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HOW TO CALIBRATE THE RISK OF BUYOUT INVESTMENTS?*

Through Buyout-Backed Initial Public Offerings

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This paper proposes to use the public market returns of buyout-backed initial public offerings (BO-backed IPOs) as a proxy for buyout funds' appraisal-based returns. Because they provide an economically significant route to exit, and their leverage and fund ownership are still significant three years after the IPO, they represent unique public candidates to directly assess the risks of buyout investments, and to circumvent the stale pricing issue inherent in appraisal-based returns. Our sample covers the 1980–2013 period, and comprises 1,063 BO-backed IPOs. Our risk factor analysis shows that the market betas are close to 1.2, and the loadings on size, value and liquidity are significantly positive. Further, the loadings on the Fama and French profitability and investment are both significantly negative. These results can guide the calibration of the expected return and risk of buyout investments in strategic asset allocation: beyond exposure to Large Cap Equities, approximately 40% of the risk and return of BO-backed IPOs is explained by additional exposure to the market, and exposures to risk factors.

Despite the economic importance of buyout funds[1] and the abundant empirical literature, there is still a huge debate, with significant lack of convergence, on their risk-adjusted performance. Three main methods using unlisted private equity data have been used to assess the exposures of buyout funds to risk factors. All three try to address the stale pricing issue inherent in the appraisal-based valuation process (i.e. partial

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adjustment of the reported net asset value, NAV, to market prices). The first method uses one-step regressions of time-weighted pooled Internal Rates of Return, IRR (sources: Cambridge Associates or Burgiss) against contemporaneous and lagged risk factors. The second method estimates discount rates of private equity returns from cash flows accruing to limited partners. The third method assesses the risk characteristics of underlying companies in buyout funds to inform a risk-adjusted index to be used in the calculation of Public Market Equivalent ratios. An additional method using market prices on publicly traded funds of funds holding unlisted private equity funds (FoFs) and listed private equity funds (LPEs) to avoid the pitfalls related to smoothed appraisal-based returns also informs the risk-adjusted performance of private equity investments.

These four methods report materially different results regarding alpha and exposures to four common risk factors (three Fama and French risk factors: market, size and value; and, the Pástor–Stambaugh liquidity factor). The range of the estimates is very broad with market beta estimates significantly lower than one, close to one and significantly higher than one, and with negative size estimates (indicating that underlying companies in buyout funds are large companies) and positive size estimates (small companies). The significant divergence in estimates of the risk factor loadings comes from the use of different methods and different data sources and samples. By contrast, using a bottom-up approach to inform the characteristics of portfolio companies in buyout funds, L'Her *et al.* (2016) show that portfolio companies tend to be on average very small companies (90% of them are in the bottom decile of the small cap S&P600 index), and to have significantly more leverage than their sector-adjusted public counterparts (net debt-to-enterprise values around 65% vs. 25%). How can we bridge the gap between these results and complement L'Her *et al.*'s findings by calibrating the exposures of buyout funds to different risk factors? This study aims at providing more clarity about risk exposures of buyout funds which are key variables for benchmark construction, performance assessment and asset allocation.

Our study adds to the literature in three ways. This is the first study focusing on buyout-backed initial public offerings (BO-backed IPOs) to proxy the risk of buyout funds. We argue that using BO-backed IPO market returns to circumvent the stale pricing issue of appraisal-based returns is an interesting and promising approach. These transactions represent a significant route to exit—on average, over the last 14 years, BO-backed IPOs made up 36% of the value of all exits (Pitchbook, 2014)—and buyout funds still have a significant ownership in the companies that they actively monitor.

Second, we compare the distribution of key risk characteristics of BO-backed IPOs–leverage, size and value–with leveraged buyout (LBOs) transactions and listed equity. This detailed fundamental analysis is based on two very comprehensive datasets of LBOs and BO-backed IPOs. The LBO sample is similar to L'Her *et al.* (2016). For BO-backed IPOs, we expand the sample of Cao and Lerner (CL, 2009) and Cao (2011) and obtain a sample comparable to Ritter (2015).

Third, to compare our results with the three approaches discussed above, we estimate the risk of BO-backed IPOs over the three-year post-transaction period using time-series regression, and the three Fama–French risk factors augmented by the Pástor–Stambaugh (2003) liquidity factor. While CL and Ritter (2015) focus on the long-term risk-adjusted performance of BO-backed IPOs using the same approach and the three Fama–French risk factors, we focus on the

estimation of their systematic risks using the same risk factors and three additional risk factors: liquidity, profitability and investment. This analysis of returns adjusted for systematic risks that BO-backed IPOs are exposed to is useful for assessing the performance of buyouts and provides key inputs for strategic asset allocation.

Discussion of findings: the relative comparison of LBOs, BO-backed IPOs and listed equity clearly shows that while the leverage of BO-backed IPOs is significantly lower than the leverage at the inception of LBOs, it is still significantly higher than in public counterparts. Further, even if they represent the largest transactions among LBOs, they are still small companies in comparison of listed equity. They tend, as LBOs, to be value neutral, and are more liquid than LBOs which are still private transactions.

The time series analyses provide risk estimates of BO-backed IPOs. Consistent with Ritter (2015), we find a market beta significantly higher than one, and significant size and value tilts. Further, in line with Ang *et al.* (2013) the loadings on the liquidity factor are positive and significant. Finally, the results are robust to the addition of the two Fama and French risk factors (profitability and investment). These results can be a useful guide for the strategic asset allocation process while calibrating the expected return and risk of buyout investments: beyond exposure to Large Cap Equities, approximately 40% of the risk and return of BO-backed IPOs is explained by additional exposure to the market, and exposures to risk factors.

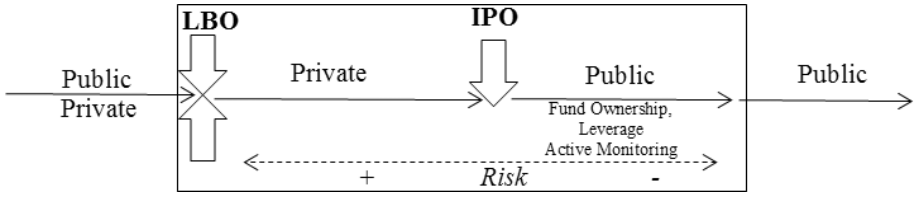
1 What do we know about BO-backed IPOs?

This section 'lifts the veil' (to use the language of Datta, Gruskin and Iskandar-Datta, DGID) on BO-backed IPOs.

BO-backed IPOs represent, as illustrated below, transactions whereby companies proceed to an initial public offering after having been private for a period of time, and after having been the target of a Leveraged Buyout (LBO: public or private company).

Prior to going private: DGID show that in the pre-buyout period, LBO targets are not poorly run (they tend to hold more leverage than their competitors, to be profitable and to pay higher dividends). However, their lower valuation levels appear to be one of the primary motivations behind these transactions.

Private period: focusing on pure RLBOs, DGID show that during the private period, firms realize significant efficiency and productivity gains (downsizing of activities; reduction in labor force; decrease of cost of goods sold; stringent cash policies). They use significantly more leverage and benefit from increases in tax shields. All these forces tend to lead to higher valuation levels. BO sponsors have incentive to exit earlier, however only 24.5% of DGID sample represent "quick flips" re-emerging within two years. CL and Cao (2011) show that RLBOs remain private on average for 3.5 to 3.75 years after LBOs. DGID show that because pure RLBOs tend to be larger firms,



the restructuring period is longer, 5.4 years on average.

Going public again: first, RLBO activity has been modest in comparison of total IPO activity, and RLBOs are larger than other IPOs. Ritter (2015) reports an average of 13% of the number of IPOs over the 1980–2012 period with a peak at 31% during the 2001–2012 period. RLBOs are larger than other IPOs. DGID (2012, 2013) show that pure RLBOs tend to be larger than other BO-backed IPOs. CL document that average gross proceeds of RLBOs are almost twice as large as those of IPOs. Ritter (2015) shows that average BO-backed IPOs' assets and sales are respectively 50% and 250% higher than for all IPOs.

Second, RLBO financial performance tends to be superior to control firms. Using different metrics (operating income-to-sales or ROA ratios), CL and Cao (2011) show that they have outperformed their industry peers. DGID also show that RLBO profitability measures (e.g. cash flow-to-sales ratios) are better than their industry peers, and that they tend to be more productive and cost effective (e.g. cash flow-to-sales ratios higher than their industry peers).

Third, CL and Cao (2011) show that typically the BO fund ownership stake decreases from approximately 60% pre-IPO to 40% post-IPO. BO funds only sell around 6% of their shares (Cao, 2011). RLBOs are also on average much less underpriced than their counterparts (approximately 12% vs. 22% for the first trading day). Private equity sponsors are very concentrated among the well-known groups, and RLBOs are backed by more reputable underwriters. BO funds still have a significant ownership and actively monitor managers: 44% of the boards of directors are from or affiliated with BO funds and 29% of RLBO firms have their chairman from BO funds. DGID show that the ownership concentration remains significantly higher than in industry peers or in control firms during the five years after the RLBO.

Finally, even if many RLBOs use the IPO proceeds to reduce or retire debt, RLBOs are significantly more leveraged than other IPOs. CL show that the ratio of the book value of debt to the sum of the book value of debt and the market value of equity is 46.6% for RLBOs vs. 27.7% for other IPOs. RLBOs consequently pay greater interest expenses and benefit from debt tax shields—DGID show that the effective tax rate drops from 33% to about 18%. DGID "*find that it can take several years after the RLBO for these firms to move back toward a stable* (*or optimal*) *capital structure*" (p. 826). Their leverage is at 41.8%.

These high levels of concentration ownership, active monitoring and leverage (discipline effect and tax shields) should facilitate value creation according to Jensen's (1986) free cash flow theory.

2 Data and comparative analysis

We first describe the samples of LBOs and BO-backed IPOs we could identify to conduct our analysis. Our data collection methodology aims at capturing the most comprehensive US sample on LBOs and BO-backed IPOs. Then, we compare BO-backed IPOs with LBOs and listed companies along three risk characteristics: leverage, size and value.

2.1 Data

LBOs: we proceed as in L'Her *et al.* (2016). Using Capital IQ, we identify 3,492 US private-to-private buyout transactions over the 1994–2014 period. We also use data from Leveraged Commentary & Data (LCD) and estimate the leverage at the transaction's inception for over 1,400 transactions from 1997 to 2014. Table 1 presents the distribution of LBOs over time:

1994–2013. The transactions identified have represented over the period examined approximately $581B, converted into dollars of 2014 purchasing power using the US Consumer Price Index.

BO-backed IPOs: we use the SDC's private equity database VentureXpert as the primary source to identify BO-backed IPOs since 1980: we get 585 transactions. We use then two secondary sources to augment our sample. After data cleansing, 265 additional transactions come from the SDC Platinum US LBO and IPO population database and 213 additional transactions come from Factset Mergers and Acquisitions (period 2000–2013). The total sample comprises 1,063 BO-backed IPOs comprising both public-to-private-to-public (pure Reverse LBOs, RLBOs) and other BO-backed IPOs (division-to-private-to-public or private-to-private-to-public transactions).[2]

Table 1 presents the distribution of both RLBOs and non-RLBOs over time: 1980–2013. We identify 776 pure RLBOs and 287 other RLBOs (private-to-private-to-public transactions), for a total of 1,063 issues. The RLBOs have represented over time approximately $200B, while the other transactions have represented $60B converted into dollars of 2014 purchasing power using the US Consumer Price Index. Our coverage is similar to CL[3] over the period 1980–2003 (526 pure RLBOs vs. 610 BO-backed IPOs), and we identify 453 additional transactions from 2004 to 2013. Our final dataset is twice as large as CL, and comparable to Ritter (2015): 1,063 vs. 987.[4] Over the period 1994–2013 where we have data on both LBOs and BO-backed IPOs, BO-backed IPOs represented 39% of the value of all exits.[5]

2.2 Comparison of BO-backed IPOs to LBOs and listed equity

To assess the risk of BO-backed IPOs relative to LBOs and listed equity (S&P600 for small caps and S&P500 for large caps), we compare their respective leverage, size and value characteristics.

Leverage: for the three samples, we measure leverage as follows: (1) net-debt-to-enterprise-value (ND/EV) at inception for LBOs; (2) average ND/EV over the three years following the public offering for BO-backed IPOs; and (3) ND/EV for listed equities. Figure 1A shows that the leverage at inception of LBOs is around 66%. This result is in line with Axelson *et al.* (2013), Acharya *et al.* (2013) and L'Her *et al.* (2016). By contrast, but in line with CL, Cao (2011) and DGID, the leverage of BO-backed IPOs (data coverage: 80% of the value of the transactions) is 34% during the three years following the IPO, and significantly higher than small cap (large cap) listed equity with an average leverage of respectively 19% and 20% for small caps and large caps (excluding financials).

Size: for LBOs, we measure size as the estimated equity investment: enterprise value (EV) times average equity contribution (30%, on average; source Leveraged Commentary & Data). For BO-backed IPOs and listed equity, we use market equity. All size estimates are converted into dollars of 2014 purchasing power using the US Consumer Price Index. Figure 1B shows that as documented in L'Her *et al.* (2016), except a few mega-buyouts in 2006–2007, the average size of LBOs is very small in comparison to the constituents of public indices: $155 million vs. $880 million for small caps and $22.5 billion for large caps. BO-backed IPOs are more than twice as large as LBOs ($325 million), but still very small in comparison to listed small caps.

Value: as measures of "value" are not readily available for LBOs, it is difficult to assess whether they have a value tilt (as expected from target companies that have free cash flows) or not—this is the reason we do not report results. Analyzing public-to-private transactions, Phalippou

Table 1 Annual distribution of LBOs and BO-backed IPOs (pure RLBOs and others).

Year	# of Firms				US $ million			
	LBOs	Pure RLBOs	Other BO-backed IPOs	Total BO-backed IPOs	LBOs	Pure RLBOs	Other BO-backed IPOs	Total BO-backed IPOs
1980	n.a.	3	2	5	n.a.	29	20	49
1981	n.a.	6	0	6	n.a.	63	0	63
1983	n.a.	15	6	21	n.a.	408	124	532
1984	n.a.	8	3	11	n.a.	199	23	223
1985	n.a.	16	4	20	n.a.	420	195	616
1986	n.a.	28	6	34	n.a.	617	815	1.433
1987	n.a.	16	11	27	n.a.	943	337	1.280
1988	n.a.	2	4	6	n.a.	36	288	324
1989	n.a.	3	6	9	n.a.	201	273	474
1990	n.a.	7	3	10	n.a.	244	148	392
1991	n.a.	30	11	41	n.a.	2.659	849	3.508
1992	n.a.	37	18	55	n.a.	2.198	2.896	5.095
1993	n.a.	43	15	58	n.a.	3.551	1.183	4.734
1994	45	20	13	33	6.830	1.290	772	2.063
1995	61	25	8	33	11.292	2.420	763	3.183
1996	79	36	15	51	8.327	3.867	1.545	5.412
1997	97	21	13	34	10.077	2.982	1.586	4.568
1998	137	25	10	35	21.743	3.711	1.406	5.117
1999	138	26	9	35	12.244	6.929	1.365	8.294
2000	213	26	6	32	15.968	6.168	810	6.978
2001	119	11	5	16	10.481	2.313	742	3.055
2002	131	14	4	18	14.664	3.403	899	4.302
2003	150	19	1	20	25.455	4.234	138	4.372
2004	194	48	9	57	28.858	10.926	1.900	12.826
2005	224	55	17	72	27.668	14.892	3.608	18.500
2006	236	47	18	65	68.138	13.343	5.212	18.556
2007	331	25	24	49	105.376	7.684	6.235	13.919
2008	285	5	1	6	26.959	1.939	189	2.128
2009	158	17	4	21	16.006	7.234	494	7.728
2010	223	29	12	41	18.846	7.582	2.673	10.255
2011	226	21	8	29	16.214	16.254	3.150	19.405
2012	255	37	2	39	16.864	9.574	281	9.855
2013	190	55	19	74	22.267	27.207	5.937	33.144
1980–2013	**3,492**	**776**	**287**	**1,063**	**581,371**[a]	**200,552**[a]	**59,990**[a]	**260,541**[a]

[a] 1980–2013 Values converted into dollars of 2014 purchasing power using the Consumer Price Index.

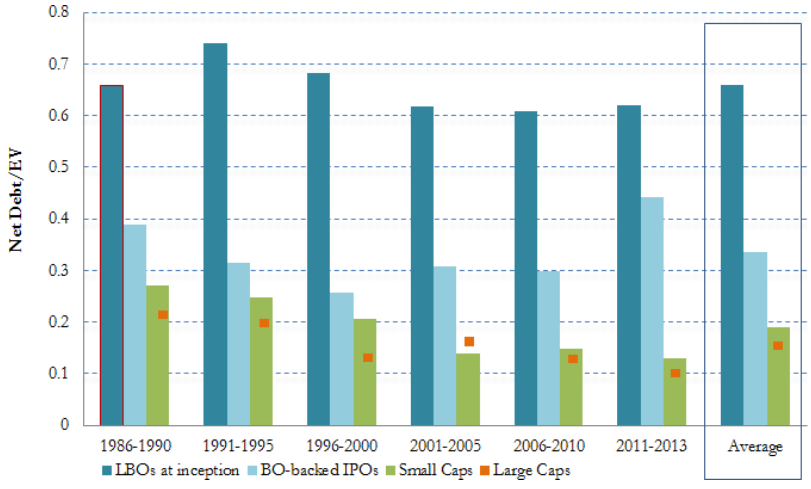


Figure 1A Leverage comparison of LBOs, BO-backed IPOs, listed US Small-Caps (S&P600) and US Large-Caps (S&P500).

Note: For LBOs from 1986 to 1990, we backfilled data assuming leverage is the same as the average (illustrative only).

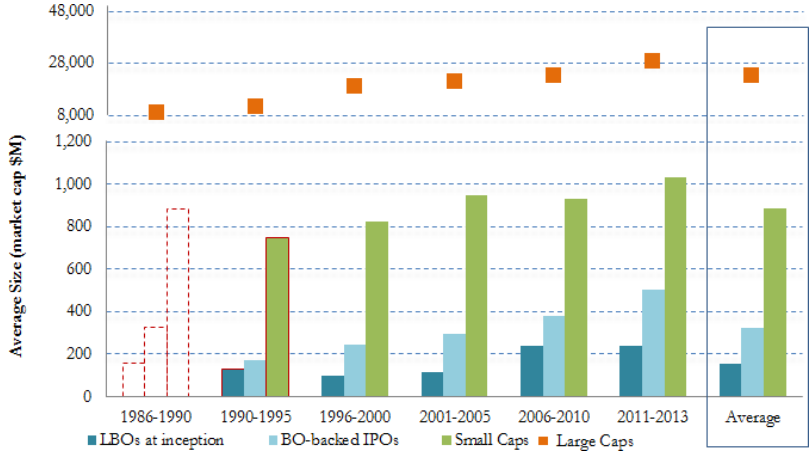


Figure 1B Size comparison of LBOs, BO-backed IPOs, listed US Small-Caps (S&P600) and US Large-Caps (S&P500).

Note: Due to lack of data availability for LBOs and listed small caps (S&P600 only created in 1994), we backfilled data assuming size is the same as the average (illustrative only). Size converted into dollars of 2014 purchasing power using the Consumer Price Index.

(2014) concludes that they are value companies, while L'Her *et al.* (2016) find inconclusive results for both public-to-private and private-to-private transactions. Our analysis shows that our average book-to-market equity ratio of 0.4 is in line with the market (0.37) and Ritter (0.32), and slightly lower than the average 0.5 ratio as found by Cao (2011). Further, the distribution of the book-to-market equity ratio is centred around the Fama and French third quintile. We conclude from this univariate analysis that BO-backed IPOs tend to be neutral along the growth/value spectrum.

3 Return and risk profile of BO-backed IPOs

Firstly, we describe the methodology used to assess the return and risk profile of BO-backed

IPOs. Secondly, we present our results using a four-factor asset pricing model (three Fama and French risk factors and the Pástor–Stambaugh liquidity factor) and compare them with previous studies. We then examine the robustness of our results to the introduction of the additional Fama and French profitability and investment risk factors, and ensure that the factor exposures of BO-backed IPOs are consistent with the underlying firm profitability and investment activities. Finally, we decompose the return and the risk of BO-backed IPOs and examine how they can be used as inputs for performance assessment and asset allocation decisions.

3.1 Calendar-time approach methodology

While previous studies focused on the relative performance (alpha) of BO-backed-IPOs, we pay particular attention to their risk profile.

CL study in detail whether RLBOs create value for investors. They use different methodologies: (1) cross-sectional analyses based on buy-and-hold returns and event-time regression results; and (2) a calendar-time (CT) analysis based on time-series regressions.[6] Ritter (2015) uses a larger sample of BO-backed IPOs, and bases most of his analysis on buy-and-hold market-adjusted returns and style-adjusted returns (matched by market cap and book-to-market ratio), but he also uses time-series regressions. While the buy-and-hold market-adjusted return is very relevant to assess outperformance, it is less appropriate for our purpose. We use a CT approach to capture exposures to risk factors over the 36 months following the IPO.

We build a portfolio starting at the first BO-backed IPO (keeping it for 36 months, or less if delisted or acquired by another company) beginning January 1980. Then, we include each subsequent BO-backed IPO, and rebalance the portfolio monthly. The first portfolio observation starts in July 1982, when our portfolio counts at least 10 observations. The latest transactions are in 2013, but we calculate the portfolio returns until December 2014. Market return series following BO-backed IPOs come from two sources: Datastream and Factset.

We use two weighting schemes: equally-weighted (EW) and value-weighted (VW). We put more emphasis on VW than EW because it is economically more meaningful and mitigates return outliers. The three main advantages of the CT approach are the following: (1) we have diversified portfolio returns across BO-backed IPOs, and hence the factor loadings are estimated with less estimation error; (2) we get a long-term time-series of BO-backed IPOs that allow for factor analysis with multiple risk factors; and (3) it also facilitates the assessment of volatility and correlation with other asset classes for strategic asset allocation purposes.

3.2 Four-factor results

We first estimate the loadings on the three-factor Fama–French risk factors and the Pástor–Stambaugh liquidity factor to be able to compare our results with the literature. More formally, we use the following regression[7]:

$$\begin{aligned} BO/IPO_{p,t} - R_{f,t} &= \alpha_p + \beta_p \cdot (R_{M,t} - R_{f,t}) + s_p \cdot SMB_t \\ &\quad + h_p \cdot HML_t + l_p \cdot Liq_t \\ &\quad + e_{p,t} \quad (t = 1 \textit{ to } 390) \end{aligned} \tag{1}$$

where $BO/IPO_{p,t}$, $R_{f,t}$, $R_{M,t} - R_{f,t}$, SMB_t, HML_t, and Liq_t represent respectively the BO-backed IPO portfolio, the risk-free rate, the market excess return, the Small minus Big (size), the High minus Low (value) and the liquidity risk factors.

Our discussion focuses on the three-year results in **Panel A** of Table 2. Two-year results are also presented in **Panel B**. The adjusted R-square values of 76% and 81% show that the factor model

Table 2 Calendar-time regressions of BO-backed IPO returns on three Fama and French risk factors and the Pástor–Stambaugh liquidity factor with two weighting schemes (equally-weighted (EW) and value-weighted (VW)). Period examined: 1980 to 2014.

Weighting scheme	Adjusted R^2	Alpha	Market–Rf	SMB	HML	Liquidity
Panel A: Three years following BO-backed IPOs						
EW	80.7%	0.09%	1.24***	0.84***	0.10	0.09*
VW	76.3%	−0.04%	1.23***	0.76***	0.15**	0.15***
Panel B: Two years following BO-backed IPOs						
EW	70.7%	0.45%	1.18***	0.84***	0.05	0.13***
VW	71.3%	0.29%	1.24***	0.73***	0.12*	0.15***

*, **, and *** indicate that the coefficient is significant at 10%, 5%, and 1% level of confidence, respectively.

explains a high percentage of the variance of the BO-backed IPO portfolio returns. The market betas are 1.23 for VW and 1.24 for EW. They are significantly higher than one and in line with CL (1.30 and 1.25 with the VW and EW schemes) and Ritter (1.32 and 1.27 with the VW and EW schemes). Other things being equal, they capture the significant difference in leverage between BO-backed IPOs and the listed equity market. Risk loadings on size range from 0.76 (VW) to 0.84 (EW). They are significantly positive, corroborating the initial findings that BO-backed IPOs are small companies. Our size risk estimates are in line with Ritter (2015) (respectively 0.79 and 0.85 for the VW and EW schemes) and slightly higher than in CL (respectively 0.48 and 0.55 for the VW and EW schemes). The loadings on value are slightly positive (0.15 for VW and 0.10 for EW), and significantly different from zero for VW only. Ritter (2015) finds a positive and significant value tilt for the EW scheme only; CL do not find significant value risk estimates. Finally, the loadings on the Pástor–Stambaugh factor are positive, and significantly different from zero, highlighting their lack of liquidity relative to the market.

We find that the risk-adjusted performance of BO-backed IPOs has not been significantly different from zero (respectively a monthly alpha of 0.09% and −0.04% for the EW and VW weighting schemes). CL find a negative but not significant risk-adjusted underperformance of −0.43% and −0.38%, however they acknowledge that when they exclude one extreme observation RLBOs show a slightly positive monthly return. Our results are consistent with Ritter (2015) who finds negative and not significant alphas of −0.07% and −0.11% with the CT approach.[8] Results for the 24 months following the BO-backed IPOs (Panel B) are in line with the results discussed above for 36 months.

3.3 Comparison with results from other approaches

We compare our results with the results obtained via other approaches: (1) one-step regressions of time-weighted pooled IRR against contemporaneous and lagged risk factors[9]; (2) estimates of discount rates of private equity returns[10]; (3) Public Market Equivalent ratios based on risk-adjusted indexes[11]; and (4) publicly traded funds of funds (FOFs) holding unlisted private equity funds and listed private equity funds (LPEs)[12] (see Table 3 for a summary of the results). The comparison focuses mainly on the loadings on

Table 3 Summary of results from different approaches.

Authors	Year	Period	Source	Alpha	Market	SMB	HML	Liquidity
Panel A: Summary of results from one-step regression studies with lags on risk factors (approach 1)								
Ewens, Jones, and Rhodes-Kropf	2013	1980–2011	Venture Economics, LP Source, and Preqin	3.75%	0.82	0.09	0.24	
Barber and Wang[a]	2013	1990–2011	Cambridge Associates	1.55%	1.00	0.64	0.01	
Pedersen, Page, and He[b]	2013	1991–2012	Cambridge Associates	n.a.	0.80	−0.90	1.4	0.2
Range				[1.55%; 5.76%]	[**0.80**, **1.00**] < **1**	[−0.90, 0.64]	[−0.18, 1.4]	
Panel B: Summary of results from studies estimating discount rates extracted from cash-flow time-series (approach 2)								
Driessen, Lin, and Phalippou	2012	1980–2003	Thomson Venture Economics	−0.97%	1.71	−0.92	1.43	
Franzoni, Nowak, and Phalippou	2012	1975–2007	Center for Private Equity Research	0.00%	1.40	−0.12	0.72	
				−0.20%	1.29	−0.04	1.02	0.64
Ang, Chen, Goetzmann, and Phalippou	2013	1992–2008	Preqin	3.00%	1.39	−0.07	0.74	
				−2.00%	1.33	−0.04	0.57	0.59
Range				[−2.0%; 3.0%]	[**1.29**; **1.71**] > **1**	[−**0.92**; −**0.04**] < **0**	[0.57; 1.43]	[0.59; 0.64]
Panel C: Studies based on PMEs do not allow a direct estimation of risk factor loadings: small caps; significant leverage (approach 3)								
Panel D: Summary of results from studies based on publicly traded funds of funds and listed private equity funds (approach 4)								
Jegadeesh, Kräussl, and Pollet[c]	2015	1994–2008	Publicly traded FoFs and LPEs	−0.48%	0.81	0.58	0.38	

[a]Barber and Wang (2013) find a beta of one, but use eights quarter lags vs. four for the other studies.
[b]Pedersen *et al.* (2013) have a loading of 1.2 on High-Yield Corporate spreads.
[c]Jegadeesh *et al.* (2015) have a loading of 0.04 on the momentum factor.

risk factors used by those three approaches (three Fama and French factors and the liquidity factor).

The market beta estimates obtained via our calendar-time approach (VW and EW) are significantly higher than 1.0. These results are in sync with one of the salient risk characteristics of buyout funds' underlying companies identified by L'Her *et al.* (2016): leverage is significantly higher than their public counterparts. These results are also in line with the results obtained via the estimation of discount rates of private equity returns from cash flows accruing to limited partners. However, they are neither in line with the results of one-step regressions of time-weighted pooled IRR against contemporaneous and lagged risk factors finding market beta estimates significantly lower than one, nor with the results from FOFs and LPEs finding market beta estimates not significantly different from one (lower for buyout vehicles than for venture capital vehicles). We believe that 1.2 should be viewed as a minimum beta estimate for buyout funds.

Our size estimates clearly indicate that BO-backed IPOs are small companies. These results are in line with the detailed bottom-up analysis from L'Her *et al.* (2016): companies that buyout funds tend to invest in are in general small. They are also in line with the results from one-step regressions (with the exception of Pedersen *et al.*, 2014) and from FOFs and LPEs. By contrast, size risk loading obtained from estimates of discount rates of private equity returns are negative, indicating that buyout funds invest mainly in large companies. Because BO-backed IPOs are larger than LBOs, we believe that the BO-backed IPO size loading of 0.70 represents a minimum bound for the buyout fund size risk estimate.

Our value estimates are significant, and in line with the results obtained via estimates of discount rates of private equity returns. They indicate that BO-backed IPOs tend to be value companies. Results from one-step regressions and FOFs and LPEs (except Pedersen *et al.*, 2014) corroborate this result: value loadings are positive but not significant.

The positive loading on the liquidity factor from Pástor–Stambaugh is consistent with Pedersen *et al.* (2014) and estimates of discount rates of private equity returns. However, our loadings of 0.08 and 0.15 are closer to the former than to the latter.

3.4 Robustness of results to the addition of the profitability and investment risk factors

Novy-Marx (2012) and Titman *et al.* (2004) provide evidence that profitability and investment are not well captured by the three-factor model of Fama and French. Fama and French (2014) show that a five-factor model (three risk factors augmented by two additional risk factors: profitability and investment) performs better than the three-factor model at capturing patterns in average stock returns.[13] As such, we examine the sensitivity of our results to the addition of these two risk factors.

Although not reported (results available upon request), we informed profitability and investment for 150 BO-backed IPOs representing 55% of the total size (converted into dollars of 2014 purchasing power using CPI returns). The data sources for these variables are Worldscope and Factset. Our results on profitability, measured as annual revenues minus cost of goods sold, interest expense, and selling, general, and administrative expenses divided by book equity (see Fama and French), show that the profitability of BO-backed IPOs is evenly distributed across Fama and French listed equity quintiles. Their average profitability is 22.4% vs. 28.0% for the market, highlighting that BO-backed IPOs tend to be somewhat less profitable than the market.[14] Our

results on investment measured as the change in total assets from the fiscal year ending in year $t-2$ to the fiscal year ending in $t-1$, divided by $t-2$ total assets (see Fama and French) indicate that BO-backed IPOs invest more aggressively than listed equity: 33% of the distribution is in the top quintile. The average investment ratio is 12.4% vs. 9.2% for the market.

We formally estimate the parameters from the following regression:

$$\begin{aligned} BO/IPO_{p,t} - R_{f,t} &= \alpha_p + \beta_p \cdot (R_{M,t} - R_{f,t}) + s_p \cdot SMB_t \\ &\quad + h_p \cdot HML_t + r_p \cdot RMW_t + c_p \cdot CMA_t \\ &\quad + l_p \cdot Liq_t + e_{p,t} \quad (t = 1 \textit{ to } 390) \end{aligned} \tag{2}$$

where RMW_t and CMA_t represent respectively the Robust minus Weak (profitability), and the Conservative minus Aggressive (investment) risk factors.

Table 4 shows that the conclusions drawn before are robust: market beta, size and liquidity loadings are almost unchanged.[15] For profitability and investment, calendar-time results are consistent with our previous analysis comparing the average ratios of our sample with the Fama and French quartiles. The loadings on the profitability factor are negative and significant at 5% confidence level for the VW scheme. It indicates that when we control for other factors, BO-backed IPOs tend to have a lower operating profitability than the market. The loadings on the investment factor are negative and significant at the 1% confidence level. These results show that BO-backed IPOs have a higher growth of total assets than the market.

Although not reported in the paper, we examined whether our results are robust to an event-time approach and to a Weighted Least Squares estimation method taking into account waves of hot and cold markets (peaks in 1993 and 2005). Cross-sectional results are consistent with time-series results. Further, Weighted Least Squares[16] results are also very similar to the Ordinary Least Squares reported results. Those results are available upon request.

3.5 Interpretation of results

We conclude from the four-factor analysis that BO-backed IPOs should be viewed as high beta investments with a very significant small size tilt, a value tilt and a liquidity tilt. Further, the six-factor analysis shows that the four-factor results are unchanged, but that BO-backed IPOs have also a negative tilt to the profitability and investment risk factors. We believe that BO-backed IPOs represent unique public candidates to directly assess the risks of buyout investments, and to circumvent the stale pricing issue inherent in appraisal-based returns. Some arguments suggest that the risk estimates of BO-backed IPOs

Table 4 Calendar-time regressions of BO-backed IPO returns (three years following the transaction) on five Fama and French risk factors and the Pástor–Stambaugh liquidity factor with two weighting schemes (equally-weighted (EW) and value-weighted (VW)). Period examined: 1980 to 2014.

Weighting scheme	Adjusted R^2	Alpha	Market–Rf	SMB	HML	RMW	CMA	Liquidity
EW	81.4%	0.29%	1.24***	0.89***	0.11	−0.11	−0.35***	0.11**
VW	77.2%	0.18%	1.23***	0.76***	0.23***	−0.20***	−0.36***	0.15***

*, **, and *** indicate that the coefficient is significant at 10%, 5% and 1% level of confidence respectively.

may represent a minimum for buyout investments; however, other arguments militate in favor a more nuanced statement.[17]

If we take the results at face value, one can argue that the loadings estimated from BO-backed IPOs should be viewed as minimum risk estimates of buyout investments because they indubitably bear significantly less risks: less business and execution risk since many PE funds' actions have already taken place; less uncertainty because there is a survivorship bias and only exit success stories are considered; less financial risk due to materially lower leverage; larger and more liquid transactions than LBOs.

However, other considerations need to be taken into account. Buyout funds use many levers to create value and to mitigate the expected risks and costs of financial distress associated with high levels of leverage. Kaplan and Strömberg (2009) classify three types of value increasing actions—financial engineering, governance engineering and operational engineering[18]—that may reduce the risk exposures of LBOs. We focus on the first one since it may potentially alter the risk profile in a more meaningful way.

According to the trade-off theory arguments of capital structure, the level of leverage at the inception of the LBO provides significant tax benefits, has disciplinary effects on management, but also increases the expected risks and costs of financial distress. Buyout funds use financial engineering to mitigate the latter. Their management teams have strong equity incentives. The presence of buyout funds significantly reduces asymmetry of information and agency costs between ownership and management, as well as fears of debt overhang (Stulz, 2003). Target companies will tend to not forego future valuable projects because buyout funds are able to improve the firm's ability to borrow against its assets, to improve bargaining power with other stakeholders including employees and customers, and to allay concerns about long-term viability. Beyond these trade-off theory arguments of capital structure, Axelson *et al.* (2013) also show that buyout funds have market-timing abilities. Accordingly, they tend to raise more debt when interest rates are low, and buy (issue) equity when equity prices are low (high): leverage is highly related to economy-wide debt market conditions.

One may also argue that the return and risk profile captured via the BO-backed IPOs calendar-time portfolio reflects the gross return of private equity funds, not the net return of private equity investors. Yet, the difference between both is material.[19] How the management and performance fees alter our results? We believe that management fees represent a drag of performance, but have no impact on the risk profile: in other words, they do not alter the betas, but impact negatively the alpha. By contrast, performance fees (a profit share or carried interest) may lower the factor loadings because they truncate the distribution of returns above the hurdle rate. When gross returns are higher than the hurdle rate, a percentage of the gross return is taken away as performance fees. As a consequence, in this state of the world, the private equity investor would have a lower beta exposure than the private equity fund. We do not see this effect to be material, but agree that our factor loadings, notably on the market, may slightly overstate the market loadings of the private equity investor.

3.6 Implications for performance assessment and portfolio construction

The above analysis where returns are appropriately adjusted for the exposures to different systematic sources of risk can guide the performance assessment of buyouts and the choice of benchmark. Our risk estimates can also serve as initial inputs to calibrate the expected return and risk of buyout investments in any portfolio

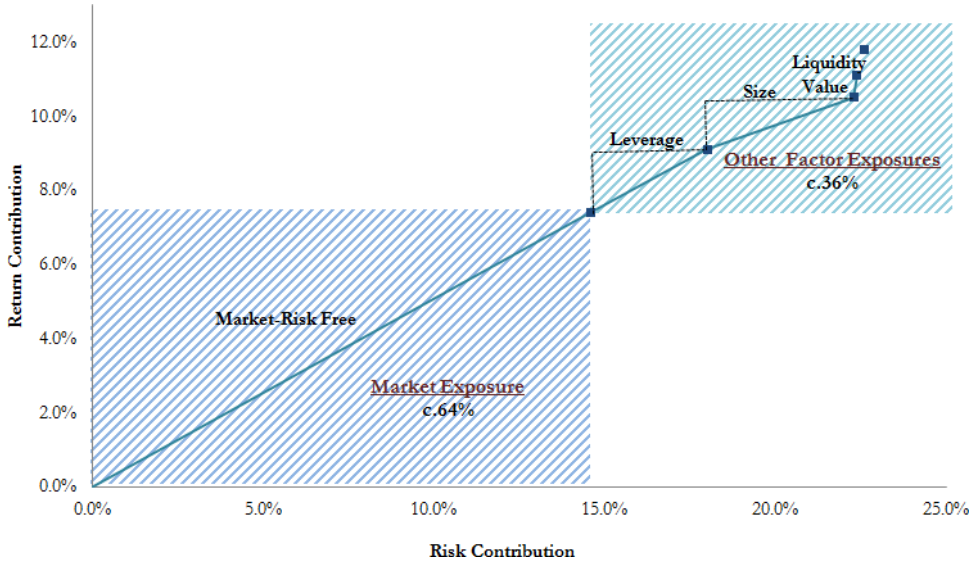


Figure 2 Decomposition of return and risk of BO-backed IPOs over the period 1980–2013.

construction process. We believe that total return and risk of LBOs is higher than that of BO-backed IPOs. However, the latter provide an opportunity to measure estimates of the risk factor exposures of LBOs via marked-to-market returns, and to assess the relative importance of return and risk attributed to these risk factors. To this end, we decompose the return and risk of BO-backed IPOs over the period 1980–2014.

Assuming alpha has been negligible over time, Figure 2 shows that the US market (beta of one) has historically explained around 64% of the return of BO-backed IPOs. 36% is explained by additional exposure to the market (e.g. leverage) and by exposures to the size, value, and liquidity factors.[20] BO-backed IPOs have historically outperformed the market by 4.4% (60% higher). This outperformance is decomposed as such: 1.7% (39%) due to the systematic risk in excess of the market, 1.4% (32%) related to the exposure to the size factor, 0.60% (13%) related to the exposure to the value factor, 0.7% (16%) related to the exposure to the liquidity factor.

Beyond Large Cap Equities, the significant percentages of return and risk attributed to factor exposures highlight the importance of taking these exposures into account when assessing performance or constructing portfolio across multi-asset classes. Non-peer group benchmarks representing the cost of opportunity of buyout investments have to be higher than Large Cap Equities. They should reflect at least the two main other factor exposures: excess market beta and small size tilt. Similarly, expected returns of buyout investments should also reflect the expected returns attributable to these factor exposures. Forecasting market returns and risk premia is beyond the scope of this paper, but we should expect to see excess market risk, size, value and liquidity to explain a significant percentage of the forecasted return of buyout investments.

The expected absolute risk of buyout investments should also reflect the volatility of the market, size, value and liquidity exposures. Another significant advantage of constructing a calendar-time portfolio return over 32.5 years is that it allows for volatility and correlation estimates. The historical volatility of the predicted model is approximately 23% per annum, while the volatility estimate of the diversified portfolio of BO-backed IPOs has

been 26%. When we decompose the explained variance, 64% is attributed to the market, but 36% is attributed to the excess market, size, value and liquidity exposures.

In the performance assessment and portfolio construction, the estimated factor exposures should be viewed as a minimum bound to assess the risk exposures of LBOs. For instance, the beta estimates of LBOs should be scaled up to reflect excess market beta. Similarly, the size loading estimates have to be inflated to take into account the fact that BO-backed IPOs tend to be significantly larger than LBOs.

4 Concluding remarks

Using two comprehensive samples of transactions over the period 1980–2013, we show that BO-backed IPOs have less leverage and are larger than LBOs. However, as documented by CL (2009), Cao (2011) and DGID (2012), buyout funds still have a significant ownership in the companies that they actively monitor, and use significantly more leverage than their public counterparts. As they represent an economically significant route to exit for buyout funds (around 40% of the value of all exits), they are unique public candidates to proxy their risk while avoiding the stale pricing inherent in appraisal-based returns.

Our study complements L'Her *et al.*'s (2016) findings by calibrating the exposures of buyout funds to risk factors. We conclude from the calendar-time analysis that US BO-backed IPOs market betas are significantly higher than one. BO-backed IPOs have an economically meaningful exposure to the small size factor, and positive exposures to the value and liquidity factors. Our results using the Fama–French three-factor pricing model are consistent with Cao and Lerner (2009) and Ritter (2015). Further, we show that the loading on the Pástor–Stambaugh Liquidity factor is also positive and significant. Finally, while our results are robust to the addition of the Fama and French profitability and investment factors, loadings on both additional factors are significant and negative, indicating that BO-backed IPOs tend to be less profitable and to invest more than the market.

These results can serve as the basis to assess risk-adjusted performance of buyouts, and as initial inputs to calibrate the expected return and risk of buyout investments in any portfolio construction process. Beyond the beta risk of the market (exposure to Large Cap Equities), approximately one-third of the risk and return of BO-backed IPOs is explained by additional exposure to the market, and exposures to size, value and liquidity factors (40% of the risk with 6 factors).

Endnotes

[1] Doeswijk *et al.* (2014) confirmed that at the end of 2012, private equity represented 3.6% of the global multi-asset market portfolio, with US$3.3 trillion, with buyout funds accounting for US$1 trillion (Preqin Ltd., 2015); in its 2015 Global Private Equity and Venture Capital Report, Preqin documented private equity assets under management by fund type as of June 2014, with buyout funds accounting for US$1 trillion.

[2] "*The term RLBO is typically used to describe three distinct classes of transactions. Public-to-private transactions involve independent, publicly traded entities before the LBO* (*we refer to these as pure RLBOs*), *while division-to-private deals more closely resemble highly levered going private equity carveouts. The third type is the private-to-private RLBO*, *where an unlisted company is typically acquired by a private equity group and subsequently taken public via an IPO*." (DGID, p. 815).

[3] Cao and Lerner (2009) identify 229 RLBOs for the period from 1981 through the middle of 1998 via Securities Data Company's Corporate New Issues database. They additionally use the VentureXpert and SDC Mergers and Acquisitions databases, as well as Capital IQ.

[4] Jerry Cao has assisted Ritter in providing data on the classification of IPOs as buyout-backed. The distribution of transactions over time is similar to ours (see Figure 1 and Table 1, Ritter, 2015). On his website,

Ritter provides results on an updated sample of 1,061 observations.

[5] The percentage of BO-backed IPOs relative to LBOs is significantly higher than the one provided by Pitchbook over the past 14 years (18% vs. 10%). However, the relative value of BO-backed IPOs relative to LBOs is close to the one reported by Pitchbook. We believe that Pitchbook may capture more growth buyouts than we do.

[6] Cao and Lerner (2009) present detailed descriptive statistics on average raw returns, matched NYSE/AMEX/NASDAQ value-weighted market returns and excess returns relative to this benchmark. They also calculate these three metrics using buy-and-hold returns and additional benchmarks: NYSE/AMEX/NASDAQ equally-weighted market returns, size and book-to-market matched portfolio returns, and Fama and French industry portfolio returns.

[7] Data for the Fama–French risk factors are available on Kenneth French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/. Data related to the liquidity factor are available on the Pástor–Stambaugh: http://faculty.chicagobooth.edu/lubos.pastor/research/liq_data_1962_2014.txt.

[8] Using a different method, less suited to capture the risk profile of BO-backed IPOs, Ritter (2015) shows that BO-backed IPOs have respectively posted a 2% average three-year buy-and-hold market-adjusted return, and a 0.7% average three-year style-adjusted return (matched by market cap and book-to-market ratio).

[9] The estimated risk loadings are the summed coefficients (Dimson's methodology, 1979). See Barber and Wang (2013), Ewens *et al.* (2013), Pedersen *et al.* (2014), and Fan *et al.* (2013).

[10] Driessen *et al.* (2012), Franzoni *et al.* (2012), and Ang *et al.* (2013) estimate discount rates of private equity returns from cash flows accruing to limited partners. They use a net present value (NPV) framework where the NPV equation involving all limited partner cash flows is assumed to be zero in expected value both across time and across funds. The estimation procedure can be interpreted as finding the set of discount rates producing the smallest errors in the fund-level NPV equations.

[11] The comparison with the third method using dollar-weighted metrics is more difficult because it does not allow a direct estimation of the factor loadings (L'Her *et al.*, 2016; Harris, Jenkinson and Kaplan (HJK), 2014, 2016; Robinson and Sensoy, 2013; Higson and Stucke, 2012).

[12] Jegadeesh *et al.* (2015) estimate the risk factor loadings of 24 publicly traded FoFs and 129 LPEs participating directly in private equity transactions. FoFs are listed outside the US with the bulk of their investments in unlisted PE funds located in the US. They usually charge an additional management fee. In contrast to unlisted PE funds which have a finite life, and must raise money for their new funds, LPEs have a different organizational structure: they are closed-end funds with an indefinite life.

[13] Fama and French (2014) show that with the addition of profitability and investment factors, the value factor of the FF three-factor model becomes redundant for describing average returns. As suggested by Fama and French, if our focus was the assessment of abnormal returns (measured by regression intercepts), we could drop the HML factor and use a more parsimonious model. However, Fama and French recommend using the five-factor model if one is interested in portfolio tilts toward size, value, profitability, and investment premiums.

[14] This result is not in line with Cao (2011). However, he contrasts the poor performance of quick flips where the private restructuring period is shortened to benefit from favorable IPO conditions or high industry valuation to the performance of other transactions where the BO sponsors play an active role in value-enhancing activities, monitoring and governance (see DGID).

[15] The value loading is higher for the VW scheme. The outperformance of BO-backed IPOs is significantly higher for the EW scheme, and slightly higher for the VW scheme.

[16] Weighted Least Squares results put more (less) weight on calendar observations for which the number of transactions in the CT portfolio is higher (lower) are very similar to the unbiased but inefficient Ordinary Least Squares results: the most noticeable difference between OLS and WLS estimates is that the loading on value for EW is then significant at the 5% confidence level.

[17] We thank an anonymous referee for highlighting these arguments.

[18] Through a survey of PE funds, Gompers *et al.* (2016) show that buyout funds' financial engineering sources of value come from boards of directors that tend to be smaller with a mix of insiders, and from a more active involvement in governance than public company directors and public shareholders. Operational engineering sources of value come from focus on increased growth (internal or external), restructurings, reduced

costs, economies of scale, development of industry and operating expertise, and facilitation of a high value exit or sale. All these actions tend to alter the operational leverage and the unlevered betas of the target companies.

[19] Phalippou (2009) and Metrick and Yasuda (2010) estimate that the average private equity buyout fund charges fees of more than 7% per year. Higson and Stucke (2012, p. 23) estimate that "*the gross IRR of the weighted-average liquidated fund is 8.4% points higher than its net IRR*".

[20] When the six-factor model is used for the decomposition, the US market explained around 60% of the return of BO-backed IPOs, and 40% is explained by exposures to the size, value, liquidity, profitability, and investment factors.

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