Private Equity Fund Debt: Agency Costs and Cash Flow Management

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Abstract

We study the effects of private equity fund debt on cash flows, performance, and agency relationships. Funds using debt delay capital calls, boosting performance measures sensitive to cash flow timing. We find that general partners use fund debt during fundraising to increase the likelihood of raising a follow-on fund and near the hurdle rate to increase their carried interest compensation, indicating that it exacerbates agency costs. A large-scale survey of general partners and limited partners suggests that fund debt facilitates cash flow management and amplifies agency conflicts. Our results highlight that fund debt could pose systemic risks to financial markets.

JEL Classification: G23, G32, E22

Keywords: Private equity, fund debt, performance, agency conflicts

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1 Introduction

Subscription lines of credit (SLCs) are debt held at the fund level in the private equity (PE) industry. Reaching nearly $30 billion in 2020, they constitute a substantial share of capital raised by buyout funds in North America, totaling 17.9% in 2020. Regulators and industry practitioners have raised concerns about systemic risks related to SLCs. For example, Nathanaël Benjamin, the Executive Director for Financial Stability Strategy and Risk at the Bank of England, recently noted that "The opacity, complexity, and interconnectedness of the [PE] sector have made assessing its developments difficult" and cautioned that trends including the emerging use of fund-level debt in PE "could pose risks to financial stability" (Benjamin (2024)).[1] The scope of the systemic risk posed by SLCs could be related to why general partners (GPs) use them. On the one hand, GPs might use SLCs briefly to more easily manage cash flows with limited partners (LPs), posing minimal systemic risk. On the other hand, GPs might use SLCs for extended periods of time to improve the apparent performance of their funds. The prolonged use of SLCs might present greater systemic risks to the financial system and broader economy (Bernanke, Gertler, and Gilchrist (1999) and Gompers and Lerner (2004)). In this paper, we present novel evidence on SLCs and examine GPs' motivation for using them.

We use data on subscription lines of credit from MSCI, which is the leading provider of cash flow data in private equity. This allows us to link quarterly levels of SLCs to transaction-level data on capital calls, distributions, and valuations. These data are representative of PE investors and cover a substantial amount of committed capital (Harris, Jenkinson, and Kaplan (2014)).

We start by evaluating the effect of subscription lines of credit on how PE funds

[1] Similarly, Howard Marks of Oaktree Capital Management, a large U.S. PE firm, asked "What would be the effect if a large number of those lines [SLCs] were pulled simultaneously during a financial crisis... [or] if regulators required banks to call in their lines?" (Marks (2017)).

deploy capital. SLCs might allow GPs to call capital from LPs less frequently. LPs could prefer for capital calls to be aggregated at the end of the quarter if they face financing frictions or constraints in providing capital more often. Alternatively, GPs might use SLCs to increase performance measures sensitive to cash flow timing, potentially improving fundraising and compensation through carried interest.

First, we examine the role of SLCs in the timing of capital called from LPs. We construct a fund's age when it has called 25%, 50%, and 75% of committed capital from LPs. We find that funds using SLCs call capital significantly later at each of these ages than funds that do not use SLCs. This suggests that funds substantially delay calling capital over their life. Next, we ask whether funds using SLCs call capital less frequently. We determine the number of capital calls by a fund within a quarter. We find that more levered funds call capital significantly less frequently. This result suggests that SLC use may be partially motivated by cash flow management objectives. We also explore the duration for which SLCs are used and when they are used in a fund's life. We find that the average fund has an outstanding SLC for more than three years. Further, we show that the majority of SLC use is in the first three years of a fund's life. Each of these findings are arguably in tension with cash flow management objectives. Combined, they suggest that other motivations might also explain SLC use, such as agency conflicts between GPs and LPs.

Given that SLCs can change the timing of a fund's cash flows, we next investigate whether they impact performance measures, particularly those sensitive to cash flow timing. We measure a fund's performance using the internal rate of return (IRR), multiple, and public market equivalent (PME). We calculate each measure using observed cash flows. We also modify the observed cash flows by substituting a fund's SLC use for capital calls and recalculate each performance measure, which we refer to as the unlevered performance measure.

By reducing the amount of time that LPs provide capital to a fund, SLCs might distort a fund's IRR, the most widely used measure of fund performance (Gompers, Kaplan, and Mukharlyamov (2016) and Da Rin and Phalippou (2017)). We find that the annualized IRR for funds using SLCs significantly increases by 1.9 percentage points. This represents a 12.6% increase relative to the sample standard deviation of the IRR.[2] We show that this effect is amplified for young funds and for those using more debt.

We also evaluate the impact of SLCs on a fund's multiple, which is the ratio of a fund's distributions and the value of its unrealized investments to the capital received from LPs. We find that the multiple for funds using SLCs decreases by an average of 0.02. This estimate is economically small, representing a 3.8% decrease relative to the sample standard deviation of the multiple. The effect is unrelated to a fund's age and it is larger in magnitude for more levered funds. The estimates are economically negligible because SLCs primarily alter the timing of a fund's cash flows and the multiple is invariant to cash flow timing.

The PME is an additional measure of fund performance based on a market adjustment (Kaplan and Schoar (2005) and Korteweg and Nagel (2016)). It compares a PE fund's cash flows to a similarly-timed investment in public equity markets. We find that the PME for funds using SLCs significantly increases by 0.03. This represents an 11.3% increase relative to the sample standard deviation of the PME. It is again larger for young and more levered funds. These results suggest that GPs can use SLCs to distort measures of fund performance that are sensitive to cash flow timing.

Since subscription lines of credit are used earlier in a fund's life and allow GPs to boost apparent performance, we next study whether SLC use arises from agency conflicts between GPs and LPs. We focus on two key settings: when GPs are fundraising and when

[2]Throughout the paper, we report the economic significance by comparing the estimates to the sample standard deviation. Mitton (2024) shows that scaling by the standard deviation overcomes potential issues with using the sample mean.

they approach the hurdle rate. First, performance is a common signal of GP quality for fundraising (Kaplan and Schoar (2005), Chung, Sensoy, Stern, and Weisbach (2012), and Harris, Jenkinson, Kaplan, and Stucke (2023)). By amplifying their fund's perceived performance, GPs might increase the chance of raising a new fund through SLC use, which benefits both their immediate compensation at the fund and longer-term career prospects in private equity. However, LPs bear agency costs related to distorting a fund's apparent performance, potentially including increased information processing costs and suboptimal investment selection. Second, SLCs can also affect GP compensation by reducing the required return before receiving carried interest. GPs again benefit from using SLCs to increase their compensation, while LPs bear the cost of lower distributions.

To study if there are agency costs due to SLCs during fundraising, we first examine how GPs use SLCs when raising capital relative to other times in a fund's life. If SLC use is higher during fundraising, it may partially reflect agency conflicts between GPs and LPs. On the extensive margin, we find that GPs are significantly more likely to use an SLC in the 12 quarters prior to follow-on fundraising. The likelihood rises by 7.9 percentage points, representing a 21% increase relative to the sample standard deviation. We also show that there is a statistically and economically significant increase on the intensive margin. These findings are consistent with GPs using SLCs to facilitate fundraising.

Since GPs use SLCs more intensively when raising a new fund, we evaluate their impact on performance before fundraising. We find that a fund's IRR increases by 10.7% due to SLC use prior to follow-on fundraising relative to the sample standard deviation of the IRR. We also show that the PME for funds using SLCs increases by 4.5% compared to its sample standard deviation before fundraising. However, we find no effect on a fund's multiple when GPs are raising capital. These results highlight that GPs using SLCs during fundraising can boost the apparent performance for those measures sensitive to cash flow timing. This can benefit GPs by increasing their likelihood of raising a new fund, which

suggests that agency conflicts may play a role in SLC use.

LPs of PE funds, including public pensions, endowments, and corporations, vary considerably in their sophistication. Since public pension LPs are the least sophisticated (Hochberg and Rauh (2013)), GPs with these types of investors might use SLCs more intensively, potentially because of reduced monitoring by these investors. To examine the composition of funds' investors, we obtain data on public pension LPs from Preqin, which we match with the MSCI data. On the extensive margin, we find that funds with public pension LPs are significantly more likely to use SLCs before fundraising. The increase of 4.1 percentage points represents a 11% rise relative to the sample standard deviation. We also show that SLC use before fundraising is higher on the intensive margin for funds with public pension LPs. These estimates indicate that the agency costs borne by a fund's LPs are amplified when GPs face less scrutiny.

Do GPs actually benefit by using subscription lines of credit prior to starting a new fund? We conclude our fundraising analysis by evaluating the impact of SLC use on raising a follow-on fund. We find that both funds using SLCs and those that increase their leverage are significantly more likely to raise a follow-on fund. Along the extensive margin, there is a 20.6% rise in the chance of raising a new fund compared to the sample standard deviation. We also show that SLC use on the intensive margin increases the likelihood of a follow-on fund. By using SLCs, GPs benefit by stabilizing their long-term career prospects through raising a follow-on fund, while LPs of the fund bear additional information processing costs and the consequences of investing based on the distorted performance.

While raising a follow-on fund supports GPs' careers and future compensation, performance at the current fund also affects their contemporaneous compensation (Chung, Sensoy, Stern, and Weisbach (2012)). Next, we study the potential role of agency conflicts between GPs and LPs when funds are near the hurdle rate to receive carried interest. The hurdle rate is the return required on the LPs' capital while it is deployed by GPs. By using

SLCs, GPs can lower the distributions required before earning carried interest and potentially increase their current compensation.

Following the approach in the fundraising analysis, we examine whether funds alter their SLC use before reaching the hurdle rate. We find that SLC use is significantly higher during this critical time period and funds are 3.3 percentage points more likely to use SLCs in the 12 quarters before reaching the hurdle rate. This estimate is economically sizable, representing an 11.9% increase relative to the sample standard deviation. Similarly, GPs increase fund leverage by 11.1%, also compared to the sample standard deviation. This suggests that GPs use SLCs to increase their likelihood of receiving carried interest.

We next explore the dollar value by which GPs increase their carried interest compensation when they use SLCs. We calculate the change in carried interest that GPs receive if capital calls were substituted for SLCs. A 10% increase in SLC use is related to a significant increase in carried interest of about 3.5%. In dollar terms, carried interest earned by GPs increases by an average of $1.6 million due to SLC use. The additional compensation received by GPs reduces the distributions available to a fund's LPs. This estimate partially quantifies the agency costs borne by LPs when GPs use SLCs.

Taken together, these findings connect to the systemic risk implications of PE funds using SLCs. One reason for GP's SLC use is to reduce the frequency of capital calls. We find some evidence for this explanation, potentially tempering concerns about systemic risk. On the other hand, our results also suggest that GPs use SLCs to support fundraising and increase their compensation. Notably, using SLCs due to these agency-related explanations often occurs over many years. This increases the amount of SLCs outstanding and might disrupt financial markets if LPs are unable or unwilling to provide capital to funds during economic downturns. Accordingly, SLC use could have implications for the propagation and resolution of financial crises, which merit attention from regulators, policymakers, and market participants.

We conclude by conducting a large-scale survey of GPs and LPs of buyout funds in North America about SLCs. GPs responded that SLCs are important for managing cash flows, consistent with cash flow management as a factor explaining why GPs use SLCs and with our finding of moderate SLC use in years four to six of a fund's life. Additionally, GPs indicate that SLCs are important for improving measures of fund performance, facilitating follow-on fundraising, and increasing carried interest. This suggests that agency conflicts also partially explain SLC use by GPs, especially when it is beneficial for fund managers. The survey reveals that about half of LPs indicate SLCs significantly increase funds' IRRs. Moreover, the vast majority of LPs consider the need to determine fund performance without the influence of SLCs, as well as the interest expense associated with SLCs, to be disadvantages. Most LPs indicate that factors related to cash flow management are small advantages of SLC use. Overall, these responses support our results that PE funds use SLCs both for managing cash flows and due to agency conflicts between GPs and LPs.

This paper contributes to the literature on systemic risks of PE and broader effects on the financial system. There is substantial cyclicality in PE investing and fundraising (Gompers and Lerner (2004), Gompers et al. (2008), and Robinson and Sensoy (2016)). We evaluate how SLCs could pose systemic risks by studying why GPs use them and their link to agency conflicts. The financial structure of PE funds appears to minimize these conflicts (Axelson, Strömberg, and Weisbach (2009)). However, agency costs are not completely dissipated because information asymmetry persists between fund managers and investors (Jensen and Meckling (1976)). There is evidence of agency frictions between GPs and LPs in the distribution of PE funds (Robinson and Sensoy (2013)) and during fundraising (Chakraborty and Ewens (2017)). We complement these findings by highlighting that fund financing is a new and economically sizable dimension on which agency conflicts between GPs and LPs may emerge.

We also add to the broader literature on private equity, and particularly its

performance (Kaplan and Strömberg (2009) and Kaplan and Sensoy (2015)). Buyout funds generally outperform public equity markets net of fees (Harris, Jenkinson, and Kaplan (2014) and Robinson and Sensoy (2016)). Risk adjustments can produce different estimates of performance for PE funds (Korteweg (2019)). Larocque, Shive, and Sustersic-Stevens (2022) study the differences between IRRs and annualized multiple-based returns for funds self-reporting that they may use an SLC. Schillinger, Braun, and Cornel (2020) generate simulated data on subscription lines of credits and argue that they are used solely for cash management purposes. In theoretical work, Bocks and Schwenkler (2023) model funds' use of subscription lines, and show that a fund's riskiness and the interest rate it pays for an SLC from a bank are inversely related. Our paper is the first to use comprehensive data on the actual use of subscription lines of credit by funds over time linked with high-quality transaction-level cash flows, allowing us to measure the extent to which common PE performance measures are altered by SLC use and understand whether they pose systemic risk to the financial system.

Finally, our paper is related to the literature on how asset managers influence their apparent performance. PE managers obscure actual returns when raising capital (Barber and Yasuda (2017) and Brown, Gredil, and Kaplan (2019)). Further, managers of mutual funds (Carhart, Kaniel, Musto, and Reed (2002)) and hedge funds (Ben-David, Franzoni, Landier, and Moussawi (2013)) tend to inflate their portfolio valuations by purchasing stocks they already own to improve their apparent performance. Asset managers also appear to strategically select mismatched benchmarks to meet their performance targets (Sensoy (2009)), temporarily overstate performance (Bollen and Pool (2009)), and window dress returns (Agarwal, Gay, and Ling (2014)). Our findings contribute to this literature by providing evidence that PE fund managers inflate their apparent performance through the use of fund debt.

2 Subscription Lines of Credit

2.1 Institutional Details

Subscription lines of credit are debt issued directly to a PE fund and can be used throughout a fund's life. SLCs are distinct from debt financing at the level of either the portfolio company or the PE firm. In this paper, we focus exclusively on SLCs used by PE funds. To our knowledge, this is the first paper to systematically study this source of capital for PE funds using detailed data over the life of a fund.

Figure 1 illustrates the typical structure of a PE firm and one of its PE funds. The middle of this figure shows that a PE fund raises equity capital through commitments by LPs at the beginning of the fund's life. As deals in portfolio companies are closed by the fund, GPs will draw down these commitments using capital calls. The middle of this figure also highlights that funds can use SLCs as an alternative source of capital. Since an SLC is debt issued to a fund and used on a continuing basis, it differs from debt for leveraged buyouts and venture debt, which are discussed in Appendix B. A portfolio company is at the bottom of this figure. Portfolio companies raise equity and debt capital from several sources, including PE funds and banks.

There are several key institutional details about subscription lines of credit, including the typical type of debt contract, pricing, maturity, collateral, and covenants.[3] First, SLCs are either a revolving line of credit or a term loan. Similar to other forms of debt financing, banks can syndicate SLCs. Second, the interest rate for an SLC is often variable and usually a benchmark overnight rate plus a spread. In addition to the interest expense, an SLC might include an upfront fee and an unused fee, which is paid on the unused portion of an SLC. Throughout the paper, we refer to interest on SLCs and any

[3]This information is drawn from Beekman, Bowman, and Brown (2014), Flood (2017), Institutional Limited Partners Association (2017), Petkanics, Pirraglia, and Oberdorf III (2018), and discussions with industry participants.

related fees as interest expense. Interest expense is paid by the fund. Third, the maturity of an SLC ranges from several months to several years. At maturity, there might be an opportunity to renew the debt contract. Fourth, LPs agree to SLC use through the limited partnership agreement (LPA) when they invest in a fund. Some LPAs allow PE funds to use capital commitments as collateral, while others prohibit SLC use. Last, SLCs may include a range of covenants. An example of a covenant is a limit on the ratio of unfunded capital commitments to the fund's total debt.

Next, we examine the aggregate use of subscription lines of credit using comprehensive data from MSCI. We calculate the total amount of SLCs outstanding in each quarter that SLC data are available, resulting in a time window from the third quarter of 2005 to the second quarter of 2020. Additional details about the data are provided in Section 3. In Figure 2, Panel A shows that there has been a substantial increase in SLCs over the sample period. The use of SLCs starts to increase around 2015. In recent quarters, there has been about $30 billion in outstanding SLCs, representing about 17.9% of capital raised in 2020 by buyout funds in North America. The patterns also offer the first evidence that SLC use may amplify systemic risk present in the economy. The aggregate amount of outstanding SLCs is economically substantial. Moreover, the rapid growth in SLC use that began around 2015 has continued beyond 2020 (Albertus, Denes, and Li (2025)). Since SLC use is growing and, as described below, funds use them for prolonged periods, they might propagate financial shocks and may inhibit their orderly resolution.

A natural question is whether SLC use relates to prevailing interest rates. To explore this relationship in Appendix C in the Internet Appendix, Figure A1 plots aggregate SLC use and the federal funds rate over the sample period. Note that the rapid rise in SLC use starting in roughly 2015 nearly coincides with the rise in interest rates. Moreover, the drop in the federal funds rate starting in 2019 is not accompanied by a clear shift in funds' use of SLCs. These patterns offer suggestive evidence that SLC use may not

be especially sensitive to interest rates and that the paper's results described below may generalize beyond the sample period.

Panel B of Figure 2 displays the use of subscription lines of credit during a fund's life. For each year of a fund's age, it plots the amount of SLCs used during a particular year (in dollars) relative to the total amount of SLCs used in the sample (in dollars). We find that the vast majority of SLCs are used during a fund's investment period, which generally occurs during a fund's first five years. Accordingly, we assume that SLCs alter capital calls and that the associated interest expense is paid with capital from LPs. The figure also provides preliminary evidence on GPs' motivation for using SLCs. It indicates that more than half of SLC use occurs during the first three years of a fund's life when SLCs' impact on cash flows and fund performance is generally the largest. This is consistent with agency conflicts between GPs and LPs as a reason for SLC use. However, there is also significant SLC use in later years, when its effect on fund performance is likely to be relatively limited. Reliance on SLCs during these years is generally more consistent with a cash flow management motivation or agency conflicts linked to carried interest.

2.2 An Example of SLCs, Cash Flows, and Fund Performance

We next present an example illustrating how subscription lines of credit can alter a fund's cash flows and impact its apparent performance. To illustrate how an SLC might change a PE fund's cash flows, we construct a hypothetical, yet realistic, example. Suppose a fund operates for 10 years and, as a base case, does not use an SLC. Additionally, assume that it raised $500 million in committed capital. In this example, we assume that there are no management fees or carried interest for simplicity and to clearly highlight the effects of an SLC on a fund's cash flows. Table 1 provides the cash inflows from LPs to this fund and cash outflows from the fund to LPs in columns 1 and 2, respectively. Cash inflows, or

capital calls, are initially large, as the fund calls committed capital to invest in portfolio companies. In contrast, the fund's cash outflows, or distributions, ramp up over its life, as some portfolio companies achieve successful exits, such as through initial public offerings or acquisitions. The fund's net cash flows in each year, in column 3, are simply the sum of its capital calls and distributions.

Next, we consider how these cash flows change if the same fund uses a subscription line of credit. Specifically, we assume that the fund borrows \$100 million using an SLC during year two with an annual 4% interest expense. Column 4 indicates that \$100 million is received by the fund in year two, which is repaid the following year. The fund uses the SLC to delay calling some of the capital it would have raised in year two until year three. Consequently, capital calls are reduced by \$100 million in year two and increase by \$100 million in year three. The 4% interest rate leads to a \$4 million interest expense at the SLC's maturity, which is recorded in column 5. Since funds tend to use SLCs during the investment period, we assume that interest expense is paid using capital calls. Column 6 reports the outflows when the fund uses an SLC, including both the altered capital calls and the interest expense. The distributions of the fund are the same when it uses an SLC, as indicated by column 7. Column 8 is the net cash flow of the fund when it uses an SLC. This example demonstrates that the SLC impacts net cash flows in years two and three. In particular, the net cash flow in year two rises by \$100 million from −\$150 million to −\$50 million, while the net cash flow in year three declines by \$104 million from −\$125 million to −\$229 million. Figure 3 plots an SLC's effect on a fund's capital calls for this example.

The use of an SLC by a PE fund results in two changes. First, when a fund uses an SLC, its contemporaneous net cash flows increase. By shifting cash inflows later in a fund's life, the fund's IRR increases. Second, net cash flows aggregated over the life of the fund are reduced by the interest expense, which has a relatively small and negative impact on a

fund's IRR.[4] In this example, the IRR increases by 1.2 percentage points from 23.9% to 25.1%. The interest expense also slightly decreases the fund's investment multiple from 2.74 to 2.71. An SLC can alter a fund's PME by shortening the time that capital is called from LPs. The PME might also change if SLC use varies with public equity markets.

3 Data

We use detailed data on subscription lines of credit for buyout funds from MSCI (formerly Burgiss). Fund managers provide information about their use of SLCs in the quarterly financial reports sent to their limited partners. Accordingly, the data are available at a quarterly frequency. The source of these confidential data is LPs' use of MSCI's record-keeping and performance monitoring services. Data on SLCs are generally based on information from the balance sheet in a quarterly report. Figure A2 of the Internet Appendix provides an example of a quarterly report used by MSCI to collect data on a fund's SLCs. In this example, the amount (in dollars) of outstanding SLCs is provided under "Borrowings under credit facility." MSCI manually reviews each report for details about a fund's liabilities. Based on conversations with MSCI, these data are comprehensive. The data on SLCs are supplemented by MSCI with transaction-level data on capital calls, distributions, and valuations, in addition to fund characteristics. Following the literature, we restrict our sample to funds with a geographical focus on North America (Harris, Jenkinson, and Kaplan (2014)). We start the sample with vintages in 2005 since this is the beginning of the SLC data. We end the sample with vintages in 2017 to

[4]Throughout the paper, we use the term interest expense to refer to both interest on SLCs and any related fees. It is also worth noting that management fees are not impacted by SLCs. Depending on a fund's limited partnership agreement, fees are usually determined by either the fund's committed capital or the fund's net invested capital. Since committed capital is set at the beginning of the fund's life, SLCs do not impact the former. Net invested capital is invested capital less the cost basis of realized investments. SLCs are unlikely to impact a fund's invested capital and we further make the assumption that SLCs do not impact the cost basis of realized investments. Consequently, we do not explicitly consider the impact of SLCs on fees.

calculate performance measures.

There are several notable features of the data from MSCI relative to alternative data sources.[5] First, the data are a complete and exact record of cash flows between LPs and GPs derived from the reporting and accounting systems of LPs. Second, MSCI validates information across LPs in the same fund, which addresses a common concern about reporting bias. Finally, the data comprise a substantial amount of investment in private equity from a comprehensive sample of LPs (Harris, Jenkinson, and Kaplan (2014)). The granular data on the actual use of SLCs paired with high-quality transaction-level data on fund cash flows allow us to provide the first systematic evidence on a new capital source in private equity.[6]

Table 2 contains descriptive statistics for subscription lines of credit based on funds using SLCs in our sample. Observations are at the fund level. In our sample, 364 funds use SLCs out of 740 total funds, representing a sizable use of fund debt. We define *SLC Amount* as the average SLC amount when a fund uses an SLC. The average is about $48 million and the median is $11 million. Among funds using SLCs, the average fund size, as measured by total committed capital, is about $1.3 billion, with a median of $500 million. The average of a fund's outstanding SLC relative to its size throughout its life is 3.8%. If we restrict to quarters when a fund uses an SLC and compare it to the fund's uncalled capital, the mean rises to 16.3%. *SLC Length* is the number of quarters that a fund has an SLC outstanding and averages almost 13 quarters. Since a majority of funds use SLCs for at least three years, this provides further preliminary evidence that agency conflicts between GPs and LPs may be an important factor in explaining SLC use. Notably, this duration is difficult to reconcile with GPs delaying capital calls until the end

[5]Preqin is an alternative data source on SLCs. In Preqin, SLC use is self-reported by funds, does not vary within a fund over time, and is often prospective (i.e., the fund reports that it expects to use an SLC).

[6]This contrasts with papers using simulated data on SLCs (Schillinger, Braun, and Cornel (2020)) and those using self-reported SLC use at a fund's inception (Larocque, Shive, and Sustersic-Stevens (2022)).

of a quarter, or even the end of a year. It also raises concerns about potential systemic risks posed by SLCs.

Table 3 has summary statistics for the variables analyzed in this paper. Panel A details the sample on capital calls, where the unit of observation is a fund-quarter. In the quarters when a fund uses an SLC, the ratio of its outstanding SLC to its uncalled capital has a mean of 17.7%, which we term *Leverage using Uncalled Capital*. SLCs are used in about 17% of the capital call sample.

Panel B provides summary statistics on performance measures for PE funds using an SLC. The unit of observation is also a fund-quarter. We calculate a fund's IRR using its net cash flows at a quarterly frequency, since the SLC data are provided each quarter. For ease of interpretation, we annualize the IRR. The annual IRR for buyout funds using SLCs is 14.4%, on average. Assuming that capital calls substitute for SLCs in the same quarter, then the quarterly IRR decreases to 12.5%. We refer to this performance measure as the *Unlevered IRR*. The investment multiple, which we refer to as *Multiple*, averages about 1.47. We similarly construct *Unlevered Multiple*, which is larger than *Multiple* due to the absence of interest expenses.[7] Last, we measure performance using the public market equivalent, PME, as developed by Kaplan and Schoar (2005). The average PME is 1.07. Its unlevered analog, *Unlevered PME*, is slightly lower.

Panel C shows summary statistics for fundraising. This panel provides variables for the fundraising analyses, including subscription lines of credit along the extensive (SLC) and intensive (*Leverage*) margins. Panel D presents summary statistics on GP compensation relevant to the compensation analysis. Δ *Carry* is the carried interest received by fund managers minus unlevered carried interest in millions of dollars. The

[7]Our baseline analyses assume that the quarterly interest expense is 1% of a fund's outstanding SLCs at the end of the previous quarter. We verify the robustness of our findings to alternative interest expenses in Table A2.

average change in carried interest is $1.6 million.[8]

4 Capital Calls and Performance

4.1 Capital Calls

Subscription lines of credit provide managers of PE funds with an additional source of capital. We begin by studying whether SLCs delay capital calls from LPs. Since this analysis is at the fund-level, we construct SLC as an indicator variable equaling one if a fund uses an SLC at any point during its life. We also define Age_{25} as a fund's age in quarters when it has first called more than 25% of committed capital from its LPs. We similarly define Age_{50} and Age_{75} as the age when a fund has called more than 50% and 75%, respectively, of committed capital from its LPs. We include vintage fixed effects in the regression specification to account for any systematic differences in funds started at different points in time over the sample period, as we do in all of the fund-level regressions.[9]

In Panel A of Table 4, we find that funds using SLCs call capital from LPs significantly later than funds that do not use SLCs. Column 1 shows that funds using SLCs tend to be about 0.7 quarters older when they have called 25% of capital, which is a 20.7% increase compared to the sample standard deviation. Funds using SLCs also are older when they have called 50% (column 2) and 75% (column 3) of committed capital.[10] These estimates are consistent with funds using SLCs to delay capital calls, as illustrated

[8]To compare compensation across time, we gross up carried interest at an 8% discount rate as a baseline. The average change in carried interest is $1.5 million using a 6% discount rate and $1.8 million using a 10% discount rate.

[9]The fund performance regressions, described in Section 4.2, are the exception to this rule. We omit vintage fixed effects in that context because we are differencing performance within funds, which itself removes heterogeneity across vintages.

[10]Given the definitions of Age_{25}, Age_{50}, and Age_{75}, the regression sample size falls as the required percentage of called capital rises. We rerun these regressions with a fixed sample size by restricting the analysis to funds that call more than 75% of their committed capital. The results are very similar, as seen in Table A1 of the Internet Appendix.

in Figure 3. It also highlights that GPs use SLCs throughout their funds' lives. Importantly, SLCs alter fund cash flows and, consequently, can impact performance measures sensitive to cash flow timing.

Next, we evaluate the effect of SLCs on the frequency of capital calls. We construct a panel of fund-quarter observations. We define *Number of Capital Calls* as the number of times that a fund calls capital from its LPs in a given quarter. In this setting, as in all of the fund-quarter level analyses throughout the paper, we include vintage fixed effects and age fixed effects. These fixed effects remove any differences in fund activity across vintages and as funds age. Since the outcome is a count variable for this analysis, we use a Poisson regression (Cohn, Liu, and Wardlaw (2022)). In Panel B of Table 4, column 1 shows that there is no effect of SLCs on the extensive margin. The number of capital calls is unrelated to whether a fund uses SLCs. Column 2 finds that there is an effect along the intensive margin. A one standard deviation increase in *Leverage* is associated with a 4% decrease in a fund's number of capital calls relative to the sample standard deviation. This provides evidence that more levered funds call capital less frequently, which is consistent with cash flow management objectives for SLC use.

GPs' motivation for using SLCs relates to their implications for systemic risk. If SLCs are used to reduce the frequency of capital calls from LPs, they likely pose relatively modest systemic risks. In a financial crisis, if banks withdrew the SLCs they had offered funds, LPs may be inconvenienced, but if the LPs themselves retain sufficient liquid capital to meet their obligations, the withdrawn SLCs might not amplify the crisis. The evidence in this section suggests SLCs are sometimes used for managing cash flows, which tempers the systemic risk concerns related to SLCs voiced by regulators and industry participants.

4.2 Performance

This section examines the role of subscription lines of credit in performance measures for PE funds. We construct a fund-quarter panel with performance measured using the internal rate of return, multiple, and public market equivalent. We calculate each measure in two ways: one based on the observed cash flows and another based on a fund calling capital from LPs rather than using an SLC, which we refer to as *unlevered*. To construct the unlevered cash flows, we assume that a fund would have called capital from its LPs in the same amount and quarter instead of using an SLC. We also adjust the fund's cash flows for interest expense on its SLC. We assume that interest expense is 1% per quarter, which is paid based on a fund's outstanding SLC in the previous quarter.[11] Section 2.2 presents an example of this unlevering process. Since we evaluate the change in performance from using an SLC, the sample for this section consists of funds using SLCs. We also require that funds are at least three years old, to avoid the influence of unstable performance values.

First, we estimate the change in a fund's internal rate of return when it uses a subscription line of credit. The IRR is a key performance measure for PE funds (Gompers, Kaplan, and Mukharlyamov (2016) and Da Rin and Phalippou (2017)), despite its numerous and well-known limitations (Phalippou and Gottschalg (2009)). As shown in Section 4.1, funds using SLCs delay capital calls, which can alter a fund's cash flows. By changing the cash flow timing, an SLC may increase a fund's IRR due to deploying the LPs' capital for a shorter duration. We define ΔIRR as the IRR based on the observed cash flows less $Unlevered\ IRR$, which is annualized for ease of interpretation.

Table 5 reports the results. In Panel A, we find that subscription lines of credit significantly increase a fund's internal rate of return. Column 1 shows that a fund's IRR

[11] We show that our results are robust to alternative approaches for incorporating interest expense. In particular, we consider interest expenses of 0.5% or 1.5%, in addition to a time-varying interest expense of LIBOR plus 50 basis points.

increases by 1.9 percentage points on average when it uses an SLC, which is a 12.6% increase relative to the sample standard deviation of IRR.[12] Funds often invest in the first five years of their lives. Accordingly, we also explore the role of fund age by defining $Young\ Fund$ as an indicator variable equaling one if a fund's age is five years or less. In column 2, we find that the increase in a fund's IRR is 2.3 percentage points larger for young funds. Consistent with the sensitivity of IRR to cash flow timing early in a fund's life (Phalippou (2009)), this finding indicates that SLCs have a larger impact on young funds' IRRs. It also highlights that SLC use due to agency conflicts between GPs and LPs might be relatively more important toward the beginning of a fund's life. In column 3, we include *Leverage*, which is the ratio of the SLC amount outstanding in a fund-quarter to the fund's size, as a covariate. We show that a one standard deviation increase in *Leverage* is associated with a 3.7 percentage point increase in a fund's IRR, which is a 24.5% increase relative to the sample standard deviation.

In a related paper, Larocque, Shive, and Sustersic-Stevens (2022) study the difference between PE funds' IRRs and their annualized multiple-based returns. The authors find no relation between SLC use and this performance difference. A possible explanation for the null result is the paper's use of data from Preqin, which is self-reported and hence subject to well-established accuracy concerns (Kaplan and Lerner (2016)). Furthermore, the Preqin data only indicate whether a fund plans to use an SLC, and not whether a fund actually does. Preqin also does not contain information on variation in a fund's SLC use over time. In contrast, we use high-quality and verified data on transaction-level cash flows linked to a fund's quarterly realized use of SLCs, allowing us to reliably estimate the impact of SLCs on specific performance measures.

An additional performance measure is the multiple of invested capital, which is

[12]Note that the R^2 is necessarily zero for this specification since it does not include any covariates. We do not include vintage fixed effects because the outcome is the difference between two measures of IRR for the same fund.

based on capital distributed to a fund's LPs and the value of the fund's unrealized investments relative to capital provided by LPs. An SLC might lower a fund's multiple since the interest expense for an SLC is paid with capital from LPs. We use the unlevered cash flows to construct a fund's $Unlevered\ Multiple$ and define $\Delta Multiple$ as its multiple based on observed cash flows less $Unlevered\ Multiple$. In Panel B of Table 5, column 1 shows that SLCs reduce a fund's multiple by 0.02, which represents a 3.8% decrease relative to the sample standard deviation of $Multiple$. Compared to the 12.9% increase in IRR for funds using SLCs, the decrease in a fund's multiple is economically small. We find that the change in a fund's multiple when it uses an SLC is unrelated to its age (column 2) and is negatively related to the intensity of its SLC use (column 3).

A final common measure of PE performance is the public market equivalent (Kaplan and Schoar (2005) and Korteweg and Nagel (2016)). Since funds using SLCs delay capital calls, their use can alter a fund's PME by reducing the time that a fund uses capital from LPs. Additionally, PME might be impacted if SLC use varies with the benchmark of S&P 500 returns. Using a fund's unlevered cash flows to construct its $Unlevered\ PME$, we define ΔPME as the PME based on the observed cash flows less $Unlevered\ PME$. In Panel C of Table 5, we find that PMEs increase when a fund uses an SLC. Column 1 shows that the average increase is 0.03, which is an 11.3% increase relative to the standard deviation of PME. The change in a fund's PME is also significantly larger for young funds (column 2) and when SLCs are larger (column 3). The change in a fund's PME associated with using an SLC is economically similar to the change in a fund's IRR. Since LPs primarily assess fund performance using IRR, fund managers have an incentive to distort this performance measure, which in turn may also change a fund's PME.

We also consider the robustness of these results to different assumptions about the interest expense for subscription lines of credit. The preceding analyses assume that the interest expense for an SLC is 1% per quarter. We evaluate the sensitivity of our results to

a lower fixed quarterly rate of 0.5%, a higher fixed quarterly rate of 1.5%, and a time-varying quarterly rate of LIBOR plus 50 basis points.[13] Table A2 of the Internet Appendix presents the results for the baseline specification without the covariates. In Panel A, we find that, using alternative assumptions for the interest expense, the change in a fund's IRR is quite similar to the baseline estimate of 1.9 percentage points and remains statistically significant at the 1% level. Similarly, we show that the effect of an SLC on a fund's multiple (Panel B) and PME (Panel C) is economically and statistically similar to that in the baseline analyses.

5 Raising Capital

5.1 Fundraising

Fundraising is related to the prior performance of GPs (Kaplan and Schoar (2005), Chung, Sensoy, Stern, and Weisbach (2012), and Harris, Jenkinson, Kaplan, and Stucke (2023)). Since subscription lines of credit may amplify a fund's apparent performance, GPs have an incentive to use SLCs during fundraising. If GPs use SLCs to boost a fund's performance, this reflects an agency conflict. Follow-on funds provide substantial benefits for GPs (Gompers and Lerner (1999), Chung, Sensoy, Stern, and Weisbach (2012), and Barber and Yasuda (2017)). In contrast, SLC use might generate agency costs borne by a fund's LPs. SLCs can generate increased information processing costs for LPs due to estimating funds' reported performance without the influence of SLCs. Further, LPs might misallocate capital to less skilled GPs who inflate their performance.

We start by evaluating SLC use by funds prior to raising a follow-on fund. For the analyses in this section, we continue to use the funds in our sample at the fund-quarter

[13]LIBOR at a daily frequency ranges from 0.5% to 3.1% over the sample period. We average LIBOR within a quarter and convert it to a quarterly rate.

level and, following Brown, Gredil, and Kaplan (2019), focus on the 12 quarters before and after raising the next fund. Our regression specification to estimate a fund's use of subscription lines of credit prior to fundraising is:

$$Y_{i,t} = \beta \times Before_{i,t} + \alpha_v + \alpha_a + \varepsilon_{i,t}. \quad (1)$$

Throughout this section, we continue to use two variables to assess a fund's use of subscription lines of credit. On the extensive margin, SLC is an indicator variable that equals one if a fund uses an SLC in a quarter. On the intensive margin, $Leverage$ is the ratio of a fund's SLC amount outstanding in a quarter to its size. $Before$ is an indicator variable that equals one during the 12 quarters prior to a fund raising a follow-on fund. Vintage fixed effects (α_v) absorb variation in SLC use that might be correlated with the PE cycle or aggregate trends (see Gompers and Lerner (2004) and Robinson and Sensoy (2016) for an overview of PE cyclicality). Fund age (in quarters) fixed effects (α_a) account for variation in SLC use over a fund's life that is potentially coincidental with fundraising. We cluster standard errors by fund.

Table 6 presents the results. In column 1, we find that funds increase SLC use on the extensive margin prior to raising a new fund. Specifically, before fundraising, there is a 7.9 percentage point increase in the likelihood of using an SLC. The estimate is statistically significant at the 1% level and is also economically substantial, representing a 21% increase relative to the sample standard deviation. Importantly, by including age and vintage fixed effects, we compare funds using SLCs that are the same age and founded in the same year. For example, this alleviates the concern that funds use SLCs and raise follow-on funds early in their lives. In column 2, we consider the intensive margin of SLC use. We show that funds have significantly higher leverage before raising a follow-on fund. This effect remains economically large and represents a 16.3% increase in fund leverage relative to the

sample standard deviation. Overall, these results show that GPs use SLCs more actively when raising a follow-on fund, which may facilitate fundraising.

5.2 Effect of SLCs on Performance During Fundraising

We next evaluate the change in fund performance due to subscription lines of credit when raising a follow-on fund. Prospective LPs commonly use the performance of the current fund to assess the GPs' skill when deciding whether to commit capital to the GPs' next fund. If SLCs distort fund performance, then this could benefit GPs by increasing their chances of raising a new fund.

We construct a fund-quarter panel of performance measures for the sample in Section 5.1 and continue to focus on the 12 quarters before and after fundraising when agency conflicts between a fund's GPs and LPs may be especially pronounced. To evaluate the change in performance before fundraising, we estimate the following specification:

$$\Delta Y_{i,t} = \alpha + \beta \times Before_{i,t} + \varepsilon_{i,t}. \tag{2}$$

As defined in Section 4.2, we use IRR, $Multiple$, and PME to measure fund performance. Since we examine the effect of SLCs on performance, the sample in this section is comprised of those funds using SLCs. Standard errors are clustered by fund.

Table 7 shows how performance changes when funds use SLCs during fundraising. In column 1, we focus on the change in a fund's IRR and find the intercept is positive and statistically significant, consistent with the results in Table 5. Notably, we find that SLC use significantly increases a fund's IRR before raising a new fund. The economic magnitude of the estimate is large, indicating that a fund's IRR increases by 10.7% when using an SLC before fundraising compared to the sample standard deviation of IRR. Since fundraising is sensitive to past performance, this result provides evidence that GPs have an incentive to

use an SLC to improve the current fund's apparent performance measured using IRR.

Next, in column 2, we consider the change in a fund's multiple when it uses SLCs prior to fundraising. Similar to Table 5, the intercept is negative and statistically significant. However, before follow-on fundraising, we find a positive but insignificant change in a fund's multiple when it uses an SLC. This pattern is consistent with two competing effects. First, GPs could use SLCs to facilitate additional investments in portfolio companies shortly before follow-on fundraising without calling additional capital from LPs until after the new fund is raised. In particular, this behavior increases the numerator of a fund's multiple by the net asset value of the new investments and, importantly, leaves the multiple's denominator unchanged. Once the follow-on fund is raised, the fund can repay the SLC by calling capital. Second, the interest expense for SLCs is paid using capital calls and increases the denominator. While the estimate is positive, it is statistically insignificant, suggesting that these two contrasting effects approximately offset.

Finally, in column 3, we evaluate the impact of SLCs on a fund's PME in the quarters preceding follow-on fundraising. The constant is positive and significant, suggesting SLC use is linked to elevated PMEs and again is consistent with the results in Table 5. We find that a fund's PME also significantly increases when it uses an SLC before fundraising. The estimate amounts to 4.5% of the sample standard deviation of PME. This indicates that the effect of SLCs on a fund's PME is amplified during follow-on fundraising.

5.3 LP Composition

There is substantial variation in the composition of limited partners across PE funds, including public pensions, endowments, and corporations. Prior literature shows

that returns vary considerably by LP type (Lerner, Schoar, and Wongsunwai (2007) and Sensoy, Wang, and Weisbach (2014)). Further, Hochberg and Rauh (2013) find that public pensions are the least sophisticated LPs. Consequently, agency costs generated by SLCs are potentially exacerbated at funds with these LPs. This could be due to reduced monitoring by pensioners for whom the LPs invest. In the following analysis, we examine whether SLC use is greater at funds with public pension LPs.

We use data on public pension LPs from Preqin, which provides substantial coverage of U.S. public pensions (Brown, Harris, Jenkinson, Kaplan, and Robinson (2015)). We match PE funds in Preqin to those funds in MSCI. Following Section 5.1, we use funds in our sample at the fund-quarter level that match to Preqin and focus on the 12 quarters before and after fundraising. We estimate the following specification:

$$Y_{i,t} = \beta_1 \times Public\ Pension_i \times Before_{i,t} + \beta_2 \times Public\ Pension_i + \beta_3 \times Before_{i,t} + \alpha_v + \alpha_a + \varepsilon_{i,t}. \quad (3)$$

Y is either SLC, which measures whether a fund uses an SLC along the extensive margin, or *Leverage*, which is fund leverage. *Public Pension* is an indicator variable that equals one if a fund has at least one public pension LP reported in Preqin. Vintage and age fixed effects are denoted by α_v and α_a, respectively. Standard errors are clustered by fund. The coefficient of interest is β_1 and captures the change in SLC use during fundraising for funds with public pension LPs.

Table 8 provides the results. In column 1, we find that funds are significantly more likely to use SLCs before follow-on fundraising ($Before$). SLC use is amplified if a fund has a public pension LP ($PublicPension \times Before$). In particular, there is a 4.1 percentage point increase in the likelihood of using an SLC for funds with public pension LPs. This effect is both statistically and economically significant, representing a 11%

increase relative to the sample standard deviation.[14] Next, we turn to the intensive margin by using *Leverage* as the dependent variable. In column 2, we show that funds with public pension LPs also use a significantly greater amount of SLCs. This estimate is also economically substantial, corresponding to an 11.4% increase relative to the sample standard deviation of *Leverage*.

5.4 Raising a Follow-on Fund

Sections 5.1 and 5.2 show that funds are substantially more likely to use SLCs during fundraising and that SLCs boost a fund's apparent performance. To complete our analysis of agency conflicts during fundraising, we ask whether funds using SLCs prior to fundraising are indeed more successful in raising a follow-on fund. We form a cross-section of funds in our sample and estimate the following specification:

$$Follow\ On_i = \beta \times SLC_i + \alpha_v + \varepsilon_i, \tag{4}$$

where *Follow On* is an indicator variable that equals one if a follow-on fund is raised. Since the unit of observation is a fund, *SLC* is an indicator variable that equals one if a fund uses an SLC in the 12 quarters before raising a follow-on fund. We also consider the intensive margin and define *Leverage* as the ratio of a fund's SLC amount to its size, averaged across the 12 quarters before raising a follow-on fund. Vintage fixed effects are represented by α_v. Standard errors are robust.

Table 9 contains the results. We find that, on the extensive margin, funds using SLCs are significantly more successful in raising a follow-on fund. The effect is also economically sizable. Specifically, funds using SLCs are 6.6 percentage points more likely to raise a follow-on fund, representing a 20.6% increase relative to the sample standard

[14] For this sample, the standard deviation of *SLC* is 0.374. The analogous statistic for *Leverage*, discussed next, is 0.044.

deviation. We also examine SLC use along the intensive margin. In column 2, we find that this estimate is again positive and statistically significant.

The preceding results on fundraising and LP composition suggest that SLC use partly reflects agency conflicts between a fund's GPs and LPs. Although LPs bear the cost of the SLCs, using them boosts GPs' apparent performance and prospects for raising a follow-on fund. To achieve these ends, SLCs may be used for multiple quarters or even years, consistent with the descriptive statistics presented in Table 2 that the median fund uses SLCs for more than three years. In this context, the propagation and resolution of a financial crisis could be impacted if banks originating SLCs quickly redeem them. Thus, insofar as SLC use arises from agency conflicts, it merits attention from regulators, policymakers, and market participants responsible for or affected by financial stability. This contrasts with the cash flow management motivation for SLC use, and more broadly indicates that the systemic risk implications of fund debt relate to the reasons why GPs deploy it.

6 GP Compensation

We next turn to studying agency conflicts between GPs and LPs that relate to GP compensation. Management fees are annual payments by investors to broadly support fund operations. Since these fees are usually based on committed capital, they do not change with a fund's use of SLCs because committed capital is set at the beginning of a fund's life and, consequently, is not impacted by SLCs (Metrick and Yasuda (2010)). Carried interest is compensation that specifically rewards managers for high performance. For buyout funds, it is generally earned if a fund reaches a certain preferred return, which is referred to as the hurdle rate or carry threshold. The hurdle rate is the return required on capital provided by LPs.

Since SLCs allow GPs to delay capital calls (Section 4.1), they have an incentive to use SLCs as they approach the hurdle rate because it might increase their carried interest compensation. Importantly, the hurdle rate is not based on capital raised using SLCs. As GPs approach the hurdle rate, the incentive to use SLCs increases because there is less uncertainty about receiving carried interest. When a fund reaches the hurdle rate due to a successful exit, GPs receive additional carried interest compensation when they use SLCs. If the GPs call capital instead of using SLCs, they would be obligated to provide the preferred return on that capital before receiving carried interest. In this context, SLC use reflects an agency conflict, since additional carried interest compensation transfers wealth from a fund's LPs to its GPs. Section 6.1 studies whether GPs use SLCs before reaching the hurdle rate. Section 6.2 evaluates the additional compensation earned by GPs using SLCs.

6.1 Hurdle Rate

There are two key features of carried interest for buyout funds (Metrick and Yasuda (2010)). First, the vast majority of these funds include a hurdle rate in order for GPs to earn carried interest. Second, most funds set the hurdle rate at 8%. After LPs receive this preferred return on their deployed capital, there is often a catch-up period when GPs earn all of the distributions until they also receive an 8% return on the fund's investments. Following this period, GPs receive 20% of the returns and LPs earn the remaining 80%. We use these parameters to calculate when a fund reaches its hurdle rate.

Do managers approaching the hurdle rate alter their use of subscription lines of credit? We evaluate this question by calculating the return generated by a fund based on its cash flows. We form a fund-quarter panel of funds that eventually receive carried interest and, following our fundraising analysis, continue to focus on the 12 quarters before

and after reaching the hurdle rate. We examine whether SLC use differs in the years leading up to reaching the hurdle rate using equation (1). We continue to measure SLC use along the extensive margin (SLC) as an indicator variable equaling one if a fund uses an SLC in a quarter. On the intensive margin, $Leverage$ is defined as the ratio of the amount of a fund's SLC in a quarter to its size. $Before$ is an indicator variable that equals one during the 12 quarters prior to a fund reaching the carry threshold. We continue to include vintage fixed effects (α_v) and age fixed effects (α_a). We cluster standard errors by fund.

Table 10 provides the results. In column 1, we find that funds are 3.3 percentage points more likely to use SLCs in the 12 quarters before reaching the carry threshold. This represents an increase of 11.9% relative to the sample standard deviation along the extensive margin. Column 2 examines the intensive margin. We show that GPs increase the amount of fund leverage they use before reaching the carry threshold by 0.4 percentage points, which amounts to an increase of 11.1% compared to the sample standard deviation. These findings suggest that GPs use fund debt to increase their likelihood of receiving carried interest. We next turn to whether SLC use increases the amount of carried interest GPs receive.[15]

6.2 Carried Interest

Finally, we examine the link between GPs using subscription lines of credit and the amount of carried interest they receive. By reducing the time that capital from LPs is deployed, SLCs might increase carried interest earned by GPs. Using the parameters described in Section 6.1, we calculate the amount of carried interest that GPs receive using the observed cash flows. We also construct unlevered carried interest using the same approach as that for the unlevered performance measures described in Section 4.2.

[15]We do not find that LP composition plays a role in SLC use as funds near their hurdle rate. This is consistent with the differences in the economic magnitudes of agency costs in these two settings, as seen by comparing Tables 6 and 10.

To estimate the effect of SLCs on carried interest, we use the following specification:

$$Log(\Delta\ Carry_i) = \beta \times Log(SLC\ Level_i) + \gamma \times Log(Fund\ Size_i) + \alpha_v + \varepsilon_i, \tag{5}$$

where $Log(\Delta\ Carry)$ is the log of the carried interest received by GPs at a fund minus the unlevered carried interest ($ million).[16] Carried interest is measured in the last quarter that a fund is observed. $Log(SLC\ Level)$ is the log of the average outstanding SLC amount over the observed life of a fund ($ million). $Log(Fund\ Size)$ is the log of the total committed capital of a fund ($ million). We include vintage fixed effects to account for time-varying trends in carried interest. The sample consists of funds using SLCs and reaching the hurdle rate. For these funds, the mean (median) change in carried interest is $1.6 million ($0.4 million). This value represents the amount of wealth transferred from a fund's LPs to its GPs via carried interest compensation due to SLC use, thereby quantifying the agency cost of SLC use linked to GP compensation. The unit of observation is the fund. Standard errors are robust.

Table 11 evaluates the change in the amount of carried interest received by GPs following the use of a subscription line of credit. In column 1, we find that a 10% increase in SLCs over a fund's life is related to a 3.6% increase in carried interest. This estimate is statistically significant at the 1% level and holds conditional on fund size. We augment the specification with vintage fixed effects in column 2 and continue to find a sizable effect.[17]

[16] We also examine the change in when funds reach the hurdle rate and find that most funds continue to hit this threshold in the same quarter. This is consistent with the lumpiness of distributions in private equity and suggests that SLCs increase the magnitude of carried interest while having negligible impact on its timing.

[17] These results are robust to using 6% and 10% discount rates for grossing up carried interest.

7 Survey of GPs and LPs

To better understand GPs' and LPs' perspectives on SLCs, we conduct a large-scale survey soliciting their views.[18] The survey offers further insights into GPs' motivation for using SLCs and LPs' perceptions of how SLCs impact their PE investments. It also extends the literature providing survey evidence on the PE industry (Gompers, Kaplan, and Mukharlyamov (2016), Da Rin and Phalippou (2017), Gompers, Gornall, Kaplan, and Strebulaev (2020), and Gompers, Kaplan, and Mukharlyamov (2022)). To our knowledge, this survey is the first to aggregate detailed information on SLCs and why they are used.

We assembled a collection of survey recipients using information provided on GPs and LPs in CapitalIQ and Preqin. We emailed 3,820 GPs and 2,578 LPs each a unique survey link. In the Internet Appendix, the complete survey is provided in Appendix D and all survey responses are tabulated in Table A3. We received responses from 138 GPs and 122 LPs for response rates of 4% and 5%, respectively. This is similar to the response rate for surveys using commercial data providers in private equity (Gompers, Gornall, Kaplan, and Strebulaev (2020)). Survey respondents overwhelmingly indicated they had current experience with SLCs: 83% of GPs responded that their current fund uses an SLC and 89% of LPs replied that the funds they are invested in use an SLC. Survey respondents hold quite senior positions: 63% of GPs are partners and the majority of LPs are chief investment officers (39%) or directors (21%).

Figure 4 provides select responses by GPs. Panel A shows that the vast majority (95%) of GPs responded that SLCs are extremely or very important for cash flow management. While most GPs indicate that SLCs play a role in improving performance measures (84%), less than half (41%) stated that SLCs are very or extremely important for this purpose (Panel B). These responses are consistent with the evidence in Sections 4 to 6

[18] We obtained approval to conduct this survey from Carnegie Mellon University's Institutional Review Board.

of the dual cash flow management and agency conflicts explanations of SLC use. The higher importance GPs attribute to cash flow management relative to improving performance could be explained by either the greater role of the former or GPs' reluctance to emphasize agency-related factors. A relatively smaller share of GPs answered that SLCs are extremely or very important for follow-on fundraising and carried interest compensation. Panel C shows that 27% considered the effects of SLCs on follow-on fundraising to be very or extremely important. Panel D reports that 9% responded similarly for carried interest compensation. This could highlight that there is variation in when these benefits are useful for GPs, in addition to whether they will be realized.

Figure 5 provides select responses from LPs. Panel A shows that LPs understand SLCs tend to increase funds' IRRs, with half characterizing the increase as significant. LPs also recognize several advantages and disadvantages to using SLCs, but they generally consider their importance to be limited. In Panel B, most LPs view cash flow management of SLCs as a benefit (82%), although about two-thirds of these indicate the advantage is small. Interestingly, Panel C shows that 72% of LPs responded that using SLCs to improve performance is either a small or large advantage. This suggests that altered fund performance from using SLCs may benefit some LPs.[19] In Table A3, Panel B highlights that LPs tend to view the interest expense and fees associated with SLCs negatively, though most respondents (70%) consider them to be a small disadvantage. Similarly, LPs also consider the need to determine fund performance without the influence of SLCs as a disadvantage, with 49% responding that it is a small one. These disadvantages highlight that agency conflicts between GPs and LPs may play a role in SLC use.

[19]However, there is also important heterogeneity among LPs in whether they view the performance effects of SLC use positively. More sophisticated LPs, as identified by their titles, view the increase in IRRs associated with LP use less favorably. Specifically, among LPs who respond that the increase in IRRs from SLC use is a small or large disadvantage, 60% are Chief Investment Officers (CIOs). In contrast, of LPs who respond that the increase in IRRs from SLC use is a small or large advantage, 39% are CIOs. This finding suggests that some LPs may not fully understand the implications of SLC use, particularly if they are less sophisticated. This is consistent with the result in Section 5.3 that SLC use before fundraising is more prevalent at funds with less sophisticated LPs.

Overall, the survey results broadly support the notion that SLC use is linked to both cash flow management and agency conflicts between GPs and LPs. GPs responded that cash flow management is a major factor for SLC use. LPs also consider cash flow management to be a benefit of SLCs, although they generally view it as less important. Further, GPs consider SLCs' impact on performance to be important. They also see advantages in terms of raising a follow-on fund. In contrast, LPs' responses suggest they do not capture large benefits from SLC use.

8 Conclusion

This paper provides the first evidence about the use of subscription lines of credit by PE funds. SLC use was virtually nonexistent in 2005 before increasing to an aggregate $2 billion in 2015 and then rapidly rising to about $30 billion in 2020. We find that funds using SLCs tend to delay calling capital from their LPs. We also show that there are increases in performance measures sensitive to cash flow timing. Funds using SLCs tend to have higher IRRs and PMEs, while there is little change in a fund's multiple.

Our results provide two explanations for the rapid rise in SLC use. First, we find evidence that SLCs are used throughout a fund's life and more levered funds call capital less frequently. This is consistent with cash flow management as an important motivation for SLC use, which is further supported by survey responses from GPs and LPs. Second, we find that SLC use is more likely when raising a follow-on fund and as funds approach the threshold for receiving carried interest. These actions stand to benefit GPs, but are likely to reduce the return LPs receive on their investment. This indicates that agency conflicts between GPs and LPs are an additional explanation for the use of SLCs. If SLCs are used for short-term cash flow management purposes, they carry limited systemic risk implications because SLCs are frequently paid back. However, GPs using SLCs on a

longer-term basis stemming from agency conflicts could pose systemic risks during a financial crisis. A future avenue of research is studying the potential disruptions to financial markets and the economy stemming from fund debt.

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Figure 1: Private Equity Structure

This figure displays a private equity firm connected to one of its private equity funds. The middle of the figure highlights that a private equity fund raises both equity capital through commitments by limited partners at the beginning of the fund's life and debt through subscription lines of credit. A portfolio company, which is at the bottom of this figure, raises equity and debt capital from several sources, including private equity funds and banks.

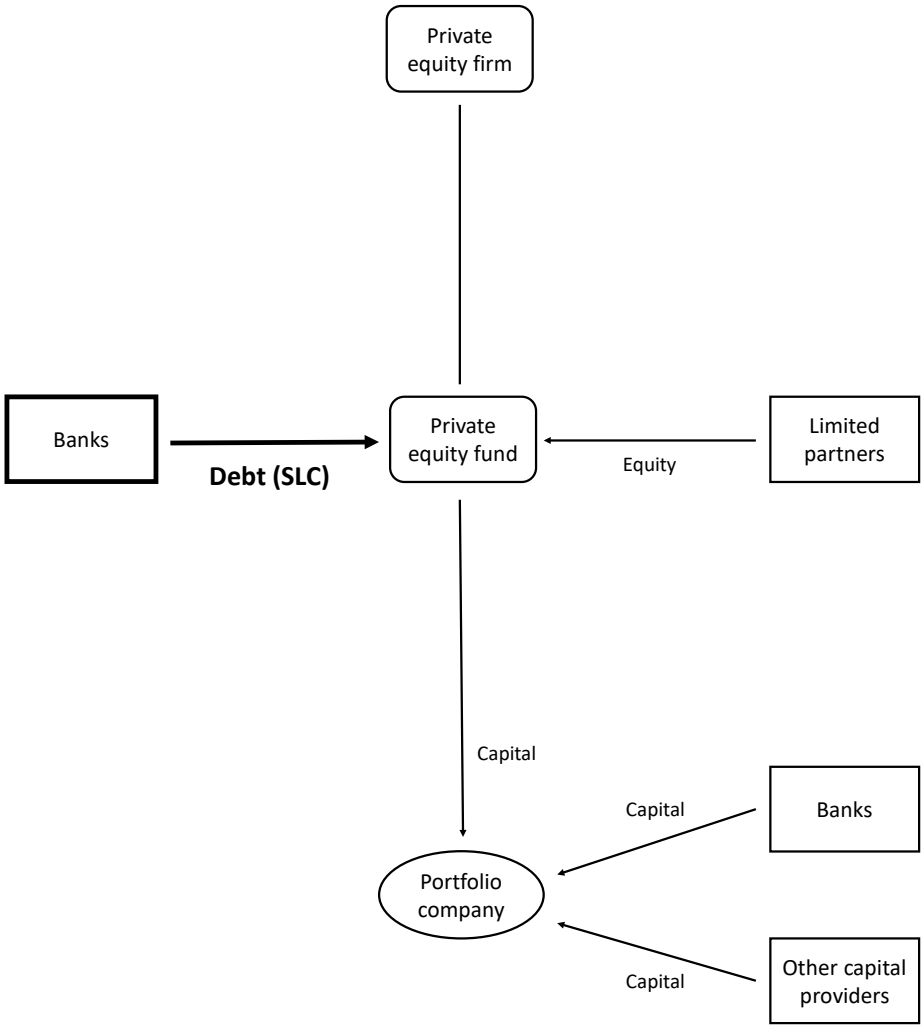
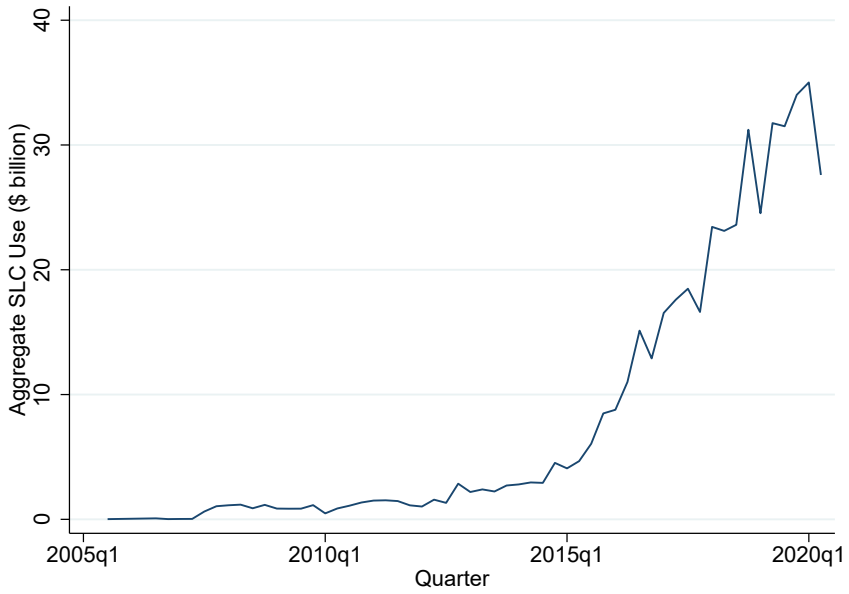


Figure 2: Subscription Lines of Credit

This figure shows the use and timing of subscription lines of credit. Panel A plots the aggregate quarterly use of SLCs. The sample period is the third quarter of 2005 to the second quarter of 2020. The unit is billions of U.S. dollars. Panel B displays when funds use SLCs. Year represents the age of the fund. The ratio of SLC use is the proportion of SLCs used in a year relative to all SLCs used in the sample.

Panel A: Aggregate SLC Use



Panel B: SLC Use During a Fund's Life

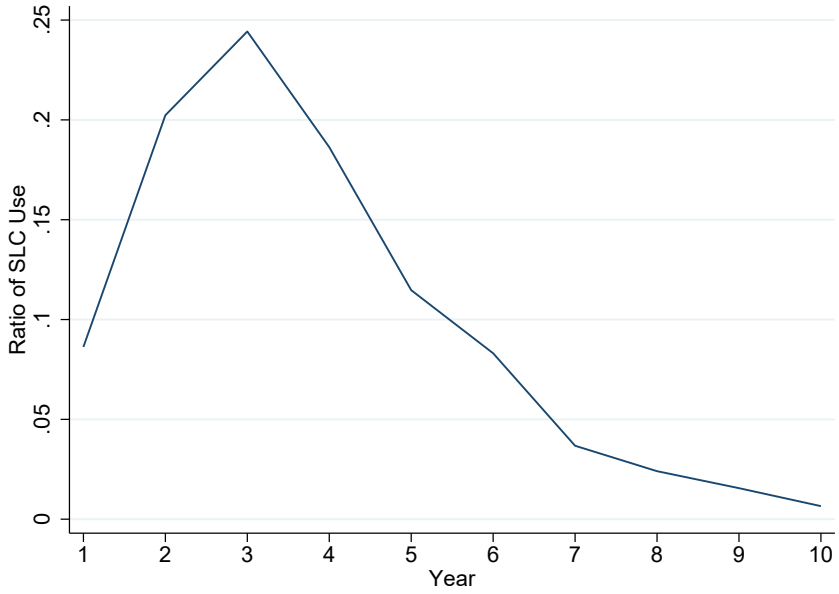


Figure 3: Effect of Hypothetical SLC Use on Fund Cash Flows

This figure illustrates the effect of a subscription line of credit on a hypothetical fund's cash inflows (capital calls) over its life of 10 years. The dashed line plots capital calls from a fund's limited partners in the absence of an SLC. The solid line plots capital calls of an otherwise identical fund that uses a $100 million SLC in year two for one year with a 4% annual interest expense. The cash flows underlying these lines are presented in Table 1.

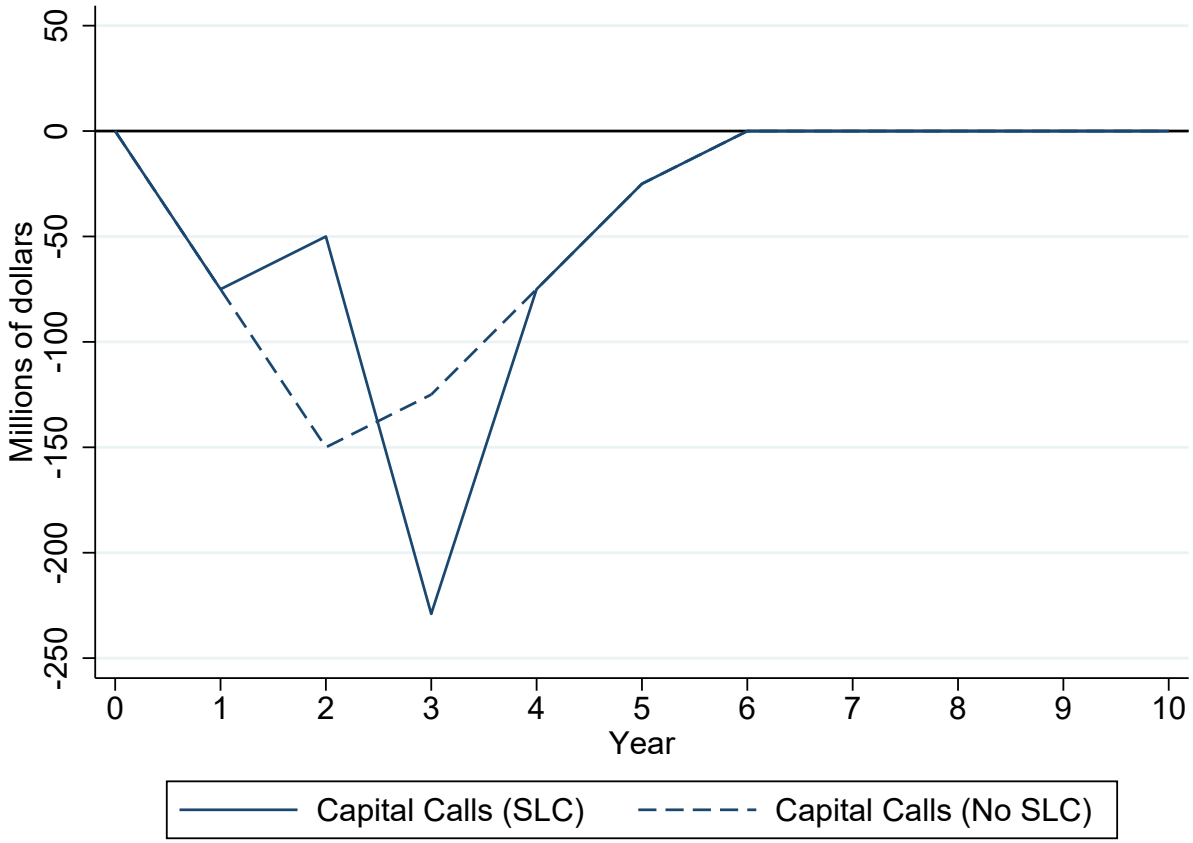
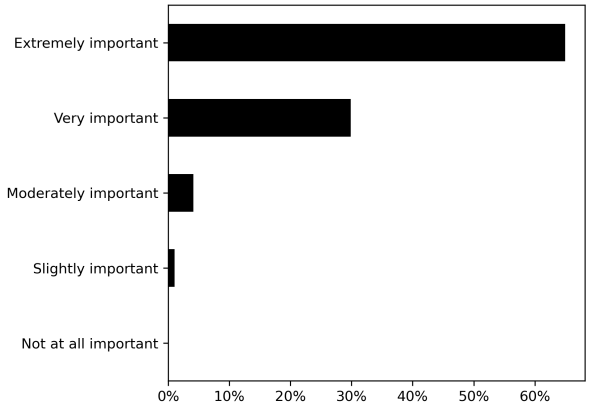


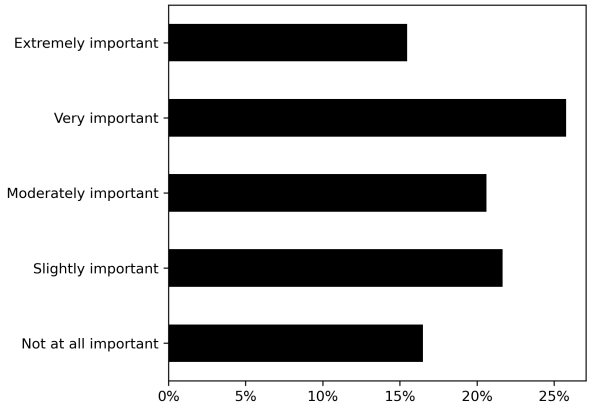
Figure 4: GP Survey Results

This figure presents the responses by general partners to survey questions about the importance of particular factors for using subscription lines of credit. Panels A, B, C, and D address managing cash flows, improving performance measures, facilitating follow-on fundraising, and increasing carried interest compensation, respectively. The horizontal axis in each panel displays the percent of GPs selecting each response to the particular question. The complete survey is provided in Appendix D and all survey responses are tabulated in Table A3.

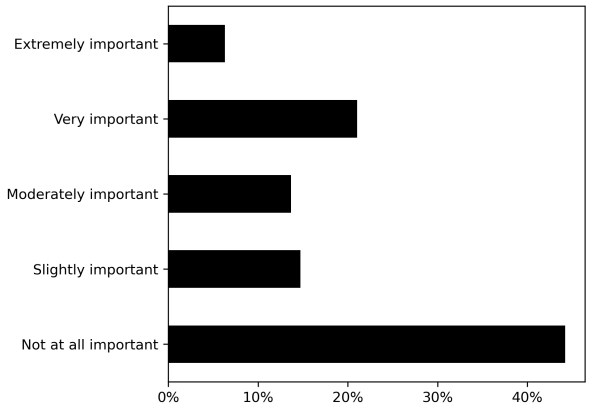
Panel A: Manage Cash Flows



Panel B: Improve Performance Measures



Panel C: Facilitate Follow-on Fundraising



Panel D: Increase Carried Interest

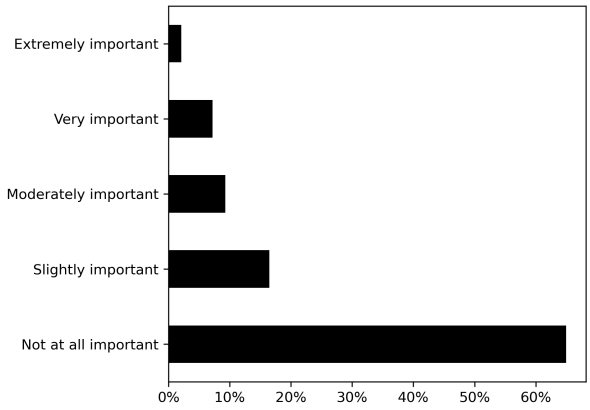
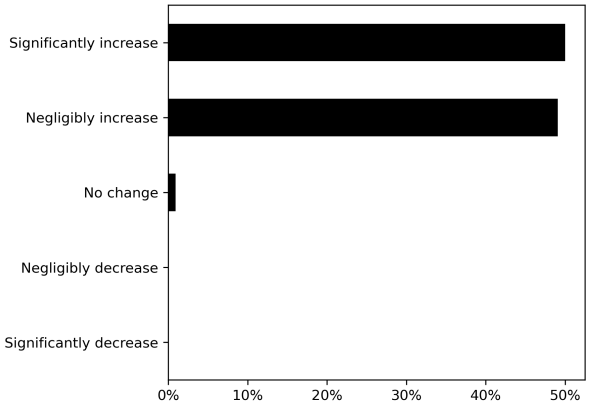


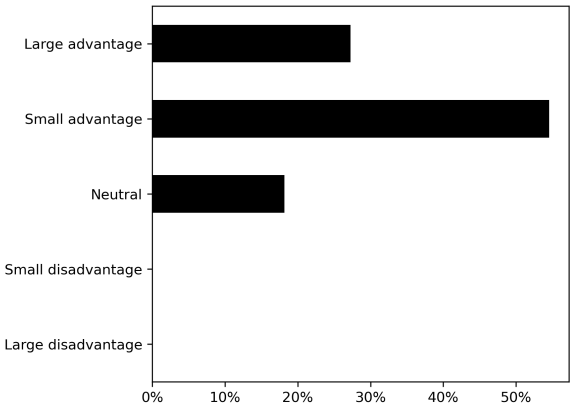
Figure 5: LP Survey Results

This figure provides the responses by limited partners to survey questions about the impact of subscription lines of credit on fund performance, in addition to the advantages and disadvantages of SLCs. Panel A addresses the impact of SLCs on a fund's IRR. Panels B and C show the advantages and disadvantages of fewer capital calls and increasing fund IRR, respectively. The horizontal axis in each panel displays the percent of LPs selecting each response to the particular question. The complete survey is provided in Appendix D and all survey responses are tabulated in Table A3.

Panel A: Impact of SLCs on Fund IRR



Panel B: Fewer Capital Calls



Panel C: Increase Fund IRR

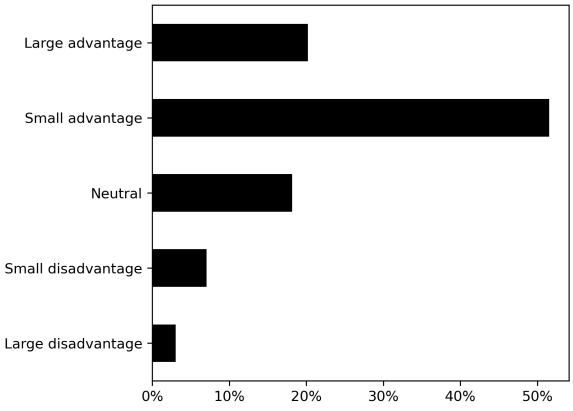


Table 1: Effect of Hypothetical SLC Use on Fund Cash Flows

This table presents hypothetical cash flows in millions of dollars for a fund that operates for 10 years. In columns 1 to 3, cash inflows (capital calls), cash outflows (distributions), and net cash flows, respectively, are provided for a fund that does not use a subscription line of credit. In columns 4 to 8, SLC change, SLC interest expense, cash inflows, cash outflows, and net cash flows, respectively, are listed for the same fund that also uses a \$100 million SLC during year two with a 4% annual interest expense. Numbers in bold indicate the cash flows that are changed when the fund uses a subscription line of credit. Figure 3 plots the cash inflows (columns 1 and 6) from this table.

	Cash flows without SLC			Cash flows with SLC				
Year	Inflows	Outflows	Net	Δ SLC	Interest	Inflows	Outflows	Net
	1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0
1	−75	0	−75	0	0	−75	0	−75
2	−150	0	−150	**100**	0	**−50**	0	**−50**
3	−125	0	−125	**−100**	**−4**	**−229**	0	**−229**
4	−75	50	−25	0	0	−75	50	−25
5	−25	125	100	0	0	−25	125	100
6	0	175	175	0	0	0	175	175
7	0	225	225	0	0	0	225	225
8	0	275	275	0	0	0	275	275
9	0	300	300	0	0	0	300	300
10	0	150	150	0	0	0	150	150

Table 2: Subscription Lines of Credit

This table provides summary statistics for subscription lines of credit at the fund level. The sample includes funds using an SLC at any point during their lives. *SLC Amount* is the average amount ($ million) of a subscription line of credit in a quarter. *Fund Size* is the total committed capital of a fund ($ million). *Leverage* is the ratio of a fund's outstanding SLC to the fund's size, which is averaged over a fund's life. *Leverage using Uncalled Capital* is the ratio of a fund's outstanding SLC, in the quarters that it has an SLC, to the fund's uncalled capital, which is averaged over a fund's life. *SLC Length* is the number of quarters that a fund has an SLC outstanding. *Fund Age* is the number of quarters since a fund's first capital call. *Young Fund* is an indicator variable equaling one if a fund's age is five years or less.

Variable	Number of Observations	Mean	Median	Standard Deviation
SLC Amount ($ million)	364	47.9	11.0	127.0
Fund Size ($ million)	364	1,280	500	2,330
Leverage	364	0.038	0.023	0.048
Leverage using Uncalled Capital	364	0.163	0.131	0.144
SLC Length (quarters)	364	12.7	12.0	7.9
Fund Age (quarters)	364	26.3	24.0	11.9
Young Fund	364	0.385	0.000	0.487

Table 3: Descriptive Statistics

This table provides descriptive statistics on capital calls in Panel A, performance in Panel B, fundraising in Panel C, and GP compensation in Panel D. Age_c is defined as a fund's age when it has first called more than c% of committed capital from its limited partners. *Number of Capital Calls* is the number of times that a fund calls capital from its limited partners in a given quarter. *SLC* is an indicator variable equaling one if a fund uses a subscription line of credit in a quarter. *Leverage* is the ratio of a fund's outstanding SLC in a quarter to the fund's size. *Leverage using Uncalled Capital* is the ratio of a fund's outstanding SLC to the fund's uncalled capital, in the quarters that it has an SLC. *IRR* is the internal rate of return of a fund based on its observed cash flows. *Unlevered IRR* is the internal rate of return of a fund based on the assumption that capital calls substitute for SLC use and the associated interest expense. *Multiple* is the ratio of a fund's total value to paid-in capital. The total value of a fund is constructed by summing a fund's distributions to investors throughout its life and adding the fund's net asset value (NAV) for the last observation in the sample. Paid-in capital is the sum of a fund's capital calls from its limited partners throughout its life. *Unlevered Multiple* modifies the calculation of *Multiple* by assuming that capital calls are reduced in magnitude by the interest expense for a fund's SLC. *PME* is the public market equivalent based on the observed cash flows and valuations. *Unlevered PME* is the public market equivalent based on the adjusted cash flows to account for SLC use and its associated interest expense. *Young Fund* is an indicator variable equaling one if a fund's age is five years or less. *Follow On* is an indicator variable equaling one if a private equity firm raises a follow-on fund. Δ *Carry* ($ millions) is the carried interest received by fund managers minus the unlevered carried interest. *Log*(*SLC Level*) is the log of the average outstanding SLC amount over the observed life of a fund ($ millions). *Log*(*Fund Size*) is the log of the total committed capital of a fund ($ millions).

Panel A: Capital Calls

Variable	Number of Observations	Mean	Median	Standard Deviation
Age_{25}	738	4.988	5.000	3.187
Age_{50}	719	9.826	10.000	4.070
Age_{75}	663	14.507	14.000	5.262
Number of Capital Calls	26,453	1.178	1.000	1.598
SLC	26,453	0.170	0.000	0.375
Leverage	26,453	0.010	0.000	0.041
Leverage using Uncalled Capital	4,490	0.177	0.083	0.242

Table 3 (continued)

Panel B: Performance

Variable	Number of Observations	Mean	Median	Standard Deviation
IRR	5,262	0.144	0.137	0.151
Unlevered IRR	5,262	0.125	0.124	0.147
Multiple	5,262	1.468	1.402	0.505
Unlevered Multiple	5,262	1.487	1.414	0.557
PME	5,262	1.071	1.037	0.301
Unlevered PME	5,262	1.037	1.008	0.283
Young Fund	5,262	0.423	0.000	0.494
Leverage	5,262	0.023	0.000	0.063
Leverage using Uncalled Capital	2,396	0.212	0.082	0.288

Panel C: Fundraising

Variable	Number of Observations	Mean	Median	Standard Deviation
SLC	11,758	0.172	0.000	0.377
Leverage	11,758	0.010	0.000	0.043
Leverage using Uncalled Capital	2,020	0.196	0.094	0.262
IRR	3,014	0.172	0.156	0.131
Unlevered IRR	3,014	0.152	0.145	0.124
Multiple	3,014	1.554	1.489	0.432
Unlevered Multiple	3,014	1.571	1.503	0.461
PME	3,014	1.112	1.081	0.288
Unlevered PME	3,014	1.080	1.051	0.277
Follow On	527	0.884	1.000	0.320

Panel D: GP Compensation

Variable	Number of Observations	Mean	Median	Standard Deviation
SLC	5,444	0.084	0.000	0.277
Leverage	5,444	0.004	0.000	0.036
Leverage using Uncalled Capital	455	0.199	0.000	0.098
Δ Carry	65	1.643	0.367	2.493
Log(Δ Carry)	65	0.660	0.313	0.737
Log(SLC Level)	65	1.600	1.445	1.059
Log(Fund Size)	65	6.200	6.053	0.854

Table 4: Capital Calls

This table examines the relationship between funds calling capital and SLC use. Panel A focuses on the timing of capital calls at the fund level and Panel B evaluates the frequency of capital calls at the fund-quarter level. Age_c is defined as a fund's age in quarters when it has first called more than c% of committed capital from its limited partners. *Number of Capital Calls* is the number of times that a fund calls capital from its limited partners in a given quarter. *SLC* is an indicator variable equaling one if a fund uses a subscription line of credit at any point during its life in Panel A and in a quarter in Panel B. *Leverage* is the ratio of a fund's outstanding SLC to the fund's size. Since the outcome is a count variable in Panel B, it is estimated using a Poisson regression. Standard errors are robust in Panel A and clustered by fund in Panel B. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Panel A: Timing of Capital Calls

Dependent variable	Age_{25}	Age_{50}	Age_{75}
	1	2	3
SLC	0.661**	1.255***	1.852***
	(0.295)	(0.359)	(0.441)
Vintage fixed effects	Yes	Yes	Yes
Adjusted R^2	0.034	0.067	0.149
Observations	738	719	663

Panel B: Frequency of Capital Calls

Dependent variable	*Number of Capital Calls*	
	1	2
SLC	-0.064	
	(0.047)	
Leverage		-1.548***
		(0.405)
Vintage fixed effects	Yes	Yes
Age fixed effects	Yes	Yes
Adjusted R^2	0.063	0.062
Observations	26,453	26,453

Table 5: Performance

This table studies how a fund's use of a subscription line of credit relates to its performance. In Panel A, the outcome variable is ΔIRR, which is the annualized IRR based on the observed cash flows less the unlevered annualized IRR based on the assumption that capital calls substitute for SLC use and the associated interest expense. In Panel B, the outcome variable is $\Delta Multiple$, which is the investment multiple based on the observed cash flows and valuation less the unlevered multiple based on the assumption that capital calls are reduced in magnitude by the interest expense for a fund's SLC. In Panel C, the outcome variable is ΔPME, which is the PME based on the observed cash flows and valuation less the unlevered PME based on the adjusted cash flows to account for SLC use and the associated interest expense. *Young Fund* is an indicator variable equaling one if a fund's age is five years or less. *Leverage* is the ratio of a fund's outstanding SLC in a quarter to the fund's size. Standard errors are clustered by fund. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Panel A: Internal Rate of Return

Dependent variable	ΔIRR		
	1	2	3
Constant	0.019^{***}	0.009^{***}	0.006^{***}
	(0.002)	(0.002)	(0.001)
Young Fund		0.023^{***}	
		(0.002)	
Leverage			0.587^{***}
			(0.074)
R^2	0.000	0.058	0.610
Observations	5,262	5,262	5,262

Panel B: Investment Multiple

Dependent variable	$\Delta Multiple$		
	1	2	3
Constant	-0.019^{***}	-0.020^{***}	-0.012^{***}
	(0.006)	(0.008)	(0.003)
Young Fund		0.002	
		(0.006)	
Leverage			-0.318^{*}
			(0.174)
R^2	0.000	0.000	0.021
Observations	5,262	5,262	5,262

Table 5 (continued)
Panel C: Public Market Equivalent

Dependent variable	ΔPME		
	1	2	3
Constant	0.034***	0.024***	0.010***
	(0.005)	(0.006)	(0.003)
Young Fund		0.025***	
		(0.004)	
Leverage			1.047***
			(0.080)
R^2	0.000	0.021	0.616
Observations	5,262	5,262	5,262

Table 6: Fundraising

This table examines the use of subscription lines of credit prior to follow-on fundraising. *SLC* is an indicator variable equaling one if a fund uses a subscription line of credit in a quarter. *Leverage* is the ratio of a fund's outstanding SLC in a quarter to the fund's size. $Before$ is an indicator variable that equals one during the 12 quarters prior to a fund raising a follow-on fund. All specifications include vintage and age fixed effects. Standard errors are clustered by fund. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	*SLC*	*Leverage*
	1	2
$Before$	0.079^{***}	0.007^{**}
	(0.020)	(0.003)
Vintage fixed effects	Yes	Yes
Age fixed effects	Yes	Yes
Adjusted R^2	0.202	0.106
Observations	11,758	11,758

Table 7: Performance around Fundraising

This table evaluates how a fund's use of a subscription line of credit alters its performance around fundraising. ΔIRR is the annualized IRR based on the observed cash flows less the unlevered annualized IRR based on the assumption that capital calls substitute for SLC use and the associated interest expense. $\Delta Multiple$ is the investment multiple based on the observed cash flows and valuation less the unlevered multiple based on the assumption that capital calls are reduced in magnitude by the interest expense for a fund's SLC. ΔPME is the PME based on the observed cash flows and valuation less the unlevered PME based on the adjusted cash flows to account for SLC use and the associated interest expense. $Before$ is an indicator variable that equals one during the 12 quarters prior to a fund raising a follow-on fund. Standard errors are clustered by fund. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	ΔIRR	$\Delta Multiple$	ΔPME
	1	2	3
$Before$	0.014^{***}	0.009	0.013^{***}
	(0.003)	(0.007)	(0.005)
$Constant$	0.013^{***}	-0.020^{***}	0.027^{***}
	(0.002)	(0.007)	(0.006)
Adjusted R^2	0.019	0.002	0.007
Observations	3,014	3,014	3,014

Table 8: LP Composition

This table studies the role of LP heterogeneity in SLC use during fundraising. *SLC* is an indicator variable equaling one if a fund uses a subscription line of credit in a quarter. *Leverage* is the ratio of a fund's outstanding SLC in a quarter to the fund's size. *Public Pension* is an indicator variable equaling one if a fund has at least one public pension LP. $Before$ is an indicator variable that equals one during the 12 quarters prior to a fund raising a follow-on fund. All specifications include vintage and age fixed effects. Standard errors are clustered by fund. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	*SLC*	*Leverage*
	1	2
Public Pension × $Before$	0.041^{*}	0.005^{**}
	(0.024)	(0.002)
Public Pension	−0.045	−0.002
	(0.028)	(0.004)
$Before$	0.051^{*}	−0.000
	(0.028)	(0.004)
Vintage fixed effects	Yes	Yes
Age fixed effects	Yes	Yes
Adjusted R^2	0.201	0.091
Observations	9,405	9,405

Table 9: Raising a Follow-on Fund

This table examines the likelihood of raising a follow-on fund when a fund uses a subscription line of credit. *Follow On* is an indicator variable equaling one if a private equity firm raises a follow-on fund. *SLC* is an indicator variable equaling one if a fund uses a subscription line of credit in the 12 quarters before raising a follow-on fund. *Leverage* is the ratio of the amount of a fund's outstanding SLC to its size, averaged across the 12 quarters before raising a follow-on fund. All specifications include vintage fixed effects. Standard errors are robust. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	*Follow On*	
	1	2
SLC	0.066^{**}	
	(0.028)	
Leverage		0.223^{**}
		(0.113)
Vintage fixed effects	Yes	Yes
Adjusted R^2	0.061	0.056
Observations	527	527

Table 10: Reaching the Carried Interest Threshold

This table examines SLC use prior to a fund reaching the carried interest threshold. *SLC* is an indicator variable equaling one if a fund uses a subscription line of credit in a quarter. *Leverage* is the ratio of a fund's outstanding SLC in a quarter to the fund's size. $Before$ is an indicator variable that equals one for the 12 quarters prior to a fund hitting the carry threshold. All specifications include vintage and age fixed effects. Standard errors are clustered by fund. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	*SLC*	*Leverage*
	1	2
$Before$	0.033^{***}	0.004^{*}
	(0.012)	(0.002)
Vintage fixed effects	Yes	Yes
Age fixed effects	Yes	Yes
Adjusted R^2	0.088	0.046
Observations	5,444	5,444

Table 11: Carried Interest Compensation

This table evaluates the change in the carried interest received by GPs following the use of a subscription line of credit. $Log(\Delta\ Carry)$ is the log of the carried interest received by fund managers minus the unlevered carried interest ($ million). Carried interest is measured in the last quarter that a fund is observed. $Log(SLC\ Level)$ is the log of the average outstanding SLC amount over the observed life of the fund ($ million). $Log(Fund\ Size)$ is the log of the total committed capital of a fund ($ million). The unit of observation is the fund. Standard errors are robust. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	$Log(\Delta\ Carry)$	
	1	2
$Log(SLC\ Level)$	0.375^{***}	0.364^{***}
	(0.062)	(0.083)
$Log(Fund\ Size)$	0.166^{*}	0.115
	(0.090)	(0.100)
Vintage fixed effects	No	Yes
Adjusted R^2	0.380	0.323
Observations	65	65

Appendix A Variable Definitions

This appendix provides definitions of the variables used in the analysis.

- Age_c is defined as a fund's age in quarters when it has first called more than $c\%$ of committed capital from its limited partners.
- $Before$, in the fundraising analysis, is an indicator variable that equals one during the 12 quarters prior to a fund raising a follow-on fund. In the compensation analysis, it is an indicator variable that equals one for the 12 quarters prior to a fund hitting its carry threshold.
- $\Delta\, Carry$ ($ millions) is the carried interest received by fund managers minus the unlevered carried interest. As a baseline, we gross up carried interest at an 8% discount rate.
- *Follow On* is an indicator variable equaling one if a private equity firm raises a follow-on fund.
- *Fund Age* is the number of quarters since a fund's first capital call.
- *Fund Size* is the total committed capital of a fund in millions of dollars.
- IRR is the internal rate of return for a fund based on its observed cash flows.
- ΔIRR is IRR less *Unlevered IRR*.
- *Leverage*, in the fund-quarter level analyses, is the ratio of a fund's outstanding SLC to the fund's size. In the fund level analysis in Section 5.4, it is the ratio of the

amount of a fund's outstanding SLC to its size, averaged across the 12 quarters before raising a follow-on fund.

- *Leverage using Uncalled Capital*, in the fund-quarter level analyses, is the ratio of a fund's outstanding SLC to the fund's uncalled capital, in the quarters that it has an SLC. At the fund level analysis, it is the ratio of a fund's outstanding SLC, in the quarters that it has an SLC, to the fund's uncalled capital, which is averaged over a fund's life.

- $Log(\Delta\ Carry)$ is the log of the carried interest received by GPs at a fund minus the unlevered carried interest ($ million).

- $Log(Fund\ Size)$ is the log of the total committed capital of a fund ($ million).

- $Log(SLC\ Level)$ is the log of the average outstanding SLC amount over the observed life of a fund ($ million).

- *Multiple* is the ratio of a fund's total value to paid-in capital. The total value for a fund is constructed by summing a fund's distributions to LPs throughout its life and adding the fund's net asset value (NAV) for the last observation in the sample, which incorporates the value of investments that have not been realized yet. Paid-in capital is the sum of the fund's capital calls from its limited partners throughout its life.

- $\Delta Multiple$ is *Multiple* less *Unlevered multiple*.

- *Number of Capital Calls* is the number of times that a fund calls capital from its limited partners in a given quarter.

- *Public Pension* is an indicator variable equaling one if a fund has at least one public

pension LP.

- PME is the public market equivalent based on the observed cash flows and valuation. Specifically, we grow fund capital calls and distributions at the same rate as the return on the S&P 500. Then we divide the aggregate value of the fund's distributions and its net asset value (if applicable) by the aggregate value of its capital calls.
- ΔPME is PME less $Unlevered\ PME$.
- SLC is an indicator variable equaling one if a fund uses a subscription line of credit in a quarter.
- $SLC\ Amount$ is the average amount ($ million) of a subscription line of credit in a quarter.
- $SLC\ Length$ is the number of quarters that a fund has an SLC outstanding.
- $SLC\ Level$ is the average outstanding SLC amount over the observed life of a fund.
- $Unlevered\ IRR$ modifies the calculation of IRR for a fund by assuming that fund capital calls are adjusted to account for SLC use and the associated interest expense.
- $Unlevered\ Multiple$ modifies the calculation of $Multiple$ by assuming that capital calls are reduced in magnitude by the interest expense for a fund's SLC.
- $Unlevered\ PME$ modifies the calculation of PME by assuming that fund capital calls are adjusted to account for SLC use and the associated interest expense.
- $Vintage\ Year$ is the year of a fund's first cash flow.
- $Young\ Fund$ is an indicator variable equaling one if a fund's age is five years or less.

Internet Appendix

Private Equity Fund Debt:

Agency Costs and Cash Flow Management

Appendix B LBO Debt and Venture Debt

This appendix compares subscription lines of credit to leveraged buyout (LBO) debt and venture debt.

Appendix B.1 LBO Debt versus SLCs

The key distinction between subscription lines of credit and debt from a leveraged buyout is the entity that is obligated to repay the debt. For an SLC, the debt is issued to a private equity fund and utilized on a continuing basis. In contrast, after an LBO transaction, a portfolio company of the private equity fund, which is the target of the LBO, is obligated to pay the LBO debt. The differences between an SLC and LBO also extend to the collateral for these different types of debt. An SLC's collateral is typically the fund's uncalled committed capital. In contrast, LBO debt is collateralized with the portfolio company's assets.

In a typical LBO, a private equity fund establishes an entity (commonly referred to as a shell company) that assumes the LBO debt. This entity has the debt only for the brief amount of time required to complete the LBO transaction. Upon the completion of the LBO, the shell company merges with the target and the target is obligated to repay the debt. The private equity fund retains the target's equity, since the target company is in the fund's portfolio. Müller and Panunzi (2004) provide additional details about the use of debt in an LBO.

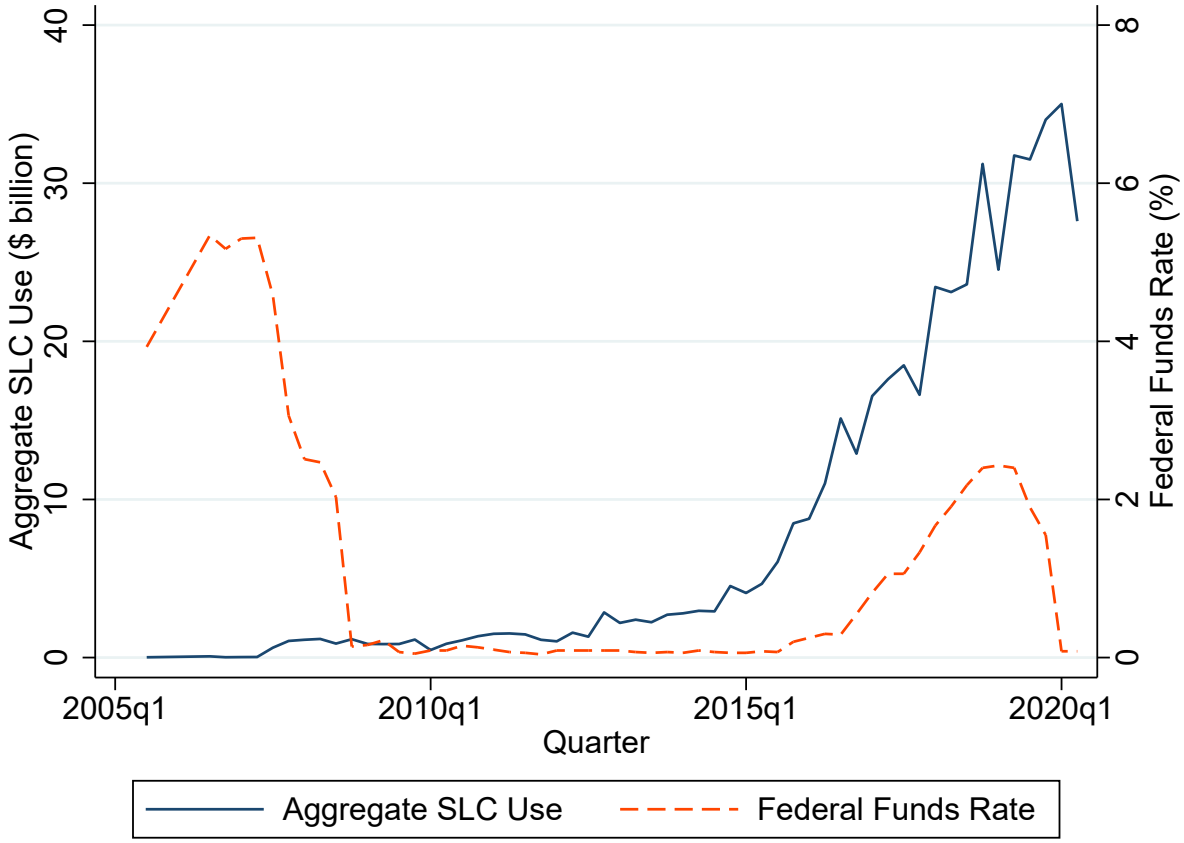
Appendix B.2 Venture Debt versus SLCs

Venture debt refers to loans issued by banks to startups. The borrowing firms using venture debt typically do not have positive cash flows or tangible collateral. The key difference between SLCs and venture debt remains the entity that is obligated to repay the debt. SLCs are debt issued to a private equity fund and utilized throughout the fund's life. In contrast, venture debt is issued to the startup, which also repays the debt. SLCs and venture debt are generally issued by banks. The use of venture debt by a startup does not depend on whether it receives capital from private equity funds.

Appendix C SLC Use and the Federal Funds Rate

Figure A1: Aggregate SLC Use and the Federal Funds Rate

This figure plots both the aggregate quarterly use of subscription lines of credit and the federal funds rate over the sample period. Aggregate SLC use is plotted as a solid line against the left axis and is recorded in billions of U.S. dollars. The federal funds rate is plotted as a dashed line against the right axis and is recorded in percentage points.



Appendix D Survey

Survey for GPs

Question 1: In addition to raising capital from limited partners, private equity funds also can use debt. This debt is commonly referred to as a subscription line of credit, subscription credit facility, or sub line. Importantly, it differs from portfolio company debt and venture debt. Does the current fund that you are most familiar with use a subscription line of credit?

a) Yes

b) No

c) I do not know

Question 2: (*If yes to Question 1.*) How important are the following factors in your fund's decision to use a subscription line of credit?
Response categories: (1) Not at all important, (2) Slightly important, (3) Moderately important, (4) Very important, and (5) Extremely important. The order of the factors below (other than the last) is randomized for the respondent.

a) Manage cash flows (for example, reduce the number of capital calls)

b) Improve performance measures

c) Facilitate follow-on fundraising

d) Increase carried interest compensation

e) Competitor private equity funds use subscription lines of credit

f) Other (please fill-in)

Question 3: (*If yes to Question 1.*) If interest rates continue to rise, would this impact your use of a subscription line of credit?

a) Yes

b) No

c) I do not know

Question 4: (*If no to Question 1.*) How important are the following factors in your fund's decision not to use a subscription line of credit?

Response categories: (1) Not at all important, (2) Slightly important, (3) Moderately important, (4) Very important, and (5) Extremely important. The order of the factors below (other than the last) is randomized for the respondent.

a) Limited partners do not allow our fund to use a subscription line of credit

b) Subscription lines of credit are too expensive in terms of interest rates and fees

c) Not familiar with subscription lines of credit

d) Bank will not provide a subscription line of credit

e) Other (please fill-in)

Question 5: What type of private equity fund do you work at?

a) Buyout fund

b) Venture capital fund

c) Both buyout fund and venture capital fund

d) Neither buyout fund or venture capital fund

Question 6: How many years of experience do you have in the private equity industry?

a) Less than 5 years

b) 5-9 years

c) 10-14 years

d) 15-19 years

e) 20 years or more

Question 7: What is your job title at your current or most recent position?

a) Partner

b) Director

c) Vice president

d) Associate

e) Analyst

f) Other (please fill in)

Question 8: Would you like to share anything else about your experience with using subscription lines of credit?

Open-ended question that participants can respond to.

Survey for LPs

Question 1: In addition to raising capital from limited partners, private equity funds also can use debt. This debt is commonly referred to as a subscription line of credit, subscription credit facility, or sub line. Importantly, it differs from portfolio company debt and venture debt. Have the funds you are currently invested in used a subscription line of credit, either currently or previously?

a) Yes

b) No

c) I do not know

Question 2: (*If yes to Question 1.*) How do subscription lines of credit typically impact a fund's internal rate of return (IRR)?

a) Significantly increase

b) Negligibly increase

c) No change

d) Negligibly decrease

e) Significantly decrease

Question 3: (*If yes to Question 1.*) What are the advantages and disadvantages of funds' use of subscription lines of credit?

Response categories: (1) Large disadvantage, (2) Small disadvantage, (3) Neutral, (4) Small advantage, and (5) Large advantage. The order of the factors below (other than the last) is randomized for the respondent.

a) Fewer capital calls

b) Delay capital calls

c) Increase fund IRR

d) Impact on my allocation to private equity

e) Interest expense and associated fees

f) Need to determine funds' performance without the influence of subscription lines of credit

g) Other (please fill in)

Question 4: What type of private equity funds do you invest in?

a) Buyout fund

b) Venture capital fund

c) Both buyout fund and venture capital fund

d) Neither buyout fund or venture capital fund

Question 5: How many years of experience do you have in the private equity industry?

a) Less than 5 years

b) 5-9 years

c) 10-14 years

d) 15-19 years

e) 20 years or more

Question 6: What is your job title at your current or most recent position?

a) Chief investment officer

b) Director

c) Vice president

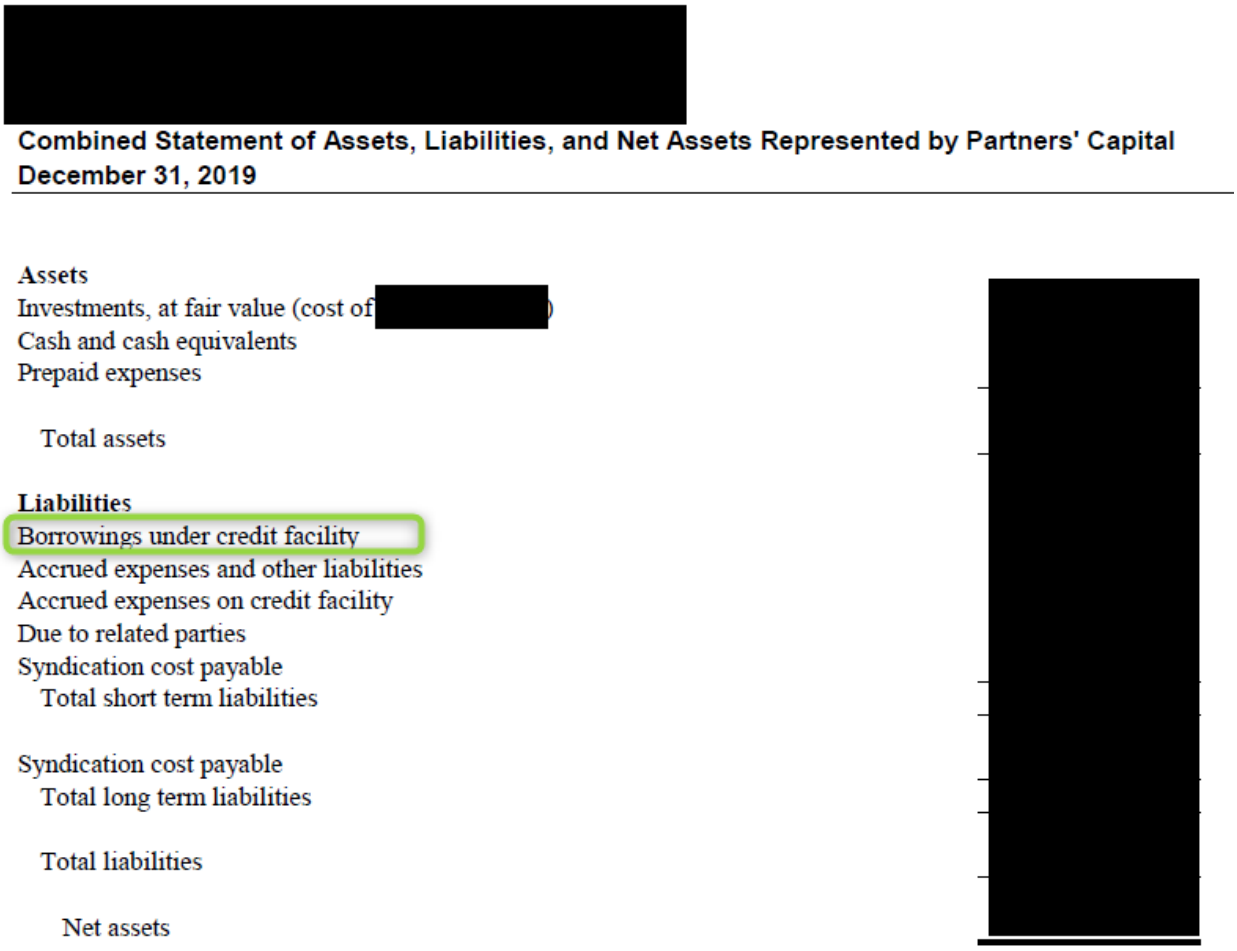
d) Associate

e) Analyst

f) Other (please fill in)

Figure A2: Example of Quarterly Report

This is an example of a quarterly report MSCI uses (in redacted form) to collect data on funds' use of subscription lines of credit.



[redacted]

Combined Statement of Assets, Liabilities, and Net Assets Represented by Partners' Capital
December 31, 2019

Assets	
Investments, at fair value (cost of [redacted])	[redacted]
Cash and cash equivalents	
Prepaid expenses	
Total assets	
Liabilities	
Borrowings under credit facility	
Accrued expenses and other liabilities	
Accrued expenses on credit facility	
Due to related parties	
Syndication cost payable	
Total short term liabilities	
Syndication cost payable	
Total long term liabilities	
Total liabilities	
Net assets	

Table A1: Capital Calls with Fixed Sample Size

This table examines the relationship between funds calling capital and SLC use with a fixed sample size. The sample is restricted to funds that call more than 75% of their committed capital. The analysis is at the fund level. Age_c is defined as a fund's age in quarters when it has first called more than c% of committed capital from its limited partners. SLC is an indicator variable equaling one if a fund uses a subscription line of credit at any point during its life. Standard errors are robust. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Dependent variable	Age_{25}	Age_{50}	Age_{75}
	1	2	3
SLC	0.763^{***}	1.354^{***}	1.852^{***}
	(0.296)	(0.365)	(0.441)
Vintage fixed effects	Yes	Yes	Yes
Adjusted R^2	0.065	0.099	0.149
Observations	663	663	663

Table A2: Robustness

This table examines the robustness of the performance results to alternative interest expenses for subscription lines of credit. Panels A, B, and C focus on ΔIRR, $\Delta Multiple$, and ΔPME, respectively. Columns 1, 2, and 3 set the quarterly SLC interest expense to 0.5%, 1.5%, or LIBOR plus 50 basis points, respectively. Standard errors are clustered by fund. ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

Panel A: Internal Rate of Return

Interest expense	0.5%	1.5%	LIBOR + 50bps
	1	2	3
Constant	0.020^{***}	0.018^{***}	0.020^{***}
	(0.002)	(0.002)	(0.002)
Observations	5,262	5,262	5,262

Panel B: Investment Multiple

Interest expense	0.5%	1.5%	LIBOR + 50bps
	1	2	3
Constant	-0.012^{***}	-0.028^{***}	-0.015^{***}
	(0.003)	(0.008)	(0.004)
Observations	5,262	5,262	5,262

Panel C: Public Market Equivalent

Interest expense	0.5%	1.5%	LIBOR + 50bps
	1	2	3
Constant	0.037^{***}	0.031^{***}	0.036^{***}
	(0.005)	(0.005)	(0.005)
Observations	5,262	5,262	5,262

Table A3: Survey Results

This table presents results from the surveys of general partners and limited partners. The survey questions are contained in Appendix D.

Panel A: General Partner Survey Responses

Question 1	
Yes	114
No	23
I do not know	1
Total	*138*
Question 2a	
Not at all important	0
Slightly important	1
Moderately important	4
Very important	29
Extremely important	63
Total	*97*
Question 2b	
Not at all important	16
Slightly important	21
Moderately important	20
Very important	25
Extremely important	15
Total	*97*
Question 2c	
Not at all important	42
Slightly important	14
Moderately important	13
Very important	20
Extremely important	6
Total	*95*
Question 2d	
Not at all important	63
Slightly important	16
Moderately important	9
Very important	7
Extremely important	2
Total	*97*

Panel A: General Partner Survey Responses (continued)

Question 2e	
Not at all important	39
Slightly important	12
Moderately important	14
Very important	21
Extremely important	11
Total	*97*
Question 3	
Yes	50
No	44
I do not know	4
Total	*98*
Question 4a	
Not at all important	11
Slightly important	2
Moderately important	2
Very important	1
Extremely important	1
Total	*17*
Question 4b	
Not at all important	8
Slightly important	4
Moderately important	3
Very important	1
Extremely important	0
Total	*16*
Question 4c	
Not at all important	13
Slightly important	0
Moderately important	1
Very important	2
Extremely important	0
Total	*16*
Question 4d	
Not at all important	10
Slightly important	0
Moderately important	3
Very important	1
Extremely important	3
Total	*17*

Panel A: General Partner Survey Responses (continued)

Question 5	
Buyout fund	84
Venture capital fund	6
Both buyout and venture capital fund	4
Neither buyout or venture capital fund	24
Total	*118*
Question 6	
Less than 5 years	2
5-9 years	21
10-14 years	19
15-19 years	28
20 years or more	48
Total	*118*
Question 7	
Partner	74
Director	13
Vice president	16
Associate	0
Analyst	0
Other	15
Total	*118*

Table A3: Survey Results (continued)

Panel B: Limited Partner Survey Responses

Question 1	
Yes	109
No	8
I do not know	5
Total	*122*
Question 2	
Significantly increase	53
Negligibly increase	52
No change	1
Negligibly decrease	0
Significantly decrease	0
Total	*106*
Question 3a	
Large disadvantage	0
Small disadvantage	0
Neutral	18
Small advantage	54
Large advantage	27
Total	*99*
Question 3b	
Large disadvantage	3
Small disadvantage	5
Neutral	22
Small advantage	54
Large advantage	15
Total	*99*
Question 3c	
Large disadvantage	3
Small disadvantage	7
Neutral	18
Small advantage	51
Large advantage	20
Total	*99*
Question 3d	
Large disadvantage	2
Small disadvantage	13
Neutral	78
Small advantage	5
Large advantage	1
Total	*99*

Panel B: Limited Partner Survey Responses (continued)

Question 3e	
Large disadvantage	14
Small disadvantage	69
Neutral	10
Small advantage	5
Large advantage	0
Total	*98*
Question 3f	
Large disadvantage	19
Small disadvantage	48
Neutral	26
Small advantage	4
Large advantage	1
Total	*98*
Question 4	
Buyout fund	19
Venture capital fund	7
Both buyout and venture capital fund	74
Neither buyout or venture capital fund	4
Total	*104*
Question 5	
Less than 5 years	11
5-9 years	24
10-14 years	15
15-19 years	24
20 years or more	28
Total	*102*
Question 6	
Chief investment officer	40
Director	21
Vice president	16
Associate	1
Analyst	4
Other	20
Total	*102*