		0.038***		0.035***
	(0.002)		(0.007)		(0.002)		(0.002)
Post × Treated$^{(c)}$		0.028***		0.008***		0.085***	
		(0.007)		(0.001)		(0.006)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	No
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	No
County-Cohort FE	No	No	No	No	No	No	Yes
Time-Cohort FE	No	No	No	No	No	No	Yes
R^2	0.72	0.72	0.72	0.72	0.72	0.72	0.72
N	76 078	76 078	65 933	65 933	78 142	78 142	220 153

(b): BDC investment amount

	SCAP		CIT		FAS 166/167		Stacked
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × Treated$^{(i)}$	5.255***		41.399***		9.113***		12.841***
	(0.252)		(1.879)		(0.327)		(0.363)
Post × Treated$^{(c)}$		17.222***		9.964***		46.402***	
		(1.216)		(0.501)		(2.020)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	No
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	No
County-Cohort FE	No	No	No	No	No	No	Yes
Time-Cohort FE	No	No	No	No	No	No	Yes
R^2	0.75	0.75	0.74	0.75	0.73	0.74	0.74
N	76 078	76 078	65 933	65 933	78 142	78 142	220 153

The tables report the estimated coefficients from the difference-in-differences regression:
$y_{j,t} = \beta Post_t \times Treated_j^{(k)} + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}, \quad k \in \{i, c\}$.
The dependent variable is (i) an indicator that equals one if a county j in quarter t has a non-zero debt investment amount by BDCs in Panel (a), and (ii) the dollar amount of BDC debt investments in county j in quarter t expressed in millions in Panel (b). $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, (ii) 2010:Q1 for the CIT shock, and (iii) 2011:Q1 for the FAS 166/167 shock. The set of treated counties and treatment intensity are defined in Section 3.1. The control group includes non-treated counties with BDC debt financing during the pre-shock period along with non-treated counties adjacent to them. The sample covers the period three years before and five years after the shock. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

following assumptions hold. First, the capital supply shocks were not anticipated. Second, we require that there exist no factors that make the treated and control counties systematically different and cannot be controlled for. Finally, absent the shock the change in the average outcomes for treated counties would not have been different than the change in the average outcomes for the untreated counties — parallel trend assumption.

Table 2 reports the counties' characteristics across the two groups prior to the shock. We find that regardless of the shock, treated counties on average have a lower job creation and job loss intensity, a higher share of middle-market firms (defined as firms with the number of employees between 50 and 500), a lower number of bank branches per 1000 establishments, exhibit a higher level of bank competition (measured by the deposits Herfindahl–Hirschman Index (HHI)), and had a higher house price growth in the pre-crisis period than control counties. There are no statistical differences in total and middle-market employment growth between the treated and control groups. For SCAP and FAS 166/167 shocks, we also find treated counties on average have a lower output growth than control counties. We control for the full set of observable characteristics presented in Table 2 to alleviate concerns about these systematic differences among counties in treated and control groups. In order to account for unobservable time-invariant county-specific characteristics and common time trends, we include time and county fixed effects. As an alternative method to address potential systematic differences between treated and control counties, we conduct our analysis with a matched control group constructed using a propensity score matching algorithm. All conclusions continue to be valid (see Appendix E.1).

The regression estimates of (1) are reported in Table 3. The coefficient of interest is β, which captures the average change in BDC presence and debt investments following the capital supply shock for the treated group of counties relative to the control group. We find that following the capital supply shock exposed counties have a 2%–6% higher presence of BDCs than counties in the control group. We additionally document a positive and statistically significant effect when we account for the treatment intensity based on continuous measures of counties' exposure to the shocks. For example, for the FAS 166/167 shock a 1% increase in the market share of treated banks leads to a 8.5% higher presence of BDCs in treated relative to control counties following the adoption of new regulation. As shown in Panel (b) of Table 3, we continue to find a positive and statistically significant effect when analyzing the debt investment volumes by BDCs. For example, following the FAS 166/167 shock BDCs allocate on average $9.1 million more debt capital to a treated county relative to a control one. To corroborate our findings, we additionally estimate a specification combining all three capital shocks together similar in spirit to the methodology of Gormley and Matsa (2011) and continue to find similar patterns.

To formally test that the entry of BDCs in the treated and control counties have evolved in parallel prior to the contractionary credit shock, we estimate the following regression specification:

$$y_{j,t} = \sum_t \gamma_t \left(\lambda_t \times Treated_j^{(i)} \right) + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}, \tag{2}$$

where λs are post-quarter dummies. For each quarter t in our sample period, we set λ_t to one in quarter t and zero otherwise. Importantly, we exclude dummies for the last quarter before the shock, which allows us to estimate the dynamics of the treatment relative to this reference period. Fig. 7 plots the coefficient estimates of γ along with the 95%

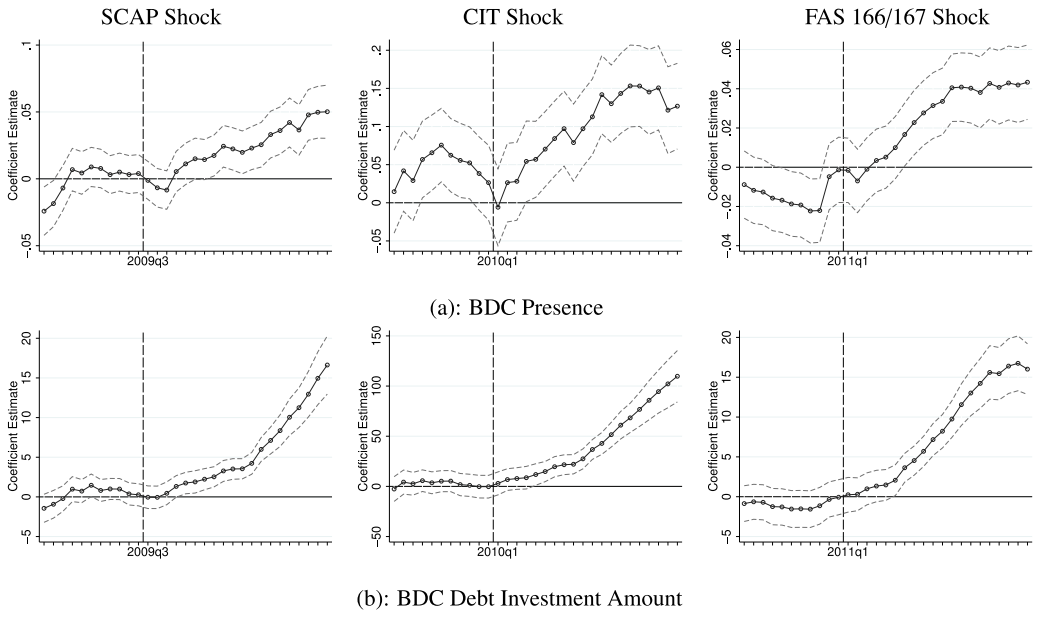


Fig. 7. Parallel trends for BDC presence and debt investment amount. The figures depict the coefficient estimates of γs along with the 95% confidence intervals from the following panel regression: $y_{j,t} = \sum_t \gamma_t \left(\lambda_t \times Treated_j^{(i)}\right) + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}$, where the dependent variable is (a) an indicator that equals one if a county j in quarter t has a non-zero debt investment amount by BDCs, and (b) the dollar amount of BDC debt investments in county j in quarter t expressed in millions. λs are post-quarter dummies: for each quarter t in the sample period, λ_t is set to one in quarter t and zero otherwise. Dummies for the last quarter before the shock are excluded.

confidence intervals for BDC presence and debt investment amounts. For the SCAP and CIT capital supply shocks, we document parallel trends in the presence of BDCs prior to the shock: there were no significant differences in the presence of BDCs between the treated and control group. In line with our conjecture, we find a rise in the BDC entry among exposed counties relative to the treated group following the shocks, with the effect becoming stronger over time. For the FAS 166/167 shock, we observe a large significant effect after the adoption of new standards on assets' consolidation, with mild pre-shock differences in the number of present BDCs. Given that the FAS 166/167 shock occurred after the SCAP and CIT shocks, the pre-FAS-shock differences can be driven in part by the BDC entry following the first two capital supply shocks. For example, a control county for the FAS 166/167 shock could have been a treated county for the CIT shock with BDC entry. For BDC debt investment amounts, the parallel trend assumption holds for all three capital supply shocks (see Panel (b) of Fig. 7). We continue to find no significant pre-trends if we use the continuous measure of the treatment (unreported for brevity).

Overall, our results confirm our hypothesis that BDCs tend to target the areas that experience shortages in capital supply suggesting that BDC capital can act as a substitute source of financing for loans originated by traditional lenders. Due to lack of data on middle-market loans, we cannot assess the magnitude of the decline in capital supply provided by banks and finance companies to BDC-funded firms. However, our findings are in line with the evidence of a substitution channel in Gopal and Schnabl (2022), who highlight the importance of finance companies and FinTech lenders in the recovery of small businesses in the aftermath of the Financial Crisis.

3.3. PD fund entry following capital supply shocks

In our main analysis, we focus on financing provided by BDCs due to the richness of the available data. At the same time, BDCs are a part of the larger private debt space rapidly growing over the recent decade (see Fig. 2). We therefore expect that PD funds follow similar investment strategies as BDCs.

To test whether PD funds, similarly to BDCs, enter markets subject to credit shortages by traditional lenders, we rely on the data available via Preqin and compare geographic presence of portfolio firms financed by BDCs and PD funds. We find a significant overlap in the county-level presence of the two investor types as measured both in terms of dollar volume and number of deals. For example, as of 2014 year end 54% of counties served by BDCs also received financing from PD funds. Further, we reestimate the difference-in-differences regression (1) for PD funds. In Table 4, we document that private debt funds are more likely to invest in counties with shortages in credit supply by traditional lenders. The results are even stronger than for BDCs both in terms of the propensity to enter and investment amounts. While this analysis is interesting and important in itself, it requires a number of assumptions due to the data limitations (see Appendix E.2). Nevertheless, our results are indicative of the rise of PD funds driven by the pullback of traditional lenders.

3.4. Effect of bank competition on BDC entry

We expect that BDCs are more likely to enter markets with low presence of regional banks, since they will face lower competition from arm's length lenders in these areas. Incumbent local banks may deter new lenders by offering better monitoring and cheaper financing. To this end, we explore the BDC entry among counties with different local banking structure focusing on the SCAP and FAS 166/167 shocks. We follow Mian and Sufi (2014) to classify counties into those predominantly served by local banks and those with high presence of national banks. For each bank, we first compute its share of deposits allocated across counties. Then, for each county j, we calculate the weighted average of these deposit shares over the banks located in the county, using the bank's dollar amounts of deposits as weights, — $Local\ Banking_j^{(c)}$. We also create an indicator variable $Local\ Banking_j^{(i)}$ that equals one if the $Local\ Banking_j^{(c)}$ for county j is above the cross-sectional median level in the year prior to the shock. A local banking county is therefore served by banks with a large fraction of their overall deposits concentrated in that county. To test our hypothesis that BDCs

Table 4
PD presence following credit supply shock.

(a): PD presence						
	SCAP		CIT		FAS 166/167	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated$^{(i)}$	0.074***		0.187***		0.051***	
	(0.002)		(0.007)		(0.002)	
Post × Treated$^{(c)}$		0.143***		0.034***		0.141***
		(0.008)		(0.001)		(0.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.69	0.69	0.73	0.73	0.76	0.76
N	65 692	65 692	47 609	47 609	68 650	68 650
(b): PD investment amount						
	SCAP		CIT		FAS 166/167	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated$^{(i)}$	278.410***		1317.688***		177.956***	
	(13.297)		(70.508)		(10.335)	
Post × Treated$^{(c)}$		851.097***		320.048***		1022.846***
		(80.842)		(18.722)		(68.381)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.79	0.79	0.83	0.83	0.82	0.82
N	65 692	65 692	47 609	47 609	68 650	68 650

The tables report the estimated coefficients from the difference-in-differences regression: $y_{j,t} = \beta Post_t \times Treated_j + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}$. The dependent variable is (i) an indicator that equals one if a county j in quarter t has at least two investment deals by PD funds in Panel (a), and (ii) the dollar amount of PD investments in county j in quarter t expressed in millions in Panel (b). $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, (ii) 2010:Q1 for the CIT shock, and (iii) 2011:Q1 for the FAS 166/167 shock. The set of treated counties is defined in Section 3.1. The control group includes non-treated counties with PD financing during the pre-shock period along with non-treated counties adjacent to them. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 5
BDC investment in counties with local and national banking.

	SCAP		FAS 166/167	
	(1)	(2)	(3)	(4)
Post × Treated$^{(i)}$	7.034***	4.916***	11.961***	8.800***
	(0.374)	(0.240)	(0.472)	(0.321)
Post × Local Banking$^{(i)}$	0.387***		0.691***	
	(0.114)		(0.137)	
Post × Treated$^{(i)}$ × Local Banking$^{(i)}$	−4.012***		−6.215***	
	(0.484)		(0.641)	
Post × Local Banking$^{(c)}$		0.327		1.386***
		(0.245)		(0.311)
Post × Treated$^{(i)}$ × Local Banking$^{(c)}$		−8.853***		−14.057***
		(0.915)		(1.404)
Controls	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.75	0.75	0.73	0.73
N	76 060	76 060	78 142	78 142

The tables report the estimated coefficients from the triple difference regression: $y_{j,t} = \beta_1 Post_t \times Treated_j^{(i)} + \beta_2 Post_t \times Local\ \ Banking_j^{(k)} + \beta_3 Post_t \times Treated_j^{(i)} \times Local\ Banking_j^{(k)} + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}$, for $k \in \{i, c\}$.
The dependent variable is the dollar amount of BDC debt investments in county j in quarter t expressed in millions. $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, and (ii) 2011:Q1 for the FAS 166/167 shock. $Local\ Banking_j^{(i)}$ is a dummy variable that equals one if a county j has the above median presence of local banks, and $Local\ Banking_j^{(c)}$ is the deposit share of local banks in county j. The set of treated counties is defined in Section 3.1. The control group includes non-treated counties with BDC debt financing during the pre-shock period along with non-treated counties adjacent to them. The sample covers the period three years before and five years after the shock. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

are more likely to enter markets with low presence of local banks, we estimate the following triple difference specification:

$$\begin{aligned} y_{j,t} = {} & \beta_1 Post_t \times Treated_j^{(i)} + \beta_2 Post_t \times Local\ Banking_j^{(k)} \\ & + \beta_3 Post_t \times Treated_j^{(i)} \times Local\ Banking_j^{(k)} \\ & + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t},\ for\ k \in \{i, c\}. \end{aligned} \tag{3}$$

For ease of interpretation and exposition, we only consider an indicator variable of county treatment. The estimation results are presented in Table 5. In line with our conjecture, we find that affected counties served predominantly by local banks experience a lower level of BDC investments relative to affected national banking counties following the shock as captured by negative and statistically significant β_3 coefficient. We also find similar effects when using the continuous measure of bank competition. Our findings suggest that BDC not only enter counties experiencing shortages in capital supply but also take into account the level of bank competition in the area and, more specifically, the presence of arm's length lenders.

3.5. BDC investment in innovation

Recall that BDCs tend to invest in firms with high expected growth potential similar to other private capital providers. We therefore formally test whether BDCs allocate more capital to high-tech and high-R&D-intensive counties by estimating the following triple difference specification:

$$\begin{aligned} BDC\ Investment_{j,t} = {} & \beta_1 Post_t \times Treated_j^{(i)} + \beta_2 Post_t \times e_j^{(k)} \\ & + \beta_3 Post_t \times Treated_j^{(i)} \times e_j^{(k)} \\ & + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}, \quad k \in \{i, c\} \end{aligned} \tag{4}$$

Table 6
BDC investment in high-tech and high-R&D-intensive counties.

(a): High-tech counties

	SCAP		CIT		FAS 166/167	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated$^{(i)}$	−0.067	4.301***	−1.892**	15.770***	−0.097	7.817***
	(0.093)	(0.218)	(0.889)	(1.486)	(0.095)	(0.290)
Post × High-Tech County$^{(i)}$	0.514***		1.817***		0.890***	
	(0.129)		(0.158)		(0.185)	
Post × Treated$^{(i)}$ × High-Tech County$^{(i)}$	8.744***		48.383***		15.358***	
	(0.449)		(2.332)		(0.602)	
Post × High-Tech County$^{(c)}$		0.025***		0.111***		0.016*
		(0.007)		(0.015)		(0.008)
Post × Treated$^{(i)}$ × High-Tech County$^{(c)}$		1.135***		5.722***		1.866***
		(0.071)		(0.352)		(0.096)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.74	0.74	0.73	0.74	0.74	0.74
N	73 904	73 904	63 934	63 934	76 062	76 062

(b): High-R&D-intensive counties

	SCAP		CIT		FAS 166/167	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated$^{(i)}$	0.102	4.910***	−2.953***	35.426***	−0.367***	8.474***
	(0.083)	(0.247)	(0.724)	(1.966)	(0.091)	(0.319)
Post × R&D County$^{(i)}$	0.801***		1.774***		0.501***	
	(0.137)		(0.159)		(0.192)	
Post × Treated$^{(i)}$ × R&D County$^{(i)}$	8.164***		49.868***		15.526***	
	(0.443)		(2.284)		(0.594)	
Post × R&D County$^{(c)}$		0.008		0.097***		−0.004
		(0.007)		(0.014)		(0.008)
Post × Treated$^{(i)}$ × R&D County$^{(c)}$		0.676***		2.855***		1.220***
		(0.049)		(0.384)		(0.076)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.74	0.74	0.73	0.73	0.74	0.74
N	73 904	73 904	63 934	63 934	76 062	76 062

The tables report the estimated coefficients from the triple difference regression:
$y_{j,t} = \beta_1 Post_t \times Treated_j^{(i)} + \beta_2 Post_t \times e_j^{(k)} + \beta_3 Post_t \times Treated_j^{(i)} \times e_j^{(k)} + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}$, for $k \in \{i, c\}$.
The dependent variable in each regression is the dollar amount of BDC debt investments in county j in quarter t expressed in millions. $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, and (ii) 2011:Q1 for the FAS 166/167 shock. $e_j^{(i)}$ is a dummy variable that equals one if a county j has the above median employment share in high-tech and high-R&D-intensive industries in Panels (a) and (b), respectively. $e_j^{(c)}$ is the employment share in high-tech and high-R&D-intensive industries in Panels (a) and (b), respectively. The set of treated counties is defined in Section 3.1. The control group includes non-treated counties with BDC debt financing during the pre-shock period along with non-treated counties adjacent to them. The sample covers the period three years before and five years after the shock. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

where $e_j^{(k)}$, $k \in \{i, c\}$ represents an indicator and continuous measures of the prevalence of innovative firms in county j. Specifically, we compute $e_j^c = High\text{-}Tech\ County_j^{(c)}$ as the share of employment in high-tech industries based on the classification method described in Section 2. We also consider an indicator variable $e_j^i = High\text{-}Tech\ County_j^{(i)}$ that equals to one if the $High\text{-}Tech\ County_j^{(c)}$ for county j is above the cross-sectional median level in one year prior to the shock. We construct $R\&D\ County_j^{(c)}$ and $R\&D\ County_j^{(i)}$ in a similar manner based on the share of employment in high-R&D-intensive industries.

In line with our descriptive evidence, we document that BDCs allocate more capital in high-tech and high-R&D-intensive counties across all three shocks. As shown in Panel (a) of Table 6, following the SCAP shock among treated counties BDCs allocate on average $8.7 million more debt capital to a high-tech county than to non-high-tech county. The comparable estimates for the CIT and FAS 166/167 shocks are $48.4 million and $15.4 million. At the same time, we find no differential capital allocation by BDCs between the treated and control groups among non-high-tech counties. The exception is the CIT shock, for which we document a negative effect, though not economically significant. For the continuous measure of the prevalence of innovative firms, we document that among treated counties a 1 percentage increase in the share of employment in high-tech industries leads to $1.1–$5.7 million increase in debt capital allocated by BDCs. We find very similar results both qualitatively and quantitatively when examining BDC investments between low- and high-R&D-intensive counties (see Panel (b) of Table 6).

Our findings suggest that BDC debt investments can be particularly well-suited for firms active in high-tech and high-R&D-intensive industries. Therefore, we argue that BDCs are important for promoting innovation and economic growth.

4. Importance of BDC financing

In this section, we analyze the effects on firms employment growth and patenting activity from having access to BDC financing. For identification, we continue to exploit our three capital supply shocks described in Section 3.

4.1. Employment and patenting dynamics of portfolio firms

To assess whether BDC investments have real effects on their portfolio firms, we first implement an event study design around investment

Table 7
Firm outcomes and BDC financing: Event-study analysis.

(a): Employment growth					
	h = 4	h = 6	h = 8	h = 12	Placebo
$\mathbb{1}\left\{t \geq t_f^*\right\}$	0.901***	1.084***	1.197***	0.800*	
	(0.281)	(0.360)	(0.396)	(0.418)	
$\mathbb{1}\left\{t \geq t_f^* - 8\right\}$					0.469
					(0.364)
Investment Qtr FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.626	0.587	0.555	0.506	0.545
N	7100	8674	10 256	13 412	9633
(b): Patenting propensity					
	h = 4	h = 6	h = 8	h = 12	Placebo
$\mathbb{1}\left\{t \geq t_f^*\right\}$	−0.000	0.010	0.020*	0.021*	
	(0.013)	(0.012)	(0.011)	(0.011)	
$\mathbb{1}\left\{t \geq t_f^* - 8\right\}$					−0.001
					(0.011)
Investment Qtr FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.737	0.731	0.726	0.700	0.698
N	7681	9385	11 097	14 513	11 097

The tables report the estimated coefficients from the firm-level regression:
$y_{f,k,t,t^*} = \beta_h \mathbb{1}\left\{t \geq t_f^*\right\} + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*}$ *for* $h \in \{4, 6, 8, 12\}$.
The dependent variable is (a) the employment growth and (b) the natural logarithm of one plus the number of patents filed by a firm f in an industry k in a quarter t with an investment quarter t^*. $\mathbb{1}\left\{t \geq t_f^*\right\}$ is an indicator variable which equals one for quarters following the BDC investment quarter in a firm f, and zero otherwise. In columns (1)–(4), the sample period includes four quarters prior to the investment date and $h \in \{4, 6, 8, 12\}$ quarters after the investment date for each firm f. The specification *Placebo* in the rightmost column is similar to the specification $h = 8$ with the sample period and investment date shifted backwards by eight quarters. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 8
Firm outcomes and BDC financing: Staggered difference-in-differences analysis.

	Employment growth		Patenting	
	Main	Placebo	Main	Placebo
$\mathbb{1}\left\{t - t_f^* = -4\right\}$	−0.191	−0.207	0.004	0.003
	(0.233)	(0.309)	(0.015)	(0.012)
$\mathbb{1}\left\{t - t_f^* = -3\right\}$	−0.023	−0.608	0.009	−0.014
	(0.413)	(0.523)	(0.018)	(0.017)
$\mathbb{1}\left\{t - t_f^* = -2\right\}$	−0.106	−0.876	0.002	−0.016
	(0.607)	(0.728)	(0.022)	(0.021)
$\mathbb{1}\left\{t - t_f^* = -1\right\}$	−0.003	−1.057	0.004	−0.002
	(0.801)	(0.935)	(0.026)	(0.026)
$\mathbb{1}\left\{t - t_f^* = 0\right\}$	0.683**	−0.066	0.006	−0.012
	(0.329)	(0.298)	(0.013)	(0.012)
$\mathbb{1}\left\{t - t_f^* = +1\right\}$	0.841*	−0.193	0.021	0.001
	(0.460)	(0.435)	(0.015)	(0.014)
$\mathbb{1}\left\{t - t_f^* = +2\right\}$	0.532	−0.432	0.021	−0.017
	(0.581)	(0.564)	(0.018)	(0.016)
$\mathbb{1}\left\{t - t_f^* = +3\right\}$	0.350	−0.813	0.049**	−0.023
	(0.713)	(0.696)	(0.019)	(0.019)
$\mathbb{1}\left\{t - t_f^* = +4\right\}$	0.266	−1.050	0.033	−0.018
	(0.849)	(0.816)	(0.022)	(0.021)
Investment Qtr FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
N	8357	6436	10 240	10 240

The tables report the estimated coefficients from the difference-in-differences regression with staggered treatment adoption:
$y_{f,k,t,t^*} = \sum_{m=-4}^{m=+4} \beta_m \mathbb{1}\left\{t - t_f^* = m\right\} + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*}$,
The dependent variable is (a) the employment growth and (b) the natural logarithm of one plus the number of patents filed by a firm f in an industry k in a quarter t with an investment quarter t^*. t_f^* is the BDC investment quarter in firm f. m is the number of quarters relative to the investment date. The indicator variables $\mathbb{1}\left\{t - t_f^* = m\right\}$ are leads and lags of the investment date indicator. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

dates. Specifically, we estimate the following regression specification

$$y_{f,k,t,t^*} = \beta_h \mathbb{1}\left\{t \geq t_f^*\right\} + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*} \quad for\ h \in \{4, 6, 8, 12\} \quad (5)$$

where the dependent variable y_{f,k,t,t^*} is either a firm-level employment growth or the natural logarithm of one plus the number of patents filed by a firm f in an industry k in a quarter t with an investment quarter t_f^*. $\mathbb{1}\left\{t \geq t_f^*\right\}$ is an indicator variable which equals one for quarters following the BDC debt investment quarter in a firm f and zero otherwise. For each firm, we include four quarters prior to the investment date as the pre-investment period. β_h measures the relative change in the outcome of interest following the BDC financing for the post-investment period of $h \in \{4, 6, 8, 12\}$ quarters. We saturate regressions with numerous fixed effects. In particular, we include firm and time fixed effects to account for unobservable time-invariant firm-specific characteristics and common trends in the firms' fundamentals. We further control for the cohort effects by including investment-quarter fixed effects and for industry-specific shocks by including industry-year fixed effects.

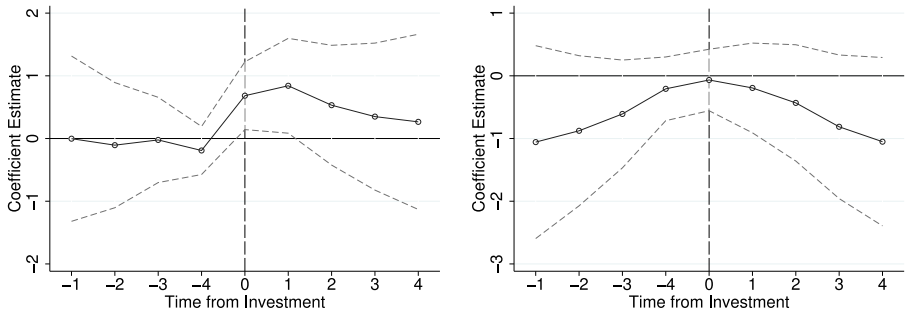
Table 7 reports the estimation results of regression (5). As shown in Panel (a), we find that BDC financing allows firms to increase their employment growth by 0.8%–1.2% per annum relative to the employment growth in the pre-investment period. This positive effect is present one year after the investment date and persists for another two years. Panel (b) demonstrates a positive effect of BDC financing on firms' patenting activity, however this effect appears only two years after the investment date. This delayed effect on patents is in line with the notion that innovation activity has a longer cycle than hiring. Specifically, BDC-funded firms file 2% more patents per quarter after receiving the financing. This coefficient estimate represents about a 10% increase from the average patenting frequency by firms in our sample in the pre-investment period.

One possible concern with the above estimation is that the observed real effects are due to BDC strategy to target firms with steady employment growth or patenting activity. To alleviate this issue, we conduct a placebo test by shifting the investment date by eight quarters backwards. The corresponding estimation results with $h = 8$ are reported in the rightmost column of Table 7. We find no significant effect both for employment growth and patenting frequency by BDC-funded firms.

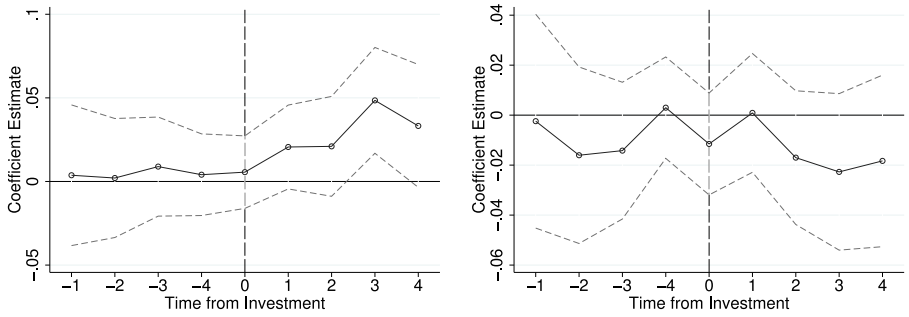
In an ideal thought experiment, we would compare growth of two identical firms following the BDC investment, where one of the firms receives BDC funding and the other one does not. Since data on private firms' fundamentals is scarce or stale, such an experiment is challenging in practice . However, we can rely on BDC-funded firms prior to receiving the BDC investment to construct a control group for firms that have already obtained BDC funding. Specifically, we implement a difference-in-differences design with staggered investments following the methodology of Borusyak et al. (2024). In such a specification, we compare the outcomes of interest for firms that received BDC investment relative to firms that have not yet received BDC funding. More formally, we estimate

$$y_{f,k,t,t^*} = \sum_{m=-4}^{m=+4} \beta_m \mathbb{1}\left\{t - t_f^* = m\right\} + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*}, \quad (6)$$

where t_f^* is the BDC investment date in firm f and m is the number of quarters relative to the investment date. Quarters preceding the investment date correspond to $m < 0$, and $m > 0$ corresponds to quarters after the investment date. The indicator variables $\mathbb{1}\left\{t - t_f^* = m\right\}$ are



(a): Employment Growth



(b): Patenting Propensity

Fig. 8. Parallel trends for employment and patenting dynamics. The figures depict the coefficient estimates of βs along with the 90% confidence intervals from the following regression: $y_{f,k,t,t^*} = \sum_{m=-4}^{m=+4} \beta_m \mathbb{1}\left\{t - t_f^* = m\right\} + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*}$, where the dependent variable is (a) the employment growth and (b) the natural logarithm of one plus the number of patents filed by a firm f in an industry k in a quarter t with an investment quarter t^*. t_f^* is the BDC investment date in firm f. m is the number of quarters relative to the investment date. The indicator variables $\mathbb{1}\left\{t - t_f^* = m\right\}$ are leads and lags of the investment date indicator. The left column of figures corresponds to the main specification, while the right column of figures correspond to the placebo specification where the investment date is shifted by eight quarters backwards.

leads and lags of the investment date indicator and as such coefficients β_m capture the dynamic investment effects.

The estimation results of regression (6) are presented in Table 8. In line with our previous findings, we observe a positive effect of BDC financing on firm employment growth (see Panel a). Specifically, we document a significant employment growth of 0.7% at the investment quarter and of 0.8% in the quarter thereafter. Importantly, we do not detect any significant pre-investment trends in employment growth (see Panel (a) of Fig. 8). For patenting activity, we observe a similar delayed effect of BDC funding as in the event study analysis with a significant positive effect of 4.9% in the third quarter after the investment date. Panel (b) of Fig. 8 demonstrates that there are no significant pre-investment trends in patenting frequency. To further validate our findings, we implement a placebo test where we shift the investment date by eight quarters backwards. As shown in the "Placebo" columns of Table 8 and Fig. 8, we find no significant effects and occasionally negative coefficient estimates both for firm employment growth and patenting frequency. Overall, our results are comparable across the event study and staggered difference-in-differences designs.

BDC Managerial Assistance. Recall that as part of their regulatory status BDCs are required to provide substantial managerial assistance to their portfolio firms. To assess whether such managerial assistance plays any role for firms' growth, we estimate the following firm-level regression:

$$\begin{aligned} y_{f,k,t,t^*} = {} & \beta_{1,h} \mathbb{1}\left\{t \geq t_f^*\right\} + \beta_{2,h} \mathbb{1}\left\{t \geq t_f^*\right\} Manager\ Attention_{f,t^*} \\ & + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*}, \end{aligned} \tag{7}$$

where we proxy for the degree of managerial assistance with the inverse of the number of firms in the BDC portfolio. Arguably, the assistance degree will depend on how many other firms are under guidance and supervisory support of a lender. In particularly, the variable $Manager\ Attention_{f,t^*}$ is defined as the inverse of the number of firms in the portfolio of the BDC when it initiates an investment in a firm f. If a firm receives an investment from multiple BDCs in the same quarter, we take the average value of the number of firms across the BDCs' portfolios. For ease of interpretation, we standardize the $Manager\ Attention$ variable by subtracting its mean and scaling by its standard deviation. As shown in Table 9, a one standard deviation increase in the degree of managerial assistance above its mean is associated with a 0.3%–0.4% higher firm employment growth following the BDC investment. These positive and statistically significant coefficient estimates indicate that manager supervision is an important source of added value for portfolio firms.[23] Furthermore, these results highlight a unique mechanism through which BDCs contribute to firm growth.

BDC vs. PD Financing. To draw a comparison between the role of BDC and PD financing for firm growth, we additionally hand-collect employment data from Preqin for PD-funded middle-market firms. We next estimate the following regression specification:

$$\begin{aligned} \Delta emp_{f,k,t,t^*} = {} & \beta_{1,h} \mathbb{1}\left\{t \geq t_f^*\right\} + \beta_{2,h} \mathbb{1}\left\{t \geq t_f^*\right\} BDC\ Funded_f \\ & + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,\tilde{t}} + \varepsilon_{f,k,t,t^*}, \end{aligned} \tag{8}$$

for $h \in \{4, 6, 8, 12\}$. $BDC\ Funded_f$ is an indicator variable which equal one if a firm f receives financing from BDCs and zero if a firm f

[23] In untabulated results, we find no effect of managerial assistance on firm patenting frequency. Arguably, BDC manager supervision would have less effect on firm innovation and R&D activity.

Table 9
Firm employment growth and BDC managerial assistance.

	h = 4	h = 6	h = 8	h = 12	Placebo
$\mathbb{1}\left\{t \geq t_f^*\right\}$	0.909***	1.102***	1.220***	0.825**	
	(0.281)	(0.360)	(0.396)	(0.419)	
$\mathbb{1}\left\{t \geq t_f^*\right\}$ × Manager Attention	0.331	0.426*	0.436*	0.404*	
	(0.229)	(0.221)	(0.234)	(0.231)	
$\mathbb{1}\left\{t \geq t_f^* - 8\right\}$					0.464
					(0.364)
$\mathbb{1}\left\{t \geq t_f^* - 8\right\}$ × Manager Attention					−0.129
					(0.243)
Investment Qtr FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.626	0.588	0.556	0.506	0.545
N	7100	8674	10 256	13 412	9633

The tables report the estimated coefficients from the firm-level regression: $y_{f,k,t,t^*} = \beta_{1,h}\mathbb{1}\left\{t \geq t_f^*\right\} + \beta_{2,h}\mathbb{1}\left\{t \geq t_f^*\right\} Manager\ Attention_{f,t^*} + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,i} + \varepsilon_{f,k,t,t^*}$, for $h \in \{4, 6, 8, 12\}$.
The dependent variable is the employment growth of a firm f in an industry k in a quarter t with an investment quarter t^*. $\mathbb{1}\left\{t \geq t_f^*\right\}$ is an indicator variable which equals one for quarters following the BDC investment quarter in a firm f, and zero otherwise. $Manager\ Attention_{f,t_f^*}$ is the inverse of the number of firms in the portfolio of the BDC when it initiates an investment in a firm f. We standardize the *Manager Attention* variable by subtracting its mean and scaling by its standard deviation. In columns (1)–(4), the sample period includes four quarters prior to the investment date and $h \in \{4, 6, 8, 12\}$ quarters after the investment date for each firm f. The specification *Placebo* in the rightmost column is similar to the specification $h = 8$ with the sample period and investment date shifted backwards by eight quarters. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 10
Firm employment growth and PD financing: Event-study analysis.

	h = 4	h = 6	h = 8	h = 12	Placebo
$\mathbb{1}\left\{t \geq t_f^*\right\}$	0.724	1.189**	1.408***	1.228**	
	(0.452)	(0.503)	(0.525)	(0.521)	
$\mathbb{1}\left\{t \geq t_f^*\right\}$ × BDC Funded	0.195	−0.029	−0.160	−0.496	
	(0.617)	(0.648)	(0.664)	(0.656)	
$\mathbb{1}\left\{t \geq t_f^* - 8\right\}$					0.447
					(0.503)
$\mathbb{1}\left\{t \geq t_f^* - 8\right\}$ × BDC Funded					0.267
					(0.648)
Investment Qtr FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.651	0.602	0.567	0.511	0.581
N	12 115	14 737	17 334	22 358	16 914

The tables report the estimated coefficients from the firm-level regression: $y_{f,k,t,t^*} = \beta_{1,h}\mathbb{1}\left\{t \geq t_f^*\right\} + \beta_{2,h}\mathbb{1}\left\{t \geq t_f^*\right\} BDC\ Funded_f + \eta_f + \tau_t + \theta_{t^*} + \omega_{k,i} + \varepsilon_{f,k,t,t^*}$, for $h \in \{4, 6, 8, 12\}$. The dependent variable is the employment growth of a firm f in an industry k in a quarter t with an investment quarter t^*. $\mathbb{1}\left\{t \geq t_f^*\right\}$ is an indicator variable which equals one for quarters following the BDC or PD investment quarter in a firm f, and zero otherwise. $BDC\ Funded_f$ is an indicator variable which equal one if a firm f receives financing from BDCs and zero if a firm f receives financing from PD capital providers. In columns (1)–(4), the sample period includes four quarters prior to the investment date and $h \in \{4, 6, 8, 12\}$ quarters after the investment date for each firm f. The specification *Placebo* in the rightmost column is similar to the specification $h = 8$ with the sample period and investment date shifted backwards by eight quarters. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table 11
Firm employment growth and BDC financing.

	SCAP	CIT	FAS 166/167	Stacked
Post	1.084*	0.969*	0.091	0.876***
	(0.632)	(0.515)	(0.406)	(0.246)
Post × Treated$^{(i)}$	−1.582**	−0.400	−1.525***	−1.108***
	(0.674)	(0.463)	(0.413)	(0.281)
Controls	Yes	Yes	Yes	Yes
Investment Qtr FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	No
Firm-Cohort FE	No	No	No	Yes
R^2	0.60	0.52	0.51	0.53
N	2496	4117	4605	11 218

The tables report the estimated coefficients from the difference-in-differences regression: $\Delta emp_{f,j,k,t,t^*} = \beta_1 Post_t + \beta_2 Post_t \times Treated_j^{(i)} + \gamma X_{j,t-1} + \eta_f + \theta_{t^*} + \varepsilon_{f,j,k,t,t^*}$.
The dependent variable is the employment growth of a firm f located in a county j in an industry k in quarter t with an investment quarter t^*. $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, (ii) 2010:Q1 for the CIT shock, and (iii) 2011:Q1 for the FAS 166/167 shock. $Treated_j^{(i)}$ is equal to one if a county j's treatment intensity is above the 25th percentile of $Treated^{(c)}$ and zero otherwise. The county treatment intensity is defined in Section 3.1. The sample of portfolio firms is limited to firms receiving BDC funding during the four quarters after the shock. The sample period covers four quarters prior to the shock and eight quarters after the shock. The rightmost column reports the estimation results for a stacked regression specification combining all three capital supply shocks. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

receives financing from PD funds. Table 10 documents that financing by PD funds allows firms to increase their employment growth by 0.7%–1.4% per annum. At the same time, we find that the difference in the employment growth after the investment is not statistically different across BDC- and PD-funded firms. These findings support our earlier results that BDCs and other private capital providers follow similar investment strategies, allowing us to study an opaque private debt space through the lens of BDC investment allocations.

4.2. Real effect of BDC funding

To estimate the causal effect of BDC financing on firms' growth, we continue to rely on the three shocks to the capital supply by traditional lenders. While there might exist endogeneity concerns regarding the allocation of BDC capital to specific firms, our capital supply shocks are plausibly exogenous as argued in Section 3.1. We therefore estimate the following difference-in-differences regression at the portfolio firm-level:

$$\Delta emp_{f,j,k,t,t^*} = \beta_1 Post_t + \beta_2 Post_t \times Treated_j^{(i)} + \gamma X_{j,t-1} + \eta_f + \theta_{t^*} + \varepsilon_{f,j,k,t,t^*} \quad (9)$$

where the dependent variable is the employment growth of a firm f located in a county j in an industry j in quarter t with an investment date t^*. $Post_t$ is the post-shock indicator variable and $Treated_j^{(i)}$ is the treatment indicator variable used in regression (1). Since most of portfolio firms are located in treated counties, we modify the treatment definition: $Treated_j^{(i)}$ is equal to one if a county j's treatment intensity is above the 25th percentile of $Treated^{(c)}$ and zero otherwise. To isolate the effect of the shocks, we limit the sample of portfolio firms to those receiving BDC funding during the four quarters after the shock. The sample period covers four quarters prior to the shock and eight quarters after the shock. The coefficients of interest are β_1, which captures the effect of BDC financing on firm employment growth in counties with no or mild reduction in capital supplied by traditional lenders, and β_2, which captures the differential effect for firms located in counties with high exposure to the capital supply shocks. For this reason, we do not include the time fixed effects which will absorb β_1. We estimate regression (9) separately for each shock, as well as stack the three shocks together in a single specification.

As shown in the rightmost column of Table 11, BDC-funded firms experience a 0.9% higher employment growth following the shock if they are located in counties with low shortages of financing by traditional lenders. By contrast, we find that the employment growth of firms located in counties with high exposure to the shocks is 1.1% lower relative to firms in counties with low shock exposure. The sum of these estimates is close zero implying that BDC-funded firms located in counties with high exposure to the shocks were merely able to substitute loss of funding from traditional lenders with BDC capital. Provided that we focus on the narrow sample period around the shocks

and the set of firms receiving BDC funding right after the shock, we argue that the observed positive effect on firm growth is attributed to BDC financing. Also, the proximity of the BDC investment dates to the capital supply shocks allows us to mitigate the concerns about the credit demand effects. These coefficient estimates are qualitatively and quantitatively similar to our previous estimates in the event study and staggered difference-in-differences designs. Overall, we document positive real effects of firms' access to BDC capital.

5. Conclusion

The Financial Crisis of 2007–2008 has triggered the tightening of regulation in the banking sector, thereby contributing to a surge in alternative lenders and, in particular, business development companies. Our paper is the first to provide a systematic analysis of these financial institutions in the academic literature. To this end, we construct an extensive database of BDC investments from publicly available filings. Using this novel hand-collected database, we describe the BDCs' uses and sources of funds — portfolio composition, types of investments, geographical presence, loan pricing terms, ownership structure, and cost of funding.

Although our initial analysis focuses on BDCs themselves, our study ultimately investigates the role of private debt capital for the growth of the middle-market sector. First, we document that BDCs enter local markets experiencing shortage of capital by traditional lenders, indicating that BDC financing acts as a substitute to more conventional sources of funding. This result is in line with the views of BDC investment managers, who often claim to target middle-market firms precisely because they are "underserved". We further find that PD funds follow a similar investment strategy to BDCs, which implies that our insights apply to the broader and more opaque private debt space. Second, relying on hand-collected firm-level data, we document that BDC financing plays an important role in promoting firms' employment growth and patenting activity.

Overall, our findings lead us to conclude that BDCs fill a niche that allows capital to reach middle-market firms – often firms with high growth opportunities and lack of sustainable funding sources, – thereafter stimulating firm growth and innovation.

CRediT authorship contribution statement

Tetiana Davydiuk: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Tatyana Marchuk:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Samuel Rosen:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors do not have any potential conflicts of interest. The first author received financial support from NSF Grant 2018854 for a research project "Direct Lending in the U.S. Middle Market". The last author received financial support from NSF Grant 2018973 for a research project "Direct Lending in the U.S. Middle Market".

Data availability

https://data.mendeley.com/datasets/3r3zsmx34k/1Direct Lenders in the U.S. Middle Market (Original data) (Mendeley Data)

Appendix A. Coverage of portfolio firm locations

In this Appendix, we describe our method for merging portfolio firm location data with our quarterly investment-level data. The investment-level data are from the schedule of investments (SOI) tables from the 10-Q and 10-K filings of BDCs that are available on the Securities and Exchange Commission (SEC) website. For each BDC in our sample, we collect location information from its N-2 filings. N-2 forms are a registration statement filed by companies when issuing new debt and equity securities. From each N-2 filing, we extract firm names along with the corresponding addresses including city, state, and ZIP code.[24] If a firm has an address outside of the United States, we flag it as a foreign firm.

In order to merge the N-2 filing location data onto the SOI data, we proceed as follows. First, we use a string matching algorithm to link the set of firm names in each N-2 filing to the SOI table from the same BDC and filing quarter. Given that we can obtain high but less than 100% matching scores due to minor differences in the string values, we manually review all of the assumed matches. Since N-2 filings should contain the addresses of all active portfolio firms reported in the SOI tables, this step yields a match rate of 95.4%. Specifically, we are able to match 19,123 out of the 20,043 total observations in the N-2 data for which there is a corresponding SOI table to match against.

We also keep track of possible address changes over time. Specifically, once we have assigned addresses to portfolio firms in quarters with a N-2 filing, we consider any given location to be effective until a future quarter in which the BDC reports a different location or the end of our sample, whichever comes first. If a BDC reports a different location for a portfolio firm in a future N-2 filing, this location becomes effective from the date of the corresponding N-2 filing. For each firm, we consider the first reported location to be valid from the first date the firm appears in the SOI tables.

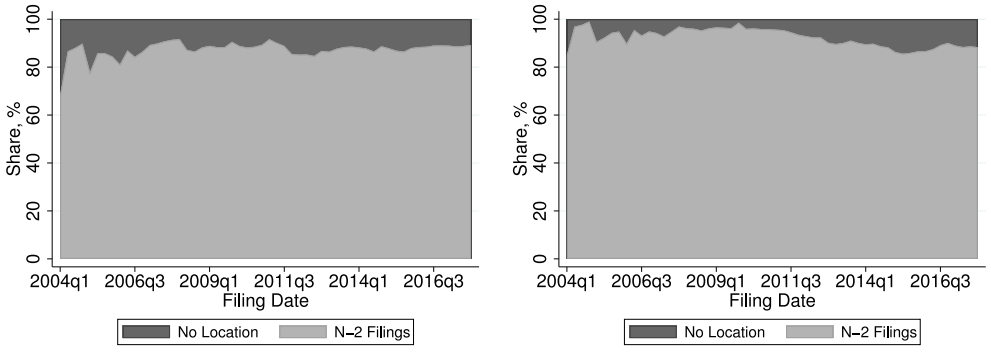
In the second step, we spread location information across BDCs if a firm receives funding from multiple BDCs. In this context, a firm's name is a unique string identifier that we have created after manually reviewing and standardizing every name reported in the SOI tables. This step allows us to assign location information to firms which borrow from BDCs that have never submitted an N-2 filing or borrow in the quarter when a BDC did not submit an N-2 filing.[25] Through these two steps, we collect location information for 77.3% of portfolio firms in our sample. Fig. A.1 summarizes the coverage of portfolio firm locations in our dataset over time. We report the match rates both in terms of the investment count and fair values throughout the sample period in each filing quarter.

Appendix B. Affiliated assets of the BDC sector

While BDCs are comparatively smaller than traditional lenders in the U.S., their assets represent only a fraction of deployed capital. This discrepancy arises because BDCs frequently operate under the umbrella of large asset management firms that manage other funds targeting similar market segments, including other direct lending and private equity funds. BDCs often report in their SEC filings that they source some of their deals through affiliates. For example, Fifth Street Finance Corporation lists "Capitalize on our investment adviser's strong relationships with private equity sponsors" as a key aspect of their business strategy. In Table B.1, we report non-BDC related assets under

[24] In some cases, a BDC only reports city and state or only state. For these observations, we manually gather and verify ZIP code information from other sources including other N-2 filings.

[25] For firms with multiple locations (e.g., branches) receiving funding from several BDCs we proceed as follows. First, we locate BDC investments based on the addresses they report in their N-2 fillings. If for one of the BDCs the location information is not available, we assign the location of another BDC.



(a): Number of Portfolio Firms (b): Fair Value of Investments

Fig. A.1. Coverage of portfolio firm locations over time. The figures depict the shares of portfolio firms with location information. The shares are calculated based on the number of portfolio firms in Panel (a) and based on fair values of investments in Panel (b). In computing these figures, we exclude collateralized loan obligations, collateralized debt obligations, and investments to venture capital funds, mutual funds, and other funds which allow investors to access the financial markets. The data are quarterly observations from 2004:Q1 to 2017:Q4.

Table B.1
Assets under management for BDC-affiliated entities.

Asset management companies	BDCs	Related AUM by strategy				Total	
		Direct lending	Private equity	Other	CLO	Lower	Upper
Apollo Global Management LLC	AINV	3.4	19.7	3.2	16.0	23.1	42.3
KKR & Co LP	CCT	1.5	8.5	4.0	8.5	9.9	22.5
Alcentra Group (BNYM)	ABDC	–	–	21.7	–	–	21.7
Blackstone Group LP	FSEP, FSIC	5.8	0.3	9.4	–	6.0	15.4
TPG Global, LLC	TSLX	–	9.8	0.7	–	9.8	10.5
Ares Management LP	ARCC	0.3	5.5	1.9	–	5.8	7.6
Goldman Sachs Group Inc	GSBD	–	6.5	–	–	6.5	6.5
New Mountain Capital Group LLC	NMFC	–	4.0	–	–	4.0	4.0
Golub Capital Inc	GBDC	2.7	–	1.3	–	2.7	4.0
American Capital Asset Management LLC	ACAS, ACSF	–	1.3	–	2.5	1.3	3.8
Tennenbaum Capital Partners LLC	TCPC	–	1.0	2.1	–	1.0	3.1
Garrison Investment Group	GARS	0.2	1.9	–	–	2.1	2.1
Monroe Capital LLC	MRCC	0.8	–	0.6	–	0.8	1.5
JMP Group Inc	HCAP	–	0.1	–	1.1	0.1	1.2
TriplePoint Capital	TPVG	–	–	1.0	–	–	1.0
Medley Capital LLC	MCC, SIRR	0.6	–	–	–	0.6	0.6
Stellus Capital Management LLC	SCM	0.4	–	–	–	0.4	0.4
BlackRock Inc	BKCC	–	0.3	–	–	0.3	0.3
OFS Capital Management LLC	OFS	0.2	–	–	–	0.2	0.2
Fifth Street Capital LLC	FSC, FSFR	–	–	0.2	–	–	0.2
Capitala Group	CPTA	–	0.2	–	–	0.2	0.2
The Tokarz Group LLC	MVC	–	0.1	–	–	0.1	0.1
Total						74.9	149.2

The table reports estimates for assets under management (AUM) for affiliated asset management companies of BDCs as of the end of 2014. The fund-level AUM data are from Preqin with the exception for Alcentra Group (BNYM); American Capital Asset Management, LLC; JMP Group, Inc; and the collateralized loan obligation (CLO) fund category for which our data are from SEC filings. From Preqin, we include data from funds with a vintage year between 2009–2014 and a geographic focus in North America. For funds with missing size information, we estimate their size by applying the average fund size for that strategy for the same fund manager as available. The "Lower" column includes only "Direct Lending" and "Private Equity". The "Upper" column adds "Other" and "CLO". All figures are in billions of dollars.

management for a set of affiliated asset management companies as of the end of 2014. We estimate that these affiliates managed $75 to $149 billion in related capital that may have been deployed alongside BDC investments of $45 billion during the period of our study. These figures suggest additional investment allocations beyond BDC financing into the middle market.

Appendix C. BDC statements about investment strategies

Within their annual filings, BDCs often state that BDC financing substitutes for traditional lending in the middle market. Here are a few examples from 2012 annual reports. Ares Capital Corporation stated that "[w]e invest primarily in U.S. middle-market companies, where we believe the supply of primary capital is limited and the investment

opportunities are most attractive". Fifth Street Finance Corporation wrote that "[a] significant part of our competitive advantage stems from the fact that the market for investments in small and mid-sized firms is underserved by traditional commercial banks and other financial sources". BlackRock Kelso Capital Corporation commented that "[w]e believe the tight supply of credit due to deleveraging by banks provides a promising environment in which to originate investments in middle-market companies". Triangle Capital Corporation asserted that the lower middle market (LMM) has "traditionally been underserved" and Main Street Capital Corporation said that they seek to "fill the current financing gap for LMM businesses, which, historically, have had more limited access to financing from commercial banks and other traditional sources".

Some BDCs identify stricter bank regulation as an important factor. In their 2012 annual report, Ares Capital Corporation explained, "[Commercial and investment banks] are limited in their ability to underwrite and hold bank loans and high yield securities for middle-market issuers as they seek to meet existing and future regulatory capital requirements. These factors may result in opportunities for alternative funding sources to middle-market companies and therefore more new-issue market opportunities for us". During the period 2013–2016, other BDCs made similar claims. In their 2013 annual report, Corporate Capital Trust wrote that, "[a]s new banking regulations such as Basel III and Dodd-Frank require financial institutions to meet new increased capital requirements, our Advisors believe the confluence of both legislative and regulatory measures will make it more difficult and inefficient for commercial banks to supply all of the capital to meet the financing needs of growing medium- to large-sized companies". In that same year, Stellus Capital Investment Corporation and OFS Capital Corporation raised similar points in their annual report. In 2014, CM Finance Inc joined the chorus by writing "the introduction of new international capital and liquidity requirements ... have caused banks to curtail lending to middle-market companies". In 2015, Alcentra Capital Corporation and Princeton Capital Corporation added similar statements to their annual reports. In 2016, Credit Suisse Park View BDC, Inc. opined that significant increases to capital and liquidity requirements for banks would "decreas[e] their capacity and appetite to hold non-investment grade loans on their balance sheets".

The belief in the general narrative that bank regulation was causing banks to lend less to the middle market was also shared by investment analysts covering the BDC sector. For instance, one 2014 report commented that "banks are showing signs of being pushed out of the market with regulation". The quote from the Wells Fargo Securities report on September 11, 2014 titled "The Q4 2014 BDC Scorecard" continues to say, "As a result of pressure from the OCC and Leveraged Lending Guidance, many banks have been shying away from more highly leveraged transactions. However, as leverage continues to creep upwards in the middle market, this has resulted in many banks being disintermediated and unable to meet their lending goals". In 2017, a Guggenheim Investments report titled "An Overview of Business Development Companies (BDCs)", opined that, "Traditional lenders, such as banks, are facing increased regulatory burdens and are unable to lend to small and mid-sized businesses, resulting in increased demand for BDC capital. BDCs have become an important source of capital by lending to American businesses that might not otherwise be able to obtain financing".

Appendix D. Additional details on BDC business model

BDC Portfolio Characteristics. In line with their regulatory requirements, BDCs tend to allocate on average 97% of their assets into cash-like securities and investments in qualifying portfolio firms (see Table D.1). In the cross section of BDCs, there is a wide dispersion in cash holdings, with the 90th percentile of the cash-to-assets ratio exceeding 25% as of 2017:Q4.

BDCs offer various financing solutions with their main investment instrument being debt securities. BDCs offer several pricing alternatives for their debt securities, including a conventional spread over a base rate (e.g., LIBOR), a fixed cash rate, and a "payment-in-kind" (PIK) rate options. Table D.2 demonstrates that debt deals with a fixed cash rate were relatively more common among BDCs in 2010, while in 2017 there has been a shift towards floating rate pricing.[26] Not surprisingly, we find that floating loan rates are on average lower than the fixed ones. For example, in 2010:Q4 the median variable loan rate offered by BDCs was almost 3% lower that the corresponding fixed rate. In 2017:Q4, this difference shrinks to less than 1%. Table D.2 also indicates that very few deals featured loan rates with a PIK option. The PIK rate offers borrowers a possibility to postpone their debt interest payments up to the maturity date, allowing them to better align the maturity of their capital expenditures and funding. Though more flexible, the PIK loans are on average more expensive than loans with conventional floating and fixed interest rates. Among firms which obtain funding from BDCs through debt securities, about 16% receive a loan with a PIK option at least once.

BDC Capital Structure and Ownership. BDCs not only provide investors with the access to illiquid investments in private firms, but also offer high returns on their capital allocations. Table D.3 reports that a typical BDC receives over 9% annually in interest income per unit of assets. The right tail of the interest income distribution exceeds 12% as of 2010:Q4 and reaches 11% as of 2017:Q4. Besides earning interest income on their investments, BDCs collect nontrivial noninterest income predominantly consisting of management fees for their capital allocation services.

The BDC sector has attracted a number of institutional investors. Using the 13-F disclosures, we find that among key institutional shareholders are private equity firms, mutual funds, and financial intermediaries. The synergies between the private equity sector and direct lenders can be particularly high because of the PE funds' expertise in screening and monitoring private ventures. Sourcing deals from the PE sector can help BDCs to facilitate their investment process. The TPG Capital LP and New Mountain Capital are two examples of private equity firms with BDC ownership. To gain exposure to the middle market, the TPG Capital LP launched a privately held BDC, TPG Specialty Lending Inc, in 2011 and took it public in 2014. New Mountain Capital has operated a public BDC, New Mountain Finance Corporation, since 2010.

Rather than financing middle-market firms directly, banking institutions may seek opportunities to enter this market segment indirectly through investments in BDC equity capital.[27] This strategy allows banks to avoid high capital charges, since debt securities issued to middle-market firms are usually not rated, but if they were they would have been rated as junk bonds. Basel II postulates that a capital charge for high-risk debt investments is 150%, while for BDCs equity investments this charge is only 100%. Admittedly, this regulatory loophole may increase bank risk exposures as equity positions in BDCs are levered claims on high-risk debt investments.

It is a common strategy among banks to hold equity of multiple BDCs. For example, Credit Suisse Group AG holds shares of American Capital Senior Floating Ltd., Oaktree Strategic Income Corp., OHA Investment Corp., and Crossroads Capital Inc. In extreme cases, financial intermediaries launch their own BDCs. For instance, in April 2013 Goldman Sachs Group Inc. launched a new lending unit to invest in high-risk debt, later known as Goldman Sachs BDC Inc. Importantly, to avoid the Volcker rule regulations the equity share of a bank should remain below 20%. Otherwise, a bank-founded BDC would be under the umbrella of a bank holding company and, as such, subject to its regulations.

[26] Note Table D.2 documents the summary statistics across BDC portfolio debt investments and does not include any controls for riskiness of their borrowers.

[27] Amid the data limitations, we are not able to distinguish between the actual equity ownership by banks, that is, using their capital, or by banks' asset management arms.

Table D.1
Balance sheet composition of BDCs.

(a) 2010:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Total assets, $ Billions	30	0.96	1.54	0.47	0.04	0.17	0.90	2.52
(Cash+Securities)/Total assets, %	30	94.26	7.88	97.93	85.83	93.13	98.25	99.01
Cash/Total assets, %	30	13.24	16.42	6.01	1.29	3.64	18.10	31.05
Securities/Total assets, %	30	81.03	17.91	87.41	54.78	75.57	93.01	96.43
Other assets/Total assets, %	30	5.74	7.88	2.07	0.99	1.75	6.87	14.17
Book equity/Total assets, %	30	71.49	18.91	70.48	50.12	58.64	84.94	98.36
Book equity/(Total assets-cash), %	30	94.98	79.10	82.52	53.35	62.42	100.27	117.88
Market equity/Total assets, %	28	66.54	22.45	67.96	41.45	56.18	79.92	90.59
Debt/Total assets, %	30	24.51	18.46	27.59	0.00	9.99	37.13	45.54
Other liabilities/Total assets, %	30	4.00	5.60	2.07	1.11	1.39	5.07	7.48

(b) 2017:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Total assets, $ Billions	81	1.15	1.76	0.51	0.05	0.23	1.55	2.44
(Cash+Securities)/Total assets, %	81	97.14	3.30	98.02	95.27	97.12	98.70	99.04
Cash/Total assets, %	81	8.99	11.33	4.97	0.58	1.78	9.57	25.13
Securities/Total assets, %	81	88.15	12.01	92.86	72.51	85.94	95.85	97.55
Other assets/Total assets, %	81	2.86	3.30	1.98	0.96	1.30	2.88	4.73
Book equity/Total assets, %	81	63.04	15.24	57.21	50.68	53.65	68.72	92.49
Book equity/(Total assets-cash), %	81	71.61	26.36	61.52	53.20	56.41	78.08	102.09
Market equity/Total assets, %	52	49.12	15.59	51.54	30.68	40.19	57.19	65.68
Debt/Total assets, %	81	32.20	16.19	37.63	0.00	22.84	43.59	46.50
Other liabilities/Total assets, %	81	4.76	7.50	2.49	0.94	1.49	3.51	10.99

The tables report the balance sheet summary statistics for publicly traded and privately held BDCs from SNL Financial. The figures represent the cross-sectional statistics across BDCs as of 2010:Q4 and 2017:Q4. The data on total assets are expressed in billions of December 2017 dollars.

Table D.2
Pricing terms of BDC debt securities.

(a) 2010:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Outstanding loan size, $ Millions	1599	11.46	16.89	5.62	0.57	2.02	12.96	29.59
New loan size, $ Millions	300	10.26	13.21	6.71	1.17	2.47	11.56	23.07
New loan maturity, Years	298	4.67	1.87	5.00	1.92	3.33	6.00	6.92
New loan rate, %	291	9.89	3.86	9.75	5.50	6.80	12.00	15.00
Rate: Cash only, %	118	10.35	3.28	10.50	6.00	8.00	13.00	14.50
Rate: PIK only, %	4	12.00	0.00	12.00	12.00	12.00	12.00	12.00
Rate: Cash and/or PIK, %	15	14.37	1.77	14.00	12.00	13.00	16.00	16.50
Rate: Base + Spread, %	152	8.97	4.07	7.50	5.50	6.25	11.00	13.75

(b) 2017:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Outstanding loan size, $ Millions	6417	9.14	20.06	2.61	0.01	0.13	10.29	23.19
New loan size, $ Millions	1027	10.11	25.59	4.24	0.03	0.40	11.85	23.70
New loan maturity, Years	1014	6.43	4.90	5.00	2.42	3.92	7.75	10.00
New loan rate, %	1002	8.44	2.18	8.02	6.20	7.15	9.60	11.25
Rate: Cash only, %	91	9.06	3.10	9.00	5.00	7.63	11.74	12.00
Rate: PIK only, %	19	11.95	5.05	12.00	3.00	9.00	14.00	16.50
Rate: Cash and/or PIK, %	4	13.56	1.69	13.25	12.00	12.25	14.88	15.75
Rate: Base + Spread, %	883	8.26	1.83	7.84	6.23	7.15	9.48	10.57

The tables report summary statistics for pricing terms of BDC debt securities. The figures represent the cross-sectional statistics across BDC debt deals as of 2010:Q4 and 2017:Q4. The data on loan size are expressed in millions of December 2017 dollars.

Appendix E. Robustness and supporting evidence

In this Appendix, we perform a series of robustness checks to validate our identification strategy and provide supporting evidence for our analysis.

E.1. Matched sample of counties

As shown in Table 2, treated counties differ across a number of observable characteristics from counties in the control group. To address these potential differences between treated and control counties, we construct a matched control group relying on the propensity score matching algorithm. Specifically, we account for the county characteristics listed in Table 2 averaged in the pre-shock period predicting the exposure to each capital supply shock. We also account for BDC presence prior to the shock. As demonstrated in Table E.1, this matching algorithm allows us to reduce the differences in observable characteristics between the treated and control groups. We are able to achieve a better match for counties exposed to the CIT shock than to the SCAP and FAS 166/167 shocks as the pool of potential control counties is substantially larger. We next re-estimate our difference-in-differences specification using a matched set of counties. Table E.2 shows that our

Table D.3
Profitability summary statistics of BDCs.

(a) 2010:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Interest income/Total assets, %	28	8.55	4.13	9.39	1.67	6.75	11.24	12.27
Interest expense/Total assets, %	28	1.10	0.99	0.94	0.00	0.33	1.72	2.42
Net Interest income/Total assets, %	28	7.46	3.87	8.54	0.95	5.41	9.98	11.95
Noninterest income/Securities, %	28	1.21	3.49	0.44	0.00	0.06	1.26	2.83
ROA, %	28	10.57	13.62	10.56	−6.42	2.93	15.15	27.14
ROE, %	28	12.36	21.62	13.73	−14.18	3.01	20.83	33.90
ROD, %	23	4.70	2.73	4.96	1.77	2.81	6.07	6.56

(b) 2017:Q4

	N	Mean	St.Dev.	Median	10%	25%	75%	90%
Interest income/Total assets, %	80	8.59	2.81	9.20	4.72	7.52	10.21	10.97
Interest expense/Total assets, %	79	1.59	0.92	1.75	0.01	1.17	2.22	2.77
Net interest income/Total assets, %	80	7.02	2.55	7.32	3.83	5.83	8.40	9.15
Noninterest income/Securities, %	81	0.57	1.27	0.27	−0.05	0.02	0.74	1.43
ROA, %	79	6.24	11.77	5.77	−1.75	3.04	7.93	10.69
ROE, %	80	6.65	14.06	7.25	−4.98	2.42	10.83	14.79
ROD, %	70	5.12	1.84	4.68	3.75	4.20	5.86	7.36

The tables report the summary statistics for publicly traded and privately held BDCs from SNL Financial. The figures represent the cross-sectional statistics across BDCs as of 2010:Q4 and 2017:Q4.

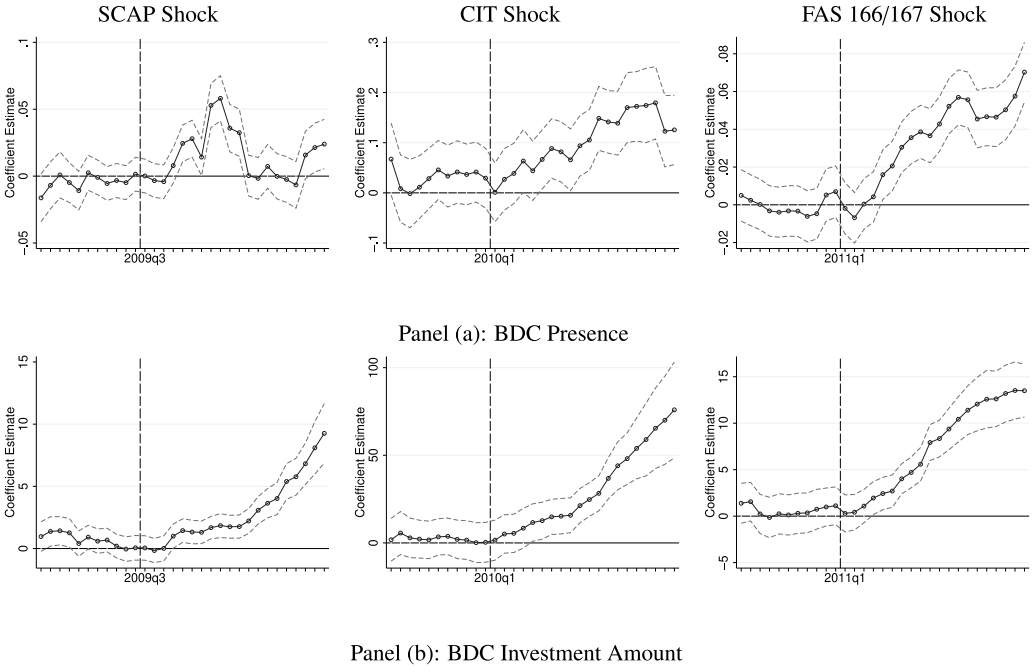


Fig. E.1. Parallel trends for BDC presence and investment amount in matched sample. The figures depict the coefficient estimates of γs along with the 95% confidence intervals from the following panel regression: $y_{j,t} = \sum_t \gamma_t \left(\lambda_t \times Treated_j^{(i)}\right) + \gamma X_{j,t-1} + \eta_j + \tau_t + \varepsilon_{j,t}$, where the dependent variable is (a) an indicator that equals one if a county j in quarter t has a non-zero debt investment amount by BDCs, and (b) the dollar amount of BDC debt investments in county j in quarter t expressed in millions. λs are post-quarter dummies: for each quarter t in the sample period, λ_t is set to one in quarter t and zero otherwise. Dummies for the last quarter before the shock are excluded. The control group of counties is constructed using the propensity score matching algorithm described in Appendix E.1.

findings are both quantitatively and qualitatively similar to our benchmark specification. Fig. E.1 shows that the parallel trends assumption underlying our analysis also continue to hold in the matched sample.

E.2. Data on PD funds

In our analysis, we rely on the deal-level data provided by Preqin. Specifically, we use the information on the exact location of the portfolio firms sponsored by PD funds. There are a few limitations with these data: (i) since the private debt sector is not regulated, all the investment information is either self-reported by PD funds or solicited via FOIA requests; (ii) investment deals are observed only at the origination date; and (iii) not all investments contain information on the size of the executed deal. To address the second issue, we assume that the maturity of each deal is equal to 6 years in line with the average maturity of BDC financing solutions and the value of the deal remains unchanged over the life of the investment. For deals with missing deal size information, we approximate its value with the industry-quarter

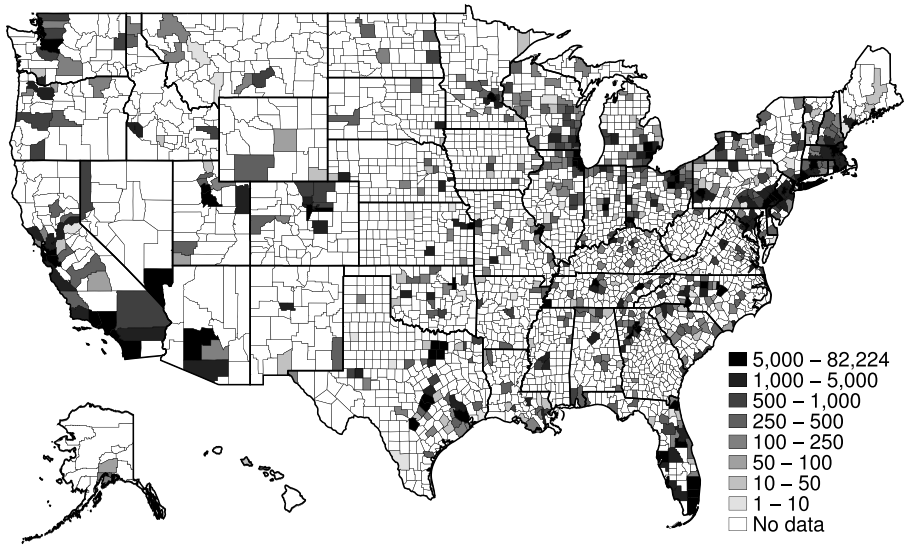


Fig. E.2. Location of PD portfolio firms. The figures show the snapshot of the geographical presence of PD portfolio firms between 2010 and 2016. The darker areas correspond to counties with larger capital allocations and the lighter areas — with smaller capital allocations. Capital allocations are recorded at their fair values.

Table E.1
Descriptive statistics: Treated vs. control counties in matched sample of counties.

(a): SCAP shock

	Treated			Control			Difference
	N	Mean	St.Dev.	N	Mean	St.Dev.	
Total employment growth, %	1330	0.22	2.69	1330	0.29	1.31	−0.071
Middle-market employment growth, %	1330	0.48	6.64	1330	0.37	2.32	0.109
Job creation/Total employment, %	1330	4.46	1.08	1330	4.44	0.48	0.025
Job loss/Total employment, %	1330	4.39	0.98	1330	4.36	0.45	0.036
Output growth, %	1330	0.51	3.74	1330	0.28	1.92	0.232 **
Middle-market firms, %	1330	4.10	1.35	1330	4.24	0.91	−0.149 ***
# of bank branches per 1000 establishments	1330	17.03	6.24	1330	17.38	4.49	−0.357 *
Deposits HHI	1330	0.24	0.11	1330	0.25	0.07	−0.008 **
Average 2001–2006 HPI growth, %	1330	5.33	2.90	1330	5.42	1.88	−0.098

(b): CIT shock

	Treated			Control			Difference
	N	Mean	St.Dev.	N	Mean	St.Dev.	
Total employment growth, %	193	−0.42	2.10	193	−0.42	1.11	−0.003
Middle-market employment growth, %	193	−0.54	3.92	193	−0.70	2.11	0.156
Job creation/Total employment, %	193	4.03	0.60	193	4.05	0.49	−0.021
Job loss/Total employment, %	193	4.08	0.56	193	4.10	0.49	−0.025
Output growth, %	193	−0.85	2.84	193	−0.74	1.87	−0.119
Middle-market firms, %	193	5.17	1.18	193	5.19	0.91	−0.027
# of bank branches per 1000 establishments	193	13.58	3.79	193	13.49	2.80	0.090
Deposits HHI	193	0.19	0.10	193	0.19	0.06	0.001
Average 2001–2006 HPI growth, %	193	6.29	3.55	193	6.31	2.63	−0.014

(c): FAS 166/167 shock

	Treated			Control			Difference
	N	Mean	St.Dev.	N	Mean	St.Dev.	
Total employment growth, %	1456	−1.24	2.45	1456	−1.15	0.99	−0.083
Middle-market employment growth, %	1456	−1.69	6.16	1456	−1.43	2.51	−0.263
Job creation/Total employment, %	1456	4.39	1.08	1456	4.50	0.60	−0.106 ***
Job loss/Total employment, %	1456	4.41	1.02	1456	4.43	0.52	−0.027
Output growth, %	1456	−0.09	3.81	1456	−0.49	3.28	0.403 ***
Middle-market firms, %	1456	3.94	1.34	1456	4.06	0.91	−0.114 ***
# of bank branches per 1000 establishments	1456	17.92	6.46	1456	17.50	5.65	0.420 *
Deposits HHI	1456	0.25	0.12	1456	0.28	0.07	−0.035 ***
Average 2001–2006 HPI growth, %	1456	5.26	2.80	1456	6.18	2.77	−0.917 ***

The tables report the descriptive statistics for counties in the treated and control groups. The county-level outcomes are averages over the three years prior to the shock. The set of treated counties is defined in Section 3.1. The control group of counties is constructed using the propensity score matching algorithm described in Appendix E.1. Middle-market firms are defined as firms with the number of employees between 50 and 500. HHI stands for Herfindahl–Hirschman Index. HPI stands for House Price Index. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Table E.2
BDC entry following credit supply shock in matched sample.

(a): BDC presence

	SCAP		CIT		FAS 166/167	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated$^{(i)}$	0.019***		0.074***		0.035***	
	(0.002)		(0.009)		(0.002)	
Post × Treated$^{(c)}$		0.046***		0.011***		0.090***
		(0.009)		(0.002)		(0.006)
Controls	No	No	No	No	No	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.69	0.69	0.72	0.72	0.78	0.78
N	85 120	85 120	12 352	12 352	93 184	93 184

(b): BDC investment amount

	SCAP		CIT		FAS 166/167	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Treated$^{(i)}$	2.363***		28.785***		6.829***	
	(0.168)		(1.858)		(0.306)	
Post × Treated$^{(c)}$		11.089***		7.927***		34.934***
		(1.074)		(0.609)		(1.990)
Controls	No	No	No	No	No	No
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.66	0.66	0.69	0.69	0.69	0.70
N	85 120	85 120	12 352	12 352	93 184	93 184

The tables report the estimated coefficients from the difference-in-differences regression:
$y_{j,t} = \beta Post_t \times Treated_j^{(k)} + \gamma X_{j,t-1} + \eta_j + \tau_t + \epsilon_{j,t}, \quad k \in \{i, c\}$
The dependent variable is (i) an indicator that equals one if a county j in quarter t has a non-zero debt investment amount by BDCs in Panel (a), and (ii) the dollar amount of BDC debt investments in county j in quarter t expressed in millions in Panel (b). $Post_t$ is a dummy variable that equals one post the capital supply shock starting from (i) 2009:Q3 for the SCAP shock, (ii) 2010:Q1 for the CIT shock, and (iii) 2011:Q1 for the FAS 166/167 shock. The set of treated counties and treatment intensity are defined in Section 3.1. The control group of counties is constructed using the propensity score matching algorithm described in Appendix E.1. The sample covers the period three years before and five years after the shock. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

averages computed based on the deals with available data. We depict the geographic presence of PD portfolio firms in terms of deal volume in Fig. E.2. In line with our expectations, we observe a significant overlap in the geographic presence of BDCs and PD funds (see Fig. 6).

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