ARE PRIVATE EQUITIES RISKIER THAN STOCKS?

January 2025

Important Note

All calculations presented in this report are based on market indices created by Scientific Infra & Private Assets, an EDHEC Venture. The privateMetrics® indices must be distinguished from manager performance benchmarks that are constructed by aggregating manager-reported performance data. Whether these benchmarks are built by computing fund-level money-weighted returns (Cambridge Associates) or calculating fund-level (modified) Dietz returns (MSCI/Burgiss, Preqin), they are not market benchmarks but manager performance benchmarks i.e. peer group benchmarks.

privateMetrics indices and benchmarks measure the time-weighted equity returns of private (unlisted) companies. De facto, *they represent the systematic exposures that investors face when building their investment strategy. Unlike fund manager performance indices, privateMetrics indices represent the performance and risk of the underlying assets computed at global or segment level. In other words, drawing a parallel with public equities, privateMetrics indices are the stock market indices for private markets whereas fund manager benchmarks are the equivalent of an index of listed mutual funds. Thus, to avoid confusion with the term `private equity' which has become synonymous with investing in private equity funds, we talk of private equities to refer to the market for investing in the equity stakes of private companies.*

The risk profile of a contributed manager benchmark also differs from that of a market index like privateMetrics. Manager performance benchmarks do not capture risk because of the way they are computed: most of the data is the result of appraisals that are done quarterly at best without reference to the latest market transaction data, understating fluctuations in asset returns. These 'smoothed' returns lead to reporting artificially lower correlations with publicly traded assets, resulting in inflated Sharpe ratios and alphas. This smoothing effect causes significant positive autocorrelation and underestimates volatility, as the appraisal-based methodology fails to capture real market fluctuations.

Of course, fund managers also smooth risk through their skills i.e., in relation to the volatility of the private asset market, their ability to account for market conditions and their ultimately non-linear exposure to the market through the timing of investment entries and exits allows them, when their skills are proven, to reduce volatility. Furthermore, the structuring of their investments can have positive effects on the associated risk: for example, by securing preferential investment conditions compared to other shareholders.

It remains that the underestimation of market risk through a fund manager benchmark can be misleading and suggest suboptimal investment decisions, whether it involves assessing the potential market risk within a private market allocation, selecting specific segments of that market, or, of course, understanding the systematic risk associated with investing in a particular project.

privateMetrics indices were created to address these issues and provide a reliable and realistic understanding of the market risk to which any investor in private equities is exposed either directly as a manager or general partner of fund, or indirectly as a limited partner in an investment fund.

Executive Summary

While they mostly invest in private assets via funds, investors select and mandate private equity managers primarily to gain exposure to **private equities market risk** i.e., the sum of the risks found in the market for investing in private companies. Of course, investors in private funds also face other risks such as liquidity and cash flow risks by virtue of investing through a partnership structure. They do so because they often need fund managers' skill to access private markets, and because they expect the delegation of investment selection and management to a specialist to be value enhancing and to maximise net returns.

But despite the key role of fund managers in this process, gaining exposure to private market risk must remain the main motivation of any investor in a private equity fund. Indeed, such investments are made in a market of willing buyers and sellers, and their value is therefore subject to the forces of supply and demand. Changes in investors' views and preferences for one or other sector, technology or business model leads to rising and falling asset prices, albeit less rapidly than in the market for public equities. In the end, market risk (and returns) will determine a large part of the outcome. One does not imagine an LP mandating a manager, however highly skilled, to invest in a disappearing or terminally declining market. Private equities market risk is *central* to any private market investment strategy.

The privateMetrics indices have been designed to measure the risk-adjusted performance of the private equities market before fund managers bring their skills to bear and make specific investment choices, add fund-level risks or mitigate idiosyncratic risk. These market indices represent private equities as an asset class and are therefore the most relevant and logical starting point to understand and undertake private asset investing.

In this report, we find that:

1. Private and public equities exhibit commensurate levels of risk.
2. Private equities have experienced less downside over the past decade, but this corresponds to an unprecedented period of demand growth and subsequent increases in market prices which may not be repeated.
3. Private equities market risk has been decreasing slightly (but mostly on the upside) over the past decade, while public equities market risk has increased.
4. Private equities market indices produced with the privateMetrics asset pricing model capture the variance of observable private equities transactions.
5. The risk of investing in private equities at the micro-economic level can be traced back to systematic factors such as size or profits or revenue growth. This, in turn, justifies the importance of measuring private equities market risk within a systematic risk framework.
6. Investing in private equity funds implies significant exposure to private equities market risk but also very variable levels of risk depending on the exposure to each segment and risk factor created by fund managers through their investment selection process.

Private vs Public Equities Market Risk

Table 1 shows that private equities, as represented by the private2000 index, have a ten-year volatility of returns and extreme risk profile that are commensurate with that of listed equities.

At the broad market level, the private2000 index tracks the performance of 2000 private companies in the 30 most active PE markets and is designed to include firms that are "PE-like" (have the same size and profitability profile as known PE portfolio companies). When compared to the MSCI ACWI, which tracks 2,647 companies in 47 markets, the level of realised risk can seem commensurate, albeit slightly higher, for private equities. Volatility ranges from 12% to 15% and Value-at-Risk between 19% and 21% on a 10-year basis.

A US-only comparison provides a different picture: public equities, as represented by the S&P500 (equally weighted), are less risky than private equities, as seen through the privateUS index, which tracks 920 US-only constituents, with a market cap of USD310bn+ at the end of 2024. US private equities exhibit a more dynamic risk profile than public equities with higher 10-year volatility and VaR due to a significant increase in market prices (Figure 1), but a lower risk profile over the past 5 years, while public equities Vol and VaR have increased over that period.

FIGURE 1: PRIVATE VS PUBLIC EQUITIES (2013-06=1000)

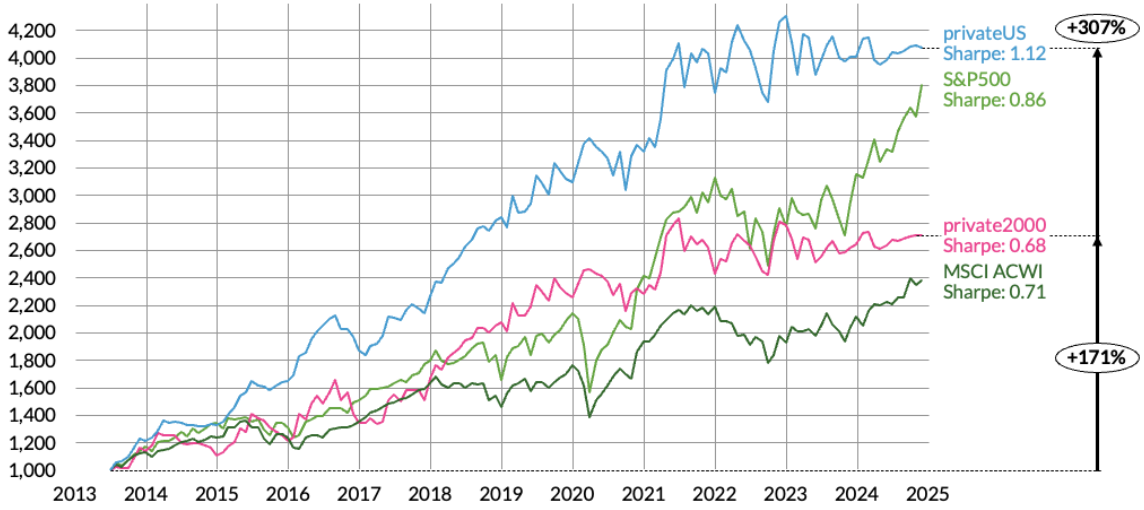


*TABLE 1: PRIVATE2000 VS MSCI ACWI AND PRIVATEUS VS S&P500- RETURN AND RISK METRICS**

	Tot. Returns			Volatility			VaR 97.5%			Max DD
	3Y	5Y	10Y	3Y	5Y	10Y	3Y	5Y	10Y	All time
private2000	1.18%	3.42%	8.82%	12.34%	13.50%	15.53%	22.47%	22.77%	20.86%	-19.25%
MSCI ACWI	3.68%	6.95%	6.67%	12.62%	14.58%	12.66%	21.0%	22.67%	19.10%	-21.32%
privateUS	7.10%	8.80%	13.6%	13.61%	14.85%	19.72%	18.75%	19.73%	23.87%	-13.38%
S&P500	8.89%	12.82%	11.01%	18.39%	20.19%	16.76%	27.22%	27.92%	22.80%	-26.70%

** All indices are equally weighted, USD Total Returns*

Turning to the downside, the maximum drawdown of public equities is consistently higher than that of private equities. This is unsurprising for a historical period of unprecedented growth of the private equities asset class characterised by significant increases in market prices.

As shown in Figure 1, the private2000 index exhibits cumulative growth of 171% over the last decade and the privateUS index has grown by more than 300%, both outperforming their respective public equities peers. This lower downside is also obvious from the high Sharpe ratio of the private equities markets, especially in the United States.

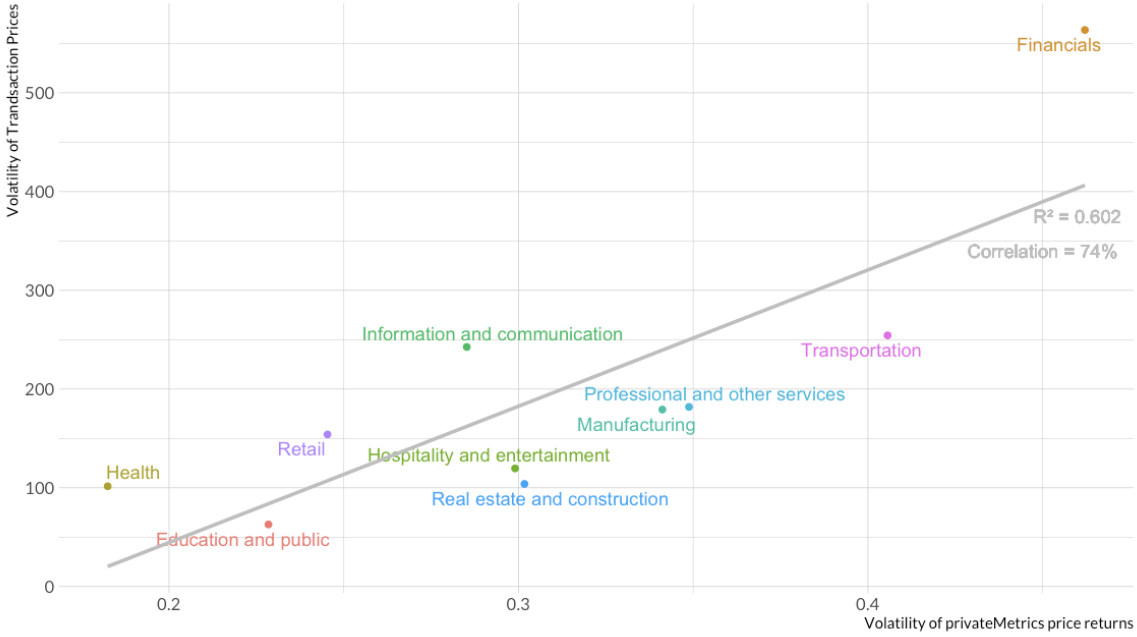
How volatile are private transaction prices?

Asset prices vary for both systematic (market-driven) and idiosyncratic reasons. The notion of private equities market risk implies that private transaction prices vary systematically and that this risk is reflected in the returns of a private equities market index.

Figure 2 (y-axis) shows the volatility of 10k observed private market transaction prices over a period of eleven years, in millions of dollars, by PECCS activity segments. Different sectors have different levels of price volatility i.e., different levels of market risk, driven by different supply and demand dynamics in each sector. Figure 2 also shows the volatility of price returns (capital returns) measured in privateMetrics using the monthly price estimates used to produce the private2000 and privateUS indices shown above (and any of the thousands of benchmarks available via the privateMetrics API). The level of fit between the two datasets is high and the correlation is highly positive and significant.

This confirms that private asset price volatility can be captured by a model of the systematic risk of private transaction prices, like the privateMetrics model, and used to build benchmarks that accurately represent the market risk of private equities.

FIGURE 2: VOLATILITY OF PRIVATE EQUITIES TRANSACTION PRICE (USDM)S BY SECTOR VS PRIVATEMETRICS RETURN VOLATILITY



Source: pitchbook, privateMetrics, 2013-2024

What drives private equities market risk?

Investors who are used to fund manager benchmarks may find the level of volatility described above surprising. Nevertheless, it is easy to see that the market price of investment in private companies for which there is changing demand should vary. For instance, the tendency of many investors and their fund managers to invest in Tech and Healthcare, two 'mega-trend' sectors, necessarily increases the market price of companies that are in finite supply at one point in time. Conversely, the demand for some assets like coal-fired power plants is declining and their market value as well. Beyond these mega-trends, supply and demand for private equities is continuously changing as the economy develops, and investors preferences for certain sectors and technologies evolve.

Fund manager benchmarks do not reflect market risk because they are built from contributed appraisals, which are not updated to reflect the latest market conditions. As a result, investors accustomed to fund manager benchmarks may be misled into thinking that volatility in private markets is very low. In effect, it is the volatility of appraisals that is low, not that of market prices and returns.

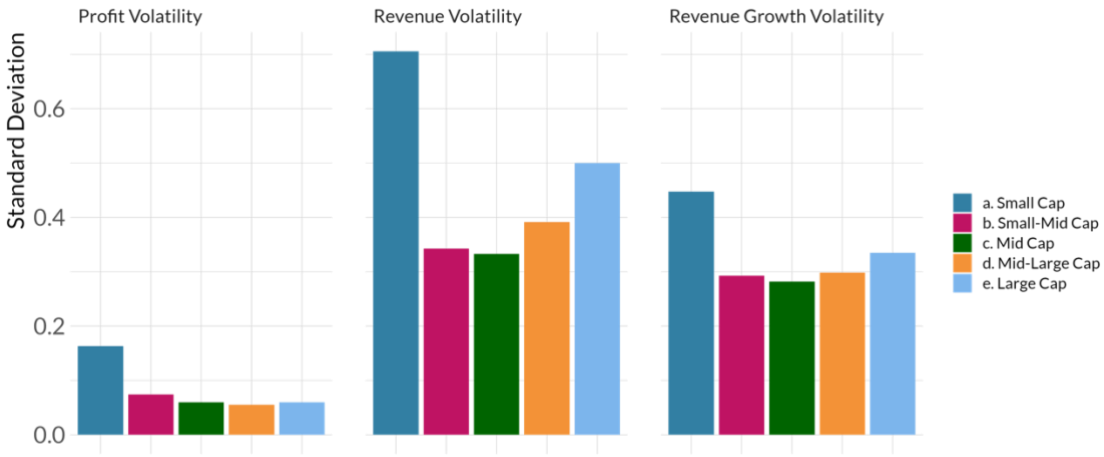
To better understand where the risk of private equities come from, we can examine two aspects of the micro-economic profile of private companies using the privateMetrics broad market universe.

Note: what follows is an abstract of a forthcoming research paper on risk in private equities that provides a detailed analysis of this question.

Revenue and Profit Risk in Private Equities

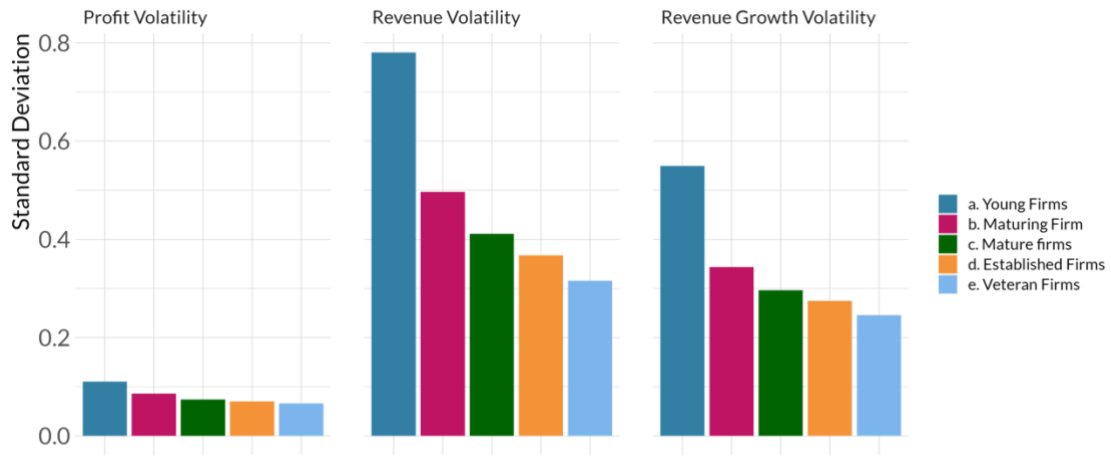
The market price of a company is highly dependent on its ability to generate revenue today, to grow revenues and to make profit. The more uncertain (volatile) these quantities, the riskier the investment in a given firm, and vice versa. We use data for 1M+ private firms in 150+ countries to measure the volatility of revenues (logged), revenue growth and profits and consider whether there are systematic drivers of these micro-economic risks.

FIGURE 3: VOLATILITY OF REVENUES (LOG), GROWTH AND PROFITS BY ASSET SIZE



Source: privateMetrics universe, 1M+ observations 2013-2024

FIGURE 4: VOLATILITY OF REVENUES, GROWTH AND PROFITS BY MATURITY



Source: privateMetrics universe, 1M+ observations 2013-2024

Figure 3 shows the level of volatility of profits, revenue and growth in private equities at the global level. There are clearly "buckets" of risk: small firms have a much higher volatility of all three micro-economic drivers of equity value, while larger firms, especially mid-caps, tend to have a lower risk profile and therefore should be more valuable on average. However, very large private firms also exhibit higher micro-economic risk in terms of revenue and growth volatility.

Likewise, Figure 4 highlights the decreasing level of micro-economic risk in older firms. The more mature a (surviving) company the less risky its fundamentals become and the more valuable it should be. This finding is valid in the cross-section (at one point in time) and over time, as firms grow in size and mature, or not.

This analysis can be repeated for a number of other risk factor buckets such as profits, leverage, capex, etc. as well as each PECCS market segment, by activity but also business model, customer model etc. A further analysis of bankruptcy risk in private equities confirms the existence of systematic risk drivers in the fundamentals of private equities (see Blanc-Brude, Clark and Selvam, forthcoming paper).

The Pricing of Systematic Risk in Private Equities

The systematic drivers of risk seen in private equities can also be related to observable private market transaction prices. In other words, when looking at exit values in private market transactions, it is apparent that these risk factors are priced.

Table 2 shows the average price-to-revenue ratio for 10k private equity transactions organised by quartile of risk factor exposure: for Size, the top quartile represents the price-to-sales multiple of the 25% largest deals by revenue size. Likewise for other quartiles and factors.

Tables 3A and 3B also show price multiples for the same dataset, split by PECCS activity and revenue model segments (PECCS has five pillars, but we only show two here for brevity). Again, it is apparent that transaction prices follow patterns of exposure to certain segments, themselves proxies for exposures to risk. Table 3B shows that subscription-based businesses, which tend to have recurring revenues, also tend to have a higher market price, etc.

TABLE 2: PRICE-TO-REVENUES MULTIPLE IN PRIVATE EQUITIES BY RISK FACTOR EXPOSURE QUARTILE 2013-2024

	Size	Growth	Profitability	Maturity	Leverage	Country Risk
Top Quartile	2.1x	3.0x	4.2x	2.1x	3.8x	2.3x
Second Quartile	2.5x	2.8x	2.5x	2.5x	2.7x	2.9x
Third Quartile	2.8x	2.6x	1.8x	3.1x	2. 5x	3.0x
Bottom Quartile	3.5x	2.5x	2.5x	3.2x	2.2x	2.8x

Source: pitchbook, privateMetrics, 2013-2024

TABLE 3A: PRICE-TO-REVENUES MULTIPLE IN PRIVATE EQUITIES BY PECCS ACTIVITY SEGMENT 2013-2024

Tables 3A and 3B show a difference from the mean test: *** indicates that the average in the segment is different from the population average at the 1% statistical significance level.

Activity	P/Sales	P/EBITDA
Education and public	1.9x	12.4x
Financials	2.4x***	11.1x**
Health	2.1x	13.1x***
Hospitality and entertainment	1.9x	11.5x**
Information and communication	2.6x***	12.8x***
Manufacturing	1.5x***	10.1x
Natural resources	1.9x	7.4x**
Professional and other services	1.6x**	10.6x
Real estate and construction	1.8x	10.5x
Retail	0.9x***	10.3x
Transportation	1.4x***	8.8x**
Utilities	1.9x	10.2x
All Transactions	1.7x	10.9x

Source: pitchbook, privateMetrics, 2013-2024

TABLE 3B: PRICE-TO-REVENUE AND EBITDA MULTIPLE IN PRIVATE EQUITIES BY PECCS REVENUE MODEL SEGMENT 2013-2024

Revenue Model	P/Sales	P/EBITDA
Advertising	2.1x***	10.9x
Reselling	1.4x***	10x
Production	1.6x***	10.5x
Subscription	2.9x***	13.6x***

Source: pitchbook, privateMetrics, 2013-2024

Thus, private equities are exposed to systematic risk factors like size, profits or leverage and also belong to different market segments that represent different levels of market risk.

Conclusion

Investing in private equity funds implies not only significant exposure to private equities market risk but also very variable levels of risk depending on the exposure to each segment and risk factor created by fund managers through their investment selection process. These risk exposures are priced in a market for private equities as a function of supply and demand for different types of firms.

privateMetrics indices are designed to measure this variation in the average price of different types of private firms in a representative and robust manner thanks to a very large dataset of companies and transactions updated monthly and an asset pricing model that can accurately predict average prices.

To find out more about privateMetrics indices, download our factsheet here.

To read about the privateMetrics methodology to estimate the level and variance of private asset prices, download a short methodological summary here.

Appendix

The privateMetrics® Valuation Model

Our approach to the valuation of private companies is designed to maximise the available transaction and financial data in private markets and provide a standardised and systematic manner to update prices with every observed transaction.

First, we construct a multi-factor model of prices using a sample of observed transactions over time which can infer the unbiased and precise factor prices that investors pay for different characteristics of a private asset. Although every transaction is idiosyncratic or unique, in a large sample of transactions, the individual errors in each transaction price can be diversified away to discern the price attributable to each factor. Factor prices refer to the premium (or discount) that an investor is willing to pay to seek exposure to a specific factor of return in private companies. For example, observing the relationship between size and valuation among reported transactions, it can be inferred how much premium or discount an investor is willing to pay for purchasing a larger private company.

Second, an important and key application of this approach is that, with the estimated factor prices, say for size, it would then be possible to price unlisted private companies whose size information is available, irrespective of whether they are traded or not. This approach provides a more robust estimate for FV and enables the creation of representative indices of private companies.

Our approach's novelty is in calibrating the model to newly observed transactions obtaining the factor price evolution over time, which allows us to update the valuation for all tracked unlisted private companies.

Common risk factors

If investors trade unlisted private companies from each other in mutually negotiated transactions, there must be some common characteristics that at least partially explain prices. For example, private companies that have higher profits or growth opportunities may be more valuable to investors than those that are not.

To arrive at a potential list of factors, we follow simple criteria that there needs to be an economic rationale for the factor to affect valuation. The factor should also be statistically related to the valuation. Moreover, the factor should also be objectively observable or measurable. With a potential list of factors, our factor selection is the result of a statistical approach, where the factors that can satisfactorily explain the variation in observed transaction valuations are included in the final model while trading off being parsimonious with being able to explain a higher variance in valuation. The privateMetrics asset pricing model uses five key risk factors as below:

- Size: Larger companies may be more complex, have higher transaction costs, and be less liquid, all of which can make them trade at a lower valuation per USD of revenue.
- Growth: As traditional PE strategies rely on growing the entry multiple, that may involve both increasing its top and bottom lines, i.e., revenue and profits. Thus, companies that can grow faster can be more sought after, making them more valuable.
- Leverage: Leverage can make a company riskier as it increases the risk of default.

However, there is also a signalling effect of leverage, as companies with stable consistent cash flows can support a higher leverage, and vice versa. Thus, leverage is expected to influence the valuation of a company.

- Profits: More profitable companies have more predictable (less risky) future payouts and hence attract a lower risk premium, making them more valuable.
- Maturity: Younger companies have fewer track records and face higher information uncertainty. Studies have shown that firms with high uncertainty tend to be overvalued and earn lower future returns. Thus, the maturity negatively affects valuation.
- Country risk: Investors may require a high return when investing in a high-risk country, thus depressing the current valuation. In other words, in countries with lower risk, investors may be willing to purchase assets at a higher valuation as government policies may be more predictable with lower macroeconomic risks.

TABLE 1: KEY FACTORS, THEIR EFFECT ON VALUATION, & THE ECONOMIC RATIONALE FOR INCLUDING THEM IN THE MODEL

Factor	Definition (Proxy)	Effect on price	Economic Rationale	References
Size	Revenues	Negative	Larger firms are more illiquid and trade a lower price	Fama & French (1993)
Growth	Change in Revenues	Positive	Companies with higher revenue growth trade at a higher price	Fama & French (1992), Petkova & Zhang (2005)
Leverage	Total debt / Revenues	Positive	Companies that can borrow more have a lower cost of capital and a higher value	Gomes & Schmid (2010), George & George & Chuan-Yang (2010)
Profits	Ebitda Margin	Positive	Companies that have higher profits have a higher value	Novy-Marx (2013), Hou et al. (2015)
Maturity	Years since incorporation	Negative	Companies that are mature exhibit less growth potential and trade a at a lower price	Jiang, Charles & Zhang (2005)
Country Risk	Term Spread	Negative	Companies in high-risk countries face more uncertain prospects	Chen & Tsang (2013)

Source: calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022

Our factors have been documented in prior academic studies to be associated with valuation. We also include factors that have been identified as key determinants of valuation from a survey of private equity practitioners that we conducted in 2023. Table 1 summarises the key factors that we use in the model, how they are measured, each factor's effect we document in the data on average, the economic rationale for their inclusion, and citations for the work that underpins their inclusion.

Empirical evidence supporting common risk factors

To illustrate the systematic effect these factors have on valuation, in Table 2 we summarise the average P/S ratio in each quartile of the transaction sample segmented by each of these factors. Even in this single-dimensional sorts, the trends as we move along the quartiles strongly indicate the presence of systematic effects in valuation. For example, viewing the size factor, we can observe that the smallest companies (those that belong to the bottom quartile) enjoy the highest valuation per USD of sales, and this keeps decreasing as we move up the quartiles one by one.

In Table 3 we summarise the average P/S ratio by each class in a PECCS® pillar. PECCS® is a private-asset-focused multi-pillar taxonomy of private companies developed by EDHEC Infra and Private Assets. By focusing on independent pillars with exhaustive and non-overlapping classes within each pillar, PECCS® can capture several dimensions of risk factors that affect the valuation of private companies. Moreover, the PECCS® classification is objective and

clearly defined to enable one to segment private companies even with the limited information that is a hallmark of private markets. Consistent with this, we find that the valuation in transactions varies systematically by PECCS® classes, with many of the classes having significantly different mean P/S compared to the other classes.

TABLE 2: KEY FACTORS, THEIR EFFECT ON VALUATION, & THE ECONOMIC RATIONALE TO INCLUDE THEM IN THE MODEL

Sample	Size	Growth	Profitability	Maturity	Leverage	Country Risk
Top Quartile	2.1x	3.0x	4.2x	2.1x	3.8x	2.3x
Second Quartile	2.5x	2.8x	2.5x	2.5x	2.7x	2.9x
Third Quartile	2.8x	2.6x	1.8x	3.1x	2. 5x	3.0x
Bottom Quartile	3.5x	2.5x	2.5x	3.2x	2.2x	2.8x

Source: Calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022

TABLE 3: DISTRIBUTION OF THE CALIBRATION DATASET BY PECCS® PILLARS

PECCS Pillar	PECCS Class	P/S	PECCS Class	P/S	PECCS Pillar
PECCS Activity	Education and public	1.9x	Startup	2.4x***	PECCS Lifecycle Phase
	Financials	2.4x***	Growth	2.1x	
	Health	2.1x	Mature	2.6x***	
	Hospitality and entertainment	1.9x***	Advertising	2.1x***	PECCS Revenue Model
	Information and communication	2.6x***	Reselling	1.4x***	
	Manufacturing	1.5x***	Production	1.6x***	
	Natural resources	1.9x	Subscription	2.9x***	
	Professional and other services	1.6x**	B2B	1.8x	PECCS Customer Model
	Real estate and construction	1.8x	B2C	1.7x***	
	Retail	0.9x***	Hybrid	2.4x	PECCS Value Chain
	Transportation	1.4x***	Products	1.5x***	
			Services	1.9x	

Source: Calculated using more than 10k deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022.

**** & ** indicate a significant mean difference with the rest of the population at the 1% & 10% levels, respectively.*

In addition to these factors, we also include control variables that have statistical power in explaining the observed valuations. Table 4 summarises the control variables in our model, grouped into three categories, including the transaction characteristics (i.e., PE Deal Controls), PECCS® segments, and equity market controls.

TABLE 4: KEY CONTROL VARIABLES, THEIR EFFECT ON VALUATION, & THE ECONOMIC RATIONALE FOR INCLUDING THEM IN THE MODEL

Factor	Definition	Effect on price	Economic Rationale	References
PE Deal Controls	Deal Leverage	Positive	Companies that trade with deal leverage are considered better prospects and have a higher value	Jenskinson & Stucke (2011)
	Percentage Control	Negative	A higher control stake in an acquisition creates larger risks and decreases the price.	Renneboog and Simons (2005)
	Add-on	Negative	Add-on deals create new risks for investors including synergy risk.	Hammer et al. (2022)
PECCS Controls	Dummy variable for PECCS classes	Positive or Negative	Different segments of private markets exhibit different average level of price because of systematic difference in risk .	See PECCS documentation
Equity Market Controls	Listed Industry Valuations	Positive	Higher same-sector valuations in listed markets correlates with higher same-sector private market valuations.	Chan, Lakonishok & Swaminathan (2007)
	Residual Market Valuations	Positive	Higher listed market sentiment correlates with higher private market valuations	Bibo & Tian (2022)
	Fama French Value Factor Return	Positive or Negative	The returns of the value factor correlate with private market valuations: private company investments are also a Value play.	Fama & French (1992)

Source: Calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022.

Model set up

The privateMetrics asset pricing model uses the Price-to-Sales ratio of observable transactions (the entry price multiple) as the modeled variable. The model is estimated as the linear sum of the product of factor exposures and factor prices. The estimation can then separate the systematic part of the valuation while leaving out 'noise' in each valuation.

$$\frac{P}{S} = \alpha + \sum_{k=2}^{K} \beta_k \lambda_k + \varepsilon$$

Following standard asset pricing notation, the factor exposure or factor loading is called a beta (β), and the factor premium is called a lambda (λ) for the k factors in the model. α is the intercept and ε is the noise or idiosyncratic part of the valuation.

Model calibration

The privateMetrics model uses a carefully curated dataset of more than 10,000 unlisted private company investments going back two decades sourced from a wide variety of datasets including PitchBook, Factset, Capital IQ, fund manager reports, and other publicly available data sources.

We calibrate this model using new observations monthly to update its estimation of the price of risk of each factor. In other words, each transaction observed is then used to 'update' this model (i.e., obtain new λs) through a dynamic estimation (using a Kalman filter), which retains the memory of past λs while also allowing the new transaction to influence the relationship while keeping the average ε close to zero. More details on the implementation of the model are available in our online documentation and Selvam and Whittaker (2024). The dataset covers all key segments of the market as shown in Figure 1.

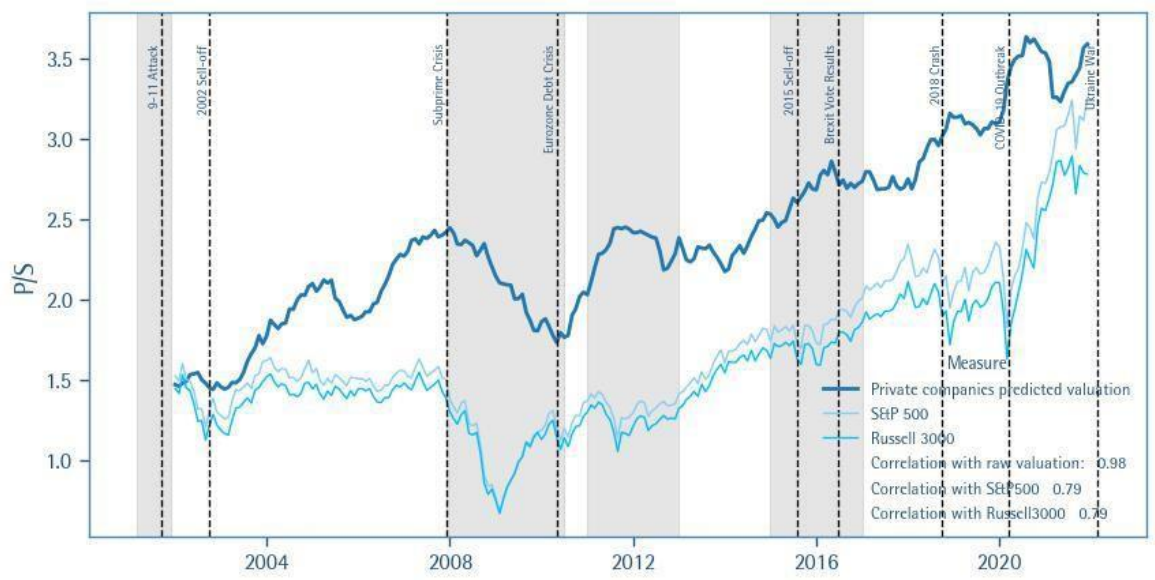
A good application of using the model to value unlisted private companies is to create a representative marked-to-market index of private companies that are regularly valued. The privateMetrics index universe in Figure 1 includes the constituents of the private2000® index constructed by Scientific Infra and Private Assets, which is developed on this shadow pricing idea and captures the performance of private companies in 30 countries globally that are important for private equity investors (read more about the index here).

FIGURE 1: PRIVATEMETRICS TRANSACTION DATASET COMPARED TO THE PRIVATEMETRICS INDEX UNIVERSE BY PECCS PILLAR & CLASS

Model output

The output of the asset pricing model is an estimated P/S ratio for each observed transaction such that on average the estimated and observed values converge. To examine how closely the predicted valuations track the raw modelled valuations in transactions, we compute the moving average P/S (using median values) of all the data over the previous 12 months and plot the predicted and the raw series. For context, we also include the monthly P/S of key public market benchmarks. Figure 2 presents the results, and we can see that the moving average of the predicted valuations from the model very closely tracks the raw valuations, with the two series having a correlation coefficient of 0.98. Moreover, we also see that the average transaction at any point in time is also highly correlated with public market valuations, as indicated by a correlation coefficient of 0.79. Thus, Figure 2 is reassuring that the modelling does not introduce any mechanical artifacts in predicted valuation and is very well aligned with raw data.

FIGURE 2: MOVING AVERAGE PREDICTED VS RAW VALUATION AND PUBLIC MARKET VALUATION



Source: Calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022.

Model Robustness

How precise are the predictions across PECCS® pillars?

To examine how closely the predicted valuations track the raw modelled valuations in transactions, we compute the average estimation errors of the full sample, and also by classes within each PECCS® pillar. What stands out is that although the model by design is expected to have lower estimation errors in the full sample, the within PECCS® class estimation errors are also very small. All the errors are within ±10%, reassuring that the model predictions on average even within each segment of PECCS® are reasonable. The errors are summarised in Table 5.

The most commonly used metric of valuation in private markets is EV/EBITDA, as PE owners have the flexibility to alter the capital structure of their holding company and hence are more interested in operational profitability without factoring interest costs. However, our model is based on P/S because P/S is statistically better, stable, and not affected by loss-making companies. Thus, it is worth investigating whether or not our predictions for EV/EBITDA might be biased.

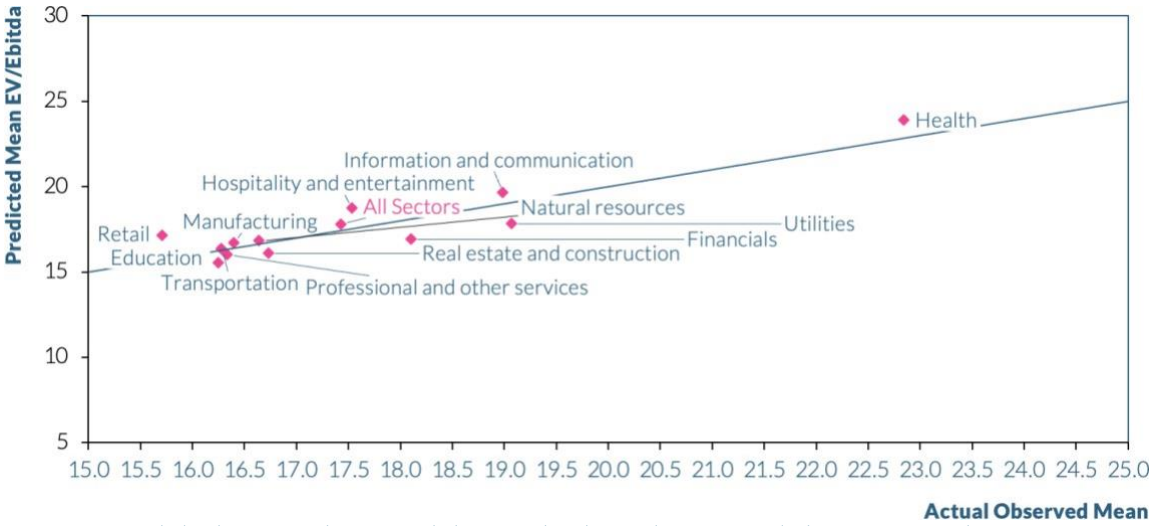
To ensure that is not the case, we compute the EV based on the book value of debt and predicted equity valuation and divide the sum by the EBITDA to get a predicted EV/EBITDA and compare it to transaction implied ratios. Figure 3 presents the average predicted and observed EV/EBITDA by PECCS® activity classes. We find that the predictions are very close to the observed values, thus mitigating this concern.

TABLE 5: AVERAGE ESTIMATION ERRORS ACROSS PECCS® CLASSES, BASED ON THE DIFFERENCE BETWEEN TRANSACTED VALUATIONS AND FACTOR MODEL PREDICTIONS

PECCS Pillar	PECCS Class	Mean Estimation Error	PECCS Class	Mean Estimation Error	PECCS Pillar
PECCS Activity	Education and public	0.9%	Startup	0.1%	PECCS Lifecycle Phase
	Financials	1.8%	Growth	-1.7%	
	Health	2.6%	Mature	2.8%	
	Hospitality and entertainment	-1.1%	Advertising	1.2%	PECCS Revenue Model
	Information and communication	-4.4%	Reselling	4.6%	
	Manufacturing	2.5%	Production	2.9%	
	Natural resources	9.4%	Subscription	-6.9%	
	Professional and other services	3.3%	B2B	1.5%	PECCS Customer Model
	Real estate and construction	1.9%	B2C	0.9%	
	Retail	0.5%	Hybrid	0.6%	PECCS Value Chain
	Transportation	7.2%	Products	1.1%	
Full Sample		1.1%	Services	3.4%	

Source: Calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022.

FIGURE 3: PREDICTED VERSUS ACTUAL EV/EBITDA RATIOS BY PECCS® ACTIVITY CLASSES



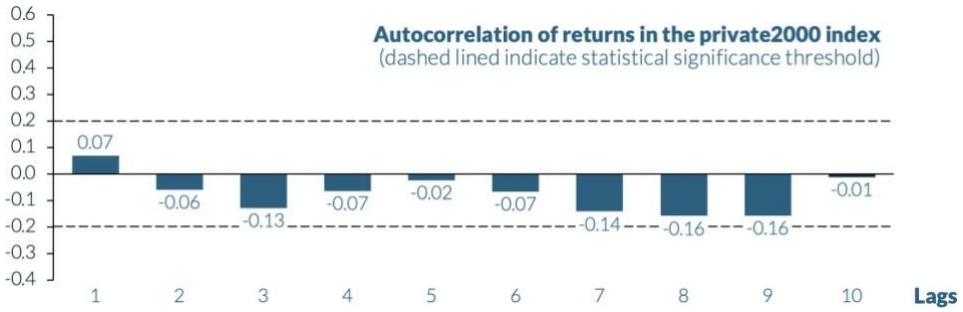
Source: Calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022.

How realistic are the results?

To assess how realistic the valuation from the shadow pricing exercise is, it would be useful to look at the return characteristics of an index constructed based on this methodology. Thus, we can look at the performance of the private2000® index constructed by Scientific Infra and Private Assets on these principles. A standard indication of 'smoothed' returns and the underestimation of volatility is the presence of autocorrelation in private asset return indices. In contrast, privateMetrics indices, such as the private2000®, exhibit no serial correlation, as shown in Figure 4. This demonstrates that they accurately capture the true risk of private markets.

Another way to look at the staleness is to compare the Sharpe ratio (excess returns per unit of risk) of different asset classes, based on appraised indices and the private2000® index. Indices with stale NAVs might show very low volatility and hence extremely high or even unrealistic Sharpe ratios.

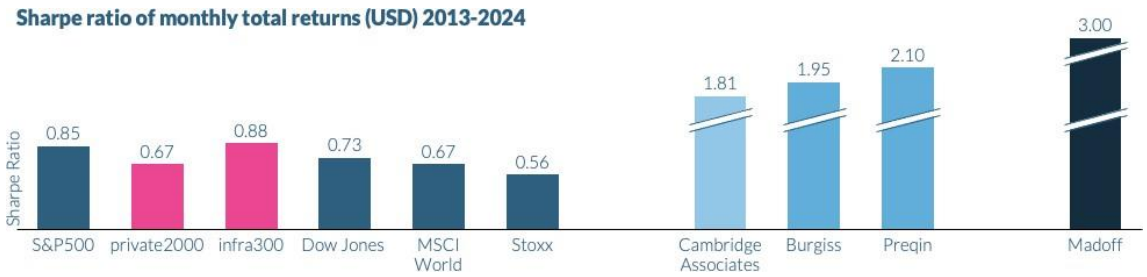
FIGURE 4: AUTOCORRELATION OF RETURNS IN THE PRIVATE2000 INDEX. THE DASHED LINES INDICATE STATISTICAL SIGNIFICANCE THRESHOLDS



Source: Scientific Infra and Private Assets' private2000 monthly index return data between 2013-2024.

In Figure 5, comparing the Sharpe ratios of public markets and different private market indices, this becomes evident. The Sharpe ratio of the private2000 index is 0.67, almost the same as that of the MSCI World Index. However, the appraisal-based private market indices (such as those of Cambridge Associates, Burgiss, or Preqin) have Sharpe ratios way over 1.5.

FIGURE 5: SHARPE RATIO OF MONTHLY TOTAL RETURNS (USD) 2013-2024 (RISK-FREE RATE = 1%)

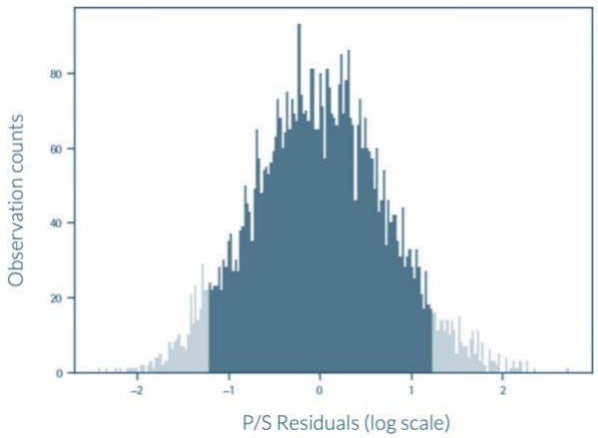


Source: Scientific Infra and Private Assets' private2000 & Infra300 monthly index return data between 2013-2024.

Model Residuals

Our factor model is constructed to capture the systematic effect of observable factors on valuation and leave out the idiosyncratic 'noise' in transactions. A diagnosis of residuals from the model can allow one to interpret whether or not that objective has been met. In Figure 6, we present the residuals from the model and can see that the average error in the model is centered around zero and, at least visually, the residuals look almost Gaussian, or in other words like 'white noise' – i.e. they have a zero mean, are symmetrical around the mean, and follow a normal distribution.

FIGURE 6: DISTRIBUTION OF MODEL RESIDUALS BASED ON A FACTOR MODEL OF LOG(P/S) USING TRANSACTION DATA



Source: Calculated using more than 10,000 deals from PitchBook, CapitalIQ, Factset, and other primary sources between 1999-2022

About Scientific Infra & Private Assets

Our products come from the cutting-edge R&D of the EDHEC Infrastructure & Private Assets Research Institute, established in 2016 by EDHEC Business School. In 2019, we transformed this academic research into a commercial enterprise, providing services like private market indices, benchmarks, valuation analytics, and climate risk metrics. We take pride in our unique dual identity, bridging scientific research and market applications.

The EDHEC Infrastructure & Private Assets Research Institute (EIPA) continues to advance academic research and innovate with technologies in risk measurement and valuation in private markets, especially utilizing artificial intelligence and language processing. Our company, Scientific Infra & Private Assets (SIPA), supplies specialised data to investors in infrastructure and private equity.

Merging academic rigor with practical business applications, our dedicated team excels in integrating quantitative research into private asset investing. Our products, infraMetrics® and privateMetrics®, are unique in the market, stemming from thorough research rather than being ancillary services of larger data providers. We are the Quants of Private Markets, leading with innovation and precision.

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