



**Scientific Infra
& Private Assets**

METHODOLOGY · PRIVATE EQUITY

privateMetrics® Asset Valuation Methodology

Estimating the fair market value of unlisted private companies

The privateMetrics® asset pricing model estimates the fair market value of unlisted private companies in a robust, dynamic way. It resolves the twin problems of private markets — smoothed, stale reported NAVs that neither mark to market nor capture risk, and too few observable transactions — by using private-market transactions to separate the market price signal from asset-specific noise, fully aligned with IFRS 13.

Scientific Infra & Private Assets (SIPA) is a private-market index and benchmark provider, part of the PEI Group and a registered benchmark administrator with ESMA. This methodology paper was prepared using SIPA's privateMetrics® data. Contact sales@scientificinfra.com for more information.

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Executive Summary

The privateMetrics® asset pricing model allows the fair market value of unlisted private equity investments to be estimated in a robust and dynamic manner. It solves the twin problems of private markets: smoothed reported NAVs that are neither convincingly marked-to-market nor capture risk, and the absence of a sufficient number of observable transaction prices. Traditional private equity valuation tends to rely on too few, often stale data points that fail to capture all the information available at the time of reporting — or to substitute multiples drawn from completely different public markets.

Because so few private companies trade, valuations built on a handful of raw multiples rest on shaky foundations. privateMetrics separates the market price signal from transaction noise so that every unlisted company can be priced to market, every month.

This white paper discusses:

- The problems with traditional private equity valuation, which relies on multiples of poor quality (public-market multiples or reported data) or poor quantity (a stale handful of recent transactions), and the consequences of using the wrong data;
- The privateMetrics asset pricing model as a reliable way to estimate the marked-to-market prices of unlisted companies, using private-market transactions to distinguish the market price signal from asset-specific noise — genuinely aligned with the IFRS 13 standard and industry guidelines;
- The robustness of this approach, including how well average predicted values track observed transactions within individual market segments and capture market risk convincingly; and
- An application of the model to build robust valuation 'Anchors' for private equity investments.

Introduction

Unlisted companies very seldom trade, leading to a dearth of market price data for any given asset and too few data points to build robust comparables from raw data. As a result, the ongoing valuation of unlisted equity investments must rely on an asset pricing model until the asset is next sold.

Following the IFRS 13 standard, the fair value of a financial asset is unequivocally defined as the exit price on the valuation date — the price as if the asset were sold in the market on that date, whether it can be liquidated then or not. In other words, the model of the price multiple used to value private equity investments must reflect the latest market conditions given the information available. Unfortunately, traditional private equity appraisals typically fail to meet this standard.

Because of the inherent uncertainty in future cash flows and the terminal horizon of private companies, market-based valuation methods (multiples) are typically preferred over income-based approaches (discounted cash flows) in private equity. However, problems arise when a market-based approach is implemented using a handful of recent transaction multiples. Recent transactions are sparse, noisy and biased, because few private companies trade regularly and each valuation is subject to idiosyncratic effects.

As the appendix shows, using raw reported data leads to meaningless multiples, because the reported data is 1/ mostly the result of appraisals, which are smooth, inconsistent and unrepresentative, and 2/ the remaining observable transactions — about 10% of the reported data (source: MSCI/Burgiss) — are too few to provide a good proxy of market prices, let alone to control for the sector, geography and risk profile of the company being valued.

This leads to various adjustments being made to comparables, but the starting point for these (often subjective) departures from the market data is never robust enough to justify them. In effect, **private valuations are built on sand**. We show in the appendix that the valuation errors arising from raw market multiples are very large, and that these problems are not solved by using a listed proxy instead.

The privateMetrics asset pricing model was developed to address these issues and to enable the best possible estimation of the market multiples required to calculate the fair value of private, unlisted equity investments. It is designed to reflect the principles of IFRS 13, echoed in the IPEV valuation guidelines: to derive valuation inputs for individual private equity assets that genuinely reflect current market conditions and the risk exposure of each investment.

privateMetrics is used to estimate prices for hundreds of thousands of assets across the private equity universe. On average, at the market-segment level, these predictions are very close to average exit prices. It follows that privateMetrics can be used to produce market-level metrics of value, risk and performance, because in aggregate it predicts accurate market exit prices. This is why the model underpins SIPA's market indices, custom benchmarks and valuation comparables. The remainder of this document describes the privateMetrics asset pricing model, its robustness, and how it is applied to build robust yet granular market-price 'Anchors'.

The privateMetrics® Valuation Model

Our approach to valuing private companies is designed to make the most of the available transaction and financial data in private markets, and to provide a standardised, systematic way to update prices with every observed transaction.

First, we construct a multi-factor model of prices from a sample of observed transactions over time, which infers the unbiased and precise factor prices that investors pay for different characteristics of a private asset. Although every transaction is idiosyncratic, in a large sample the individual errors in each transaction price diversify away, revealing the price attributable to each factor. A factor price is the premium (or discount) an investor is willing to pay for exposure to a given characteristic — observing the relationship between size and valuation across reported transactions, for example, reveals how much investors will pay for a larger private company.

Second, and crucially, once factor prices are estimated — say, for size — it becomes possible to price any unlisted company whose size is known, whether or not it has traded. This provides a more robust estimate of fair value and enables the creation of representative indices of private companies. The novelty of the approach is that calibrating the model to newly observed transactions yields the evolution of factor prices over time, which in turn updates the valuation of every tracked unlisted company.

Common risk factors

If investors trade unlisted private companies with one another in mutually negotiated transactions, there must be common characteristics that at least partly explain prices — companies with higher profits or growth opportunities, for instance, may be more valuable. To arrive at a list of factors, we require that each has an economic rationale for affecting valuation, is statistically related to valuation, and is objectively observable or measurable. The final selection results from a statistical process that trades off parsimony against explanatory power. The model uses five key risk factors, plus a country-risk factor:

- **Size.** Larger companies may be more complex, carry higher transaction costs and be less liquid, all of which can lower their valuation per dollar of revenue.
- **Growth.** Traditional PE strategies rely on growing the entry multiple by expanding both top and bottom lines, so faster-growing companies can be more sought after and more valuable.
- **Leverage.** Leverage raises default risk, but also signals quality — companies with stable, consistent cash flows can support higher leverage — so it is expected to influence valuation.
- **Profits.** More profitable companies have more predictable, less risky future payouts and attract a lower risk premium, making them more valuable.
- **Maturity.** Younger companies have shorter track records and higher information uncertainty; firms with high uncertainty tend to be overvalued and earn lower future returns, so maturity is negatively related to valuation.
- **Country risk.** Investors require a higher return in higher-risk countries, depressing current valuations; where policy is more predictable and macro risk lower, assets trade at higher valuations.

■ **TABLE 1 · KEY FACTORS, THEIR EFFECT ON VALUATION, AND THE ECONOMIC RATIONALE FOR THEIR INCLUSION**

FACTOR	DEFINITION (PROXY)	EFFECT ON PRICE	ECONOMIC RATIONALE	REFERENCES
Size	Revenues	Negative	Larger firms are more illiquid and trade at 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 & Hwang (2010)
Profits	EBITDA margin	Positive	More profitable companies have a higher value.	Novy-Marx (2013); Hou et al. (2015)
Maturity	Years since incorporation	Negative	Mature companies show less growth potential and trade at a lower price.	Jiang et al. (2005)
Country risk	Term spread	Negative	Companies in higher-risk countries face more uncertain prospects.	Chen & Tsang (2013)

Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022. Factor selection also draws on a 2023 survey of private equity practitioners.

Empirical evidence supporting the common risk factors

Table 2 shows the average P/S ratio in each quartile of the transaction sample, sorted by each factor. Even in these single-dimensional sorts, the trends across quartiles strongly indicate systematic effects. For size, the smallest companies (bottom quartile) enjoy the highest valuation per dollar of sales, and this decreases quartile by quartile.

■ TABLE 2 · AVERAGE P/S RATIO BY FACTOR QUARTILE

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 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022.

Table 3 summarises the average P/S ratio by class within each PECCS® pillar. PECCS® – the Private Company Classification Standard, developed by EDHEC Infra & Private Assets – is a multi-pillar taxonomy whose independent pillars, with exhaustive and non-overlapping classes, capture several dimensions of the risk factors that affect valuation. Because it is objective and clearly defined, PECCS® can segment private companies even with the limited information typical of private markets. Valuation varies systematically across PECCS® classes, with many classes showing mean P/S significantly different from the rest.

■ TABLE 3 · AVERAGE P/S RATIO BY PECCS® PILLAR AND CLASS

PECCS® ACTIVITY

CLASS	P/S
Education & public	1.9x
Financials	2.4x ^{***}
Health	2.1x
Hospitality & entertainment	1.9x ^{***}
Information & communication	2.6x ^{***}
Manufacturing	1.5x ^{***}
Natural resources	1.9x
Professional & other services	1.6x ^{**}
Real estate & construction	1.8x
Retail	0.9x ^{***}
Transportation	1.4x ^{***}
Services	1.9x

PECCS® LIFECYCLE PHASE

Startup	2.4x ^{***}
Growth	2.1x
Mature	2.6x ^{***}

PECCS® REVENUE MODEL

Advertising	2.1x ^{***}
Reselling	1.4x ^{***}
Production	1.6x ^{***}
Subscription	2.9x ^{***}

PECCS® CUSTOMER MODEL

B2B	1.8x
B2C	1.7x ^{***}

PECCS® VALUE CHAIN

Hybrid	2.4x
Products	1.5x ^{***}

Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022. *** and ** indicate a mean difference from the rest of the population significant at the 1% and 10% levels, respectively.

In addition to these factors, we include control variables with statistical power in explaining observed valuations. Table 4 groups them into transaction characteristics (PE deal controls), PECCS® segments, and equity-market controls.

■ **TABLE 4 · KEY CONTROL VARIABLES, THEIR EFFECT ON VALUATION, AND THE ECONOMIC RATIONALE FOR THEIR INCLUSION**

GROUP / CONTROL	EFFECT	ECONOMIC RATIONALE	REFERENCES
PE DEAL CONTROLS			
Deal leverage	Positive	Companies trading with higher deal leverage are seen as better prospects and command a higher value.	Jenkinson & Stucke (2011)
Percentage control	Negative	A larger control stake creates larger risks and lowers the price.	Renneboog & Simons (2005)
PE-backed	Positive	Professional ownership, tighter monitoring and reputational concern improve the trading price.	Katz (2009)
Add-on	Negative	Add-on deals create new risks, including synergy risk.	Hammer et al. (2022)
PECCS® CONTROLS			
PECCS® class dummies	+/-	Different segments show different average price levels because of systematic differences in risk.	PECCS® documentation
OTHER CONTROLS			
Labour intensity	Positive	Labour-intensive operations gain from operational efficiency improvements.	Olsson & Tåg (2017)
Long-term interest rates	Negative	Higher long-term debt costs dampen value creation through financial engineering.	Long Jr (1974)
Innovative	Positive	Innovative companies show higher growth potential and trade at a higher price.	Hall (1999)

Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022.

Model set-up

The model uses the price-to-sales (P/S) ratio of observable transactions — the entry price multiple — as the modelled variable, estimated as the linear sum of the products of factor exposures and factor prices. This separates the systematic part of the valuation while leaving out the noise in each transaction. Following standard asset-pricing notation, the factor exposure (or loading) is a beta and the factor premium a lambda, for the k factors in the model; an intercept captures the base level and a residual term captures the idiosyncratic part of the valuation.

Model calibration

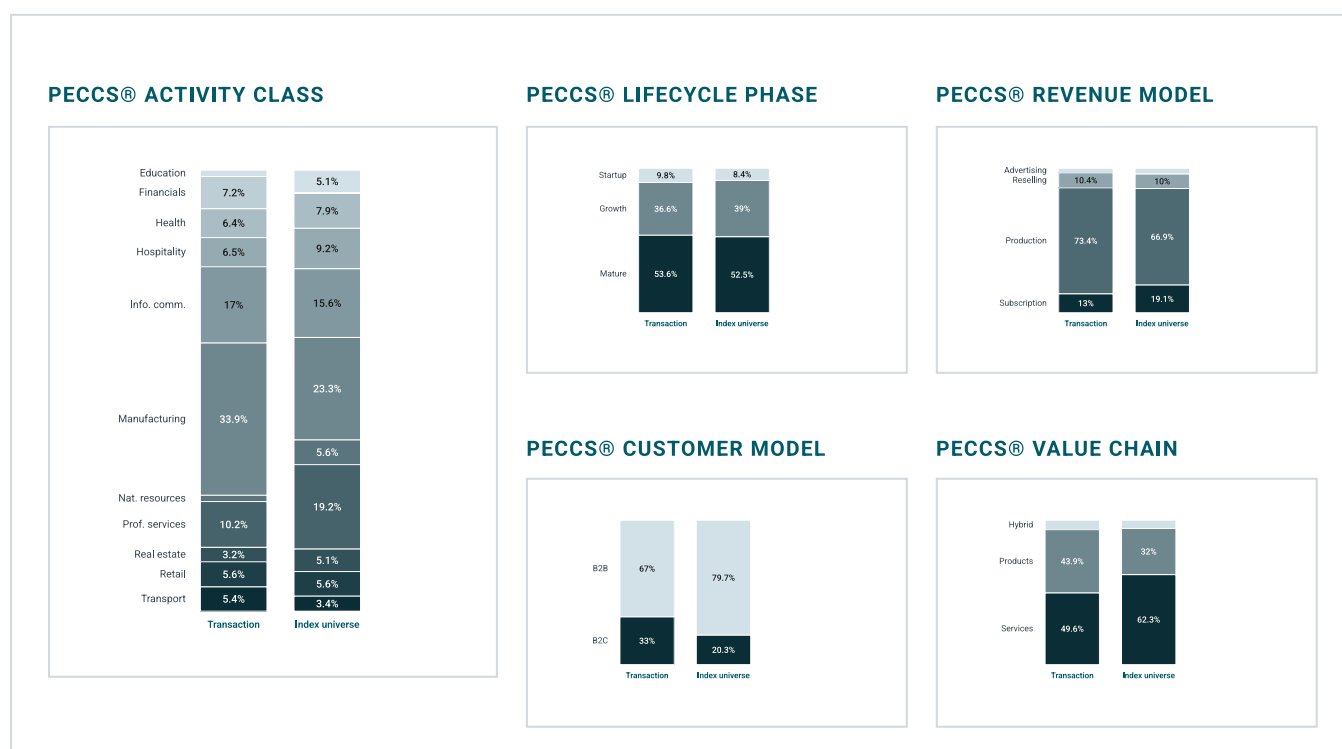
The model uses a carefully curated dataset of more than 10,000 unlisted private-company investments going back two decades, sourced from PitchBook, FactSet, Capital IQ, fund-manager reports and other publicly available data. We calibrate it monthly: each new transaction is used to update the model — obtaining new factor prices through a dynamic estimation (a Kalman filter) that retains the memory of past estimates while letting the new transaction influence the relationship, keeping the average residual close to zero. Further detail is available in the online documentation and in Selvam and Whittaker (2024). The dataset covers all key segments of the market, as shown in Figure 1.

A natural application is to build a representative, marked-to-market index of regularly valued private companies. The privateMetrics index universe in Figure 1 includes the constituents of the [private2000® index](#) built by Scientific Infra & Private Assets on this shadow-pricing idea, capturing the performance of private companies across 30 countries important to private equity investors.

Model output

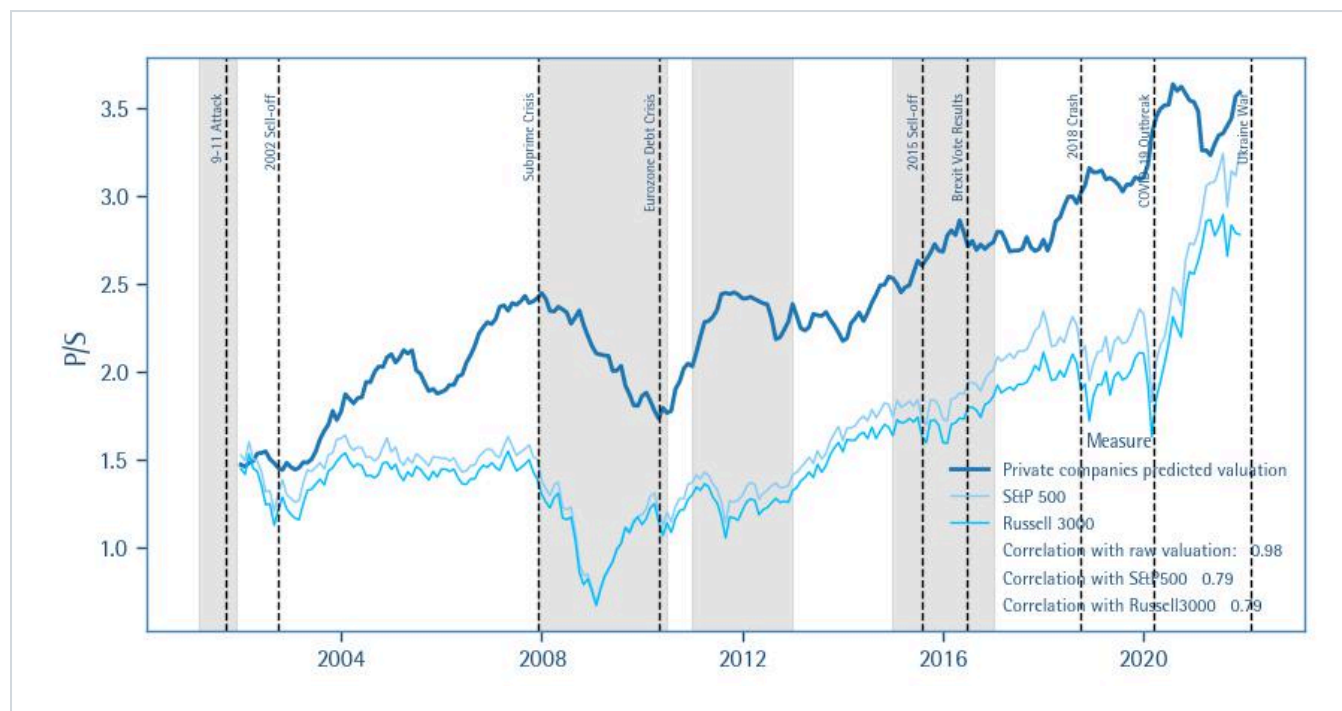
The output is an estimated P/S ratio for each observed transaction such that, on average, estimated and observed values converge. To see how closely predicted valuations track raw transaction valuations, we compute the 12-month moving average P/S (using medians) of all data and plot the predicted and raw series, alongside the monthly P/S of key public benchmarks. Figure 2 shows that the moving average of predicted valuations tracks raw valuations very closely, with a correlation of 0.98; the average transaction is also highly correlated with public-market valuations (0.79). This is reassuring that the modelling introduces no mechanical artefacts and is well aligned with the raw data.

■ FIGURE 1 · PRIVATEMETRICS TRANSACTION DATASET VS. THE INDEX UNIVERSE, BY PECCS® PILLAR & CLASS



Source: Scientific Infra & Private Assets, privateMetrics®. Shares shown as a percentage of the transaction dataset and of the index-universe constituents.

■ FIGURE 2 · MOVING-AVERAGE PREDICTED VS. RAW VALUATION AND PUBLIC-MARKET VALUATION



Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022. Correlation with raw valuation 0.98; with the S&P 500 and Russell 3000, 0.79.

Model Robustness

How precise are the predictions across PECCS® pillars?

To see how closely predicted valuations track raw transaction valuations, we compute the average estimation errors of the full sample and within each class of every PECCS® pillar. Although the model is expected, by design, to have lower errors in the full sample, the within-class errors are also very small. All errors fall within $\pm 10\%$, reassuring that model predictions are reasonable even within each segment. The errors are summarised in Table 5. We also compute an 18-month moving average of model inputs and outputs and find that the difference between average observed and predicted prices is consistently zero (Figure 3).

The most common valuation metric in private markets is EV/EBITDA, since PE owners can alter the capital structure of a holding company and focus on operational profitability. Our model is built on P/S, which is statistically better behaved, more stable and unaffected by loss-making companies – so one might worry that predicted EV/EBITDA is biased. To check, we compute EV from the book value of debt and the predicted equity valuation, divide by EBITDA, and compare with transaction-implied ratios. Figure 4 shows average predicted and observed EV/EBITDA by PECCS® activity class: predictions are very close to observed values, mitigating the concern.

■ **TABLE 5 · AVERAGE ESTIMATION ERROR ACROSS PECCS® CLASSES (TRANSACTIONED VALUATIONS VS. FACTOR-MODEL PREDICTIONS)**

PECCS® ACTIVITY

CLASS	MEAN ERROR
Education & public	0.9%
Financials	1.8%
Health	2.6%
Hospitality & entertainment	-1.1%
Information & communication	-4.4%
Manufacturing	2.5%
Natural resources	9.4%
Professional & other services	3.3%
Real estate & construction	1.9%
Retail	0.5%
Transportation	7.2%
Services	3.4%
Full sample	1.1%

PECCS® LIFECYCLE PHASE

Startup	0.1%
Growth	-1.7%
Mature	2.8%

PECCS® REVENUE MODEL

Advertising	1.2%
Reselling	4.6%
Production	2.9%
Subscription	-6.9%

PECCS® CUSTOMER MODEL

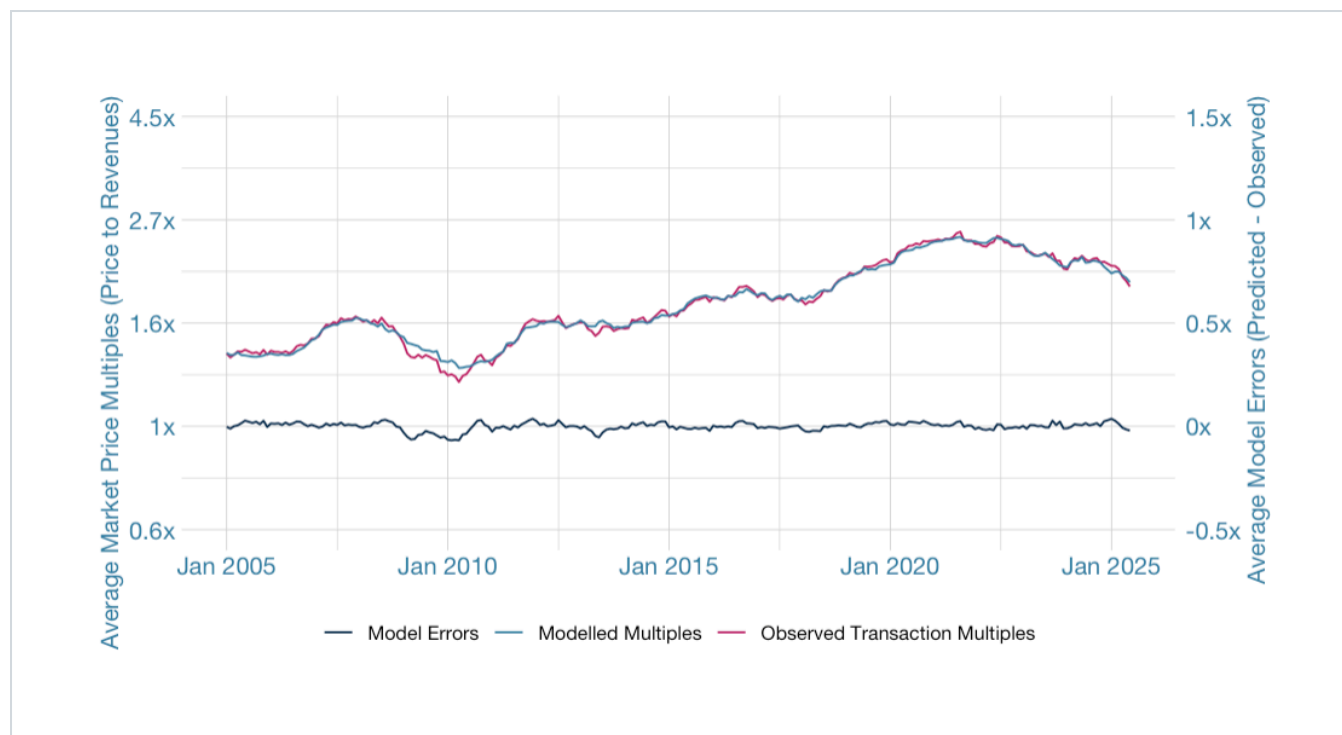
B2B	1.5%
B2C	0.9%

PECCS® VALUE CHAIN

Hybrid	0.6%
Products	1.1%

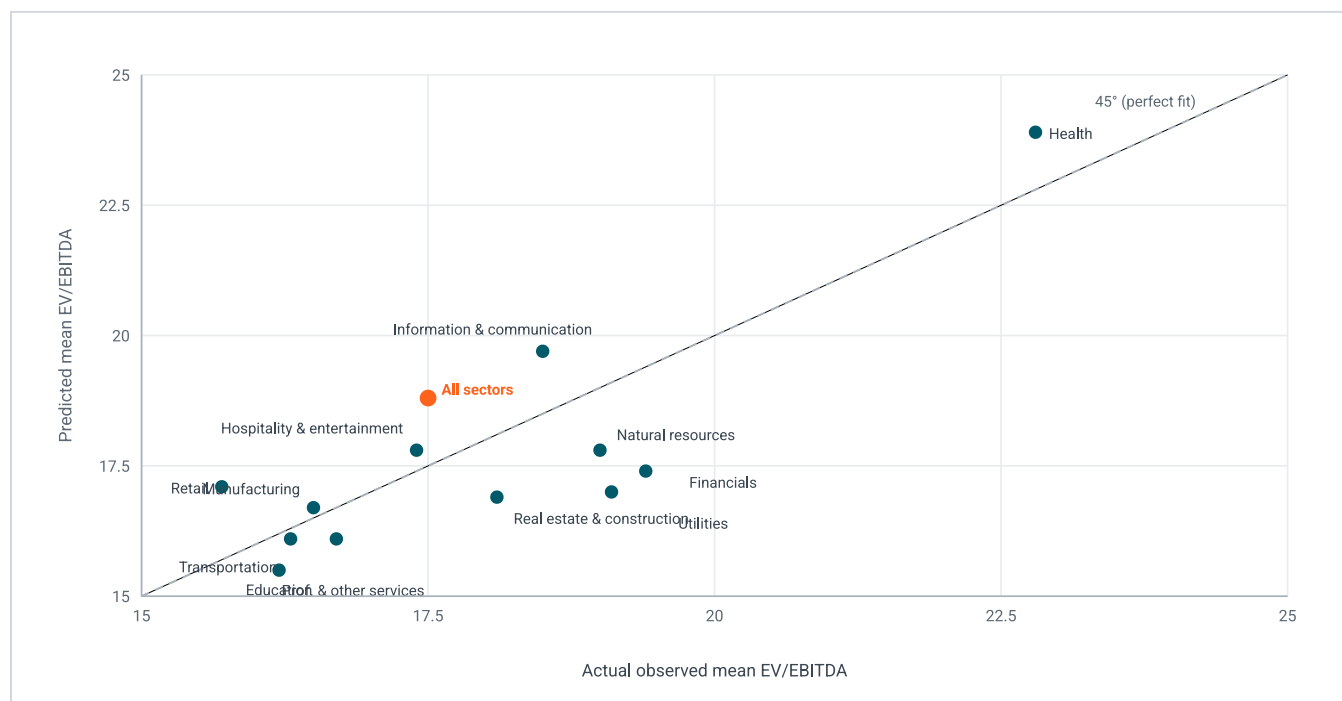
Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022.

■ **FIGURE 3 · 18-MONTH MOVING-AVERAGE BUYOUT MULTIPLE, PRIVATEMETRICS PREDICTED MULTIPLE (LHS) AND MOVING-AVERAGE MODEL ERROR (RHS)**



Source: Scientific Infra & Private Assets, privateMetrics®. Modelled and observed multiples track closely; the average model error is consistently near zero.

■ **FIGURE 4 · PREDICTED VS. ACTUAL EV/EBITDA BY PECCS® ACTIVITY CLASS**



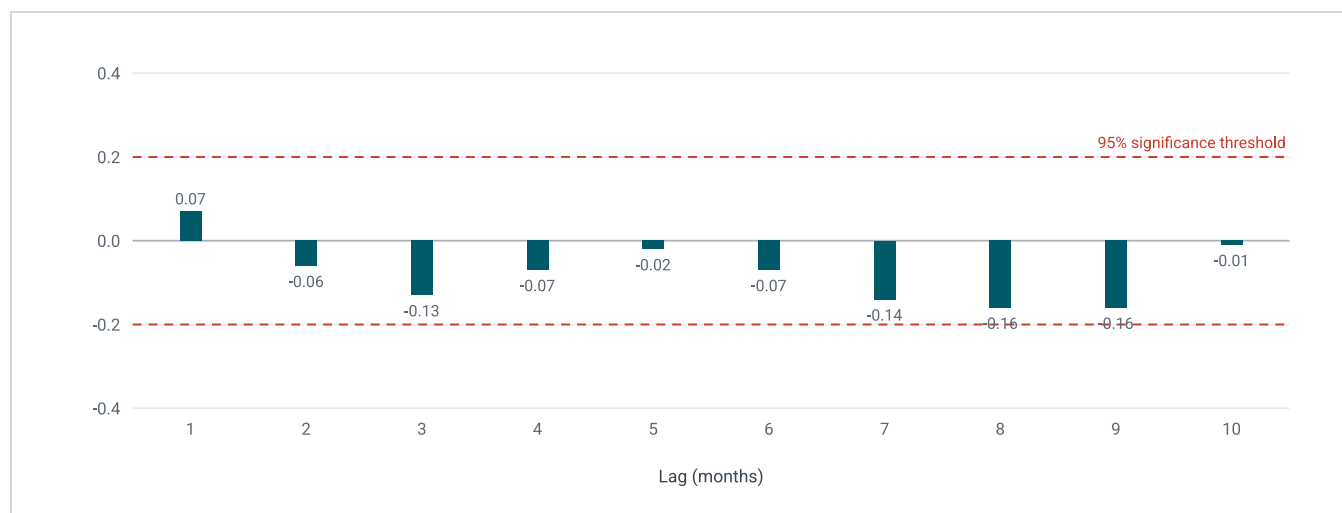
Each point is a PECCS® activity class; proximity to the 45° line indicates that predicted multiples track observed ones.

Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022. Point coordinates read from the underlying exhibit.

How realistic are the results?

To assess how realistic the shadow-pricing valuations are, it helps to look at the return characteristics of an index built on this methodology — here, the private2000® index. A standard sign of smoothed returns and underestimated volatility is autocorrelation in private-asset return indices. By contrast, privateMetrics indices such as the private2000® exhibit no serial correlation (Figure 5), demonstrating that they capture the true risk of private markets.

■ FIGURE 5 · AUTOCORRELATION OF RETURNS IN THE PRIVATE2000® INDEX



Dashed lines indicate the statistical-significance threshold. All lags fall within the band — consistent with no serial correlation.

Source: Scientific Infra & Private Assets, private2000® monthly index returns, 2013–2024.

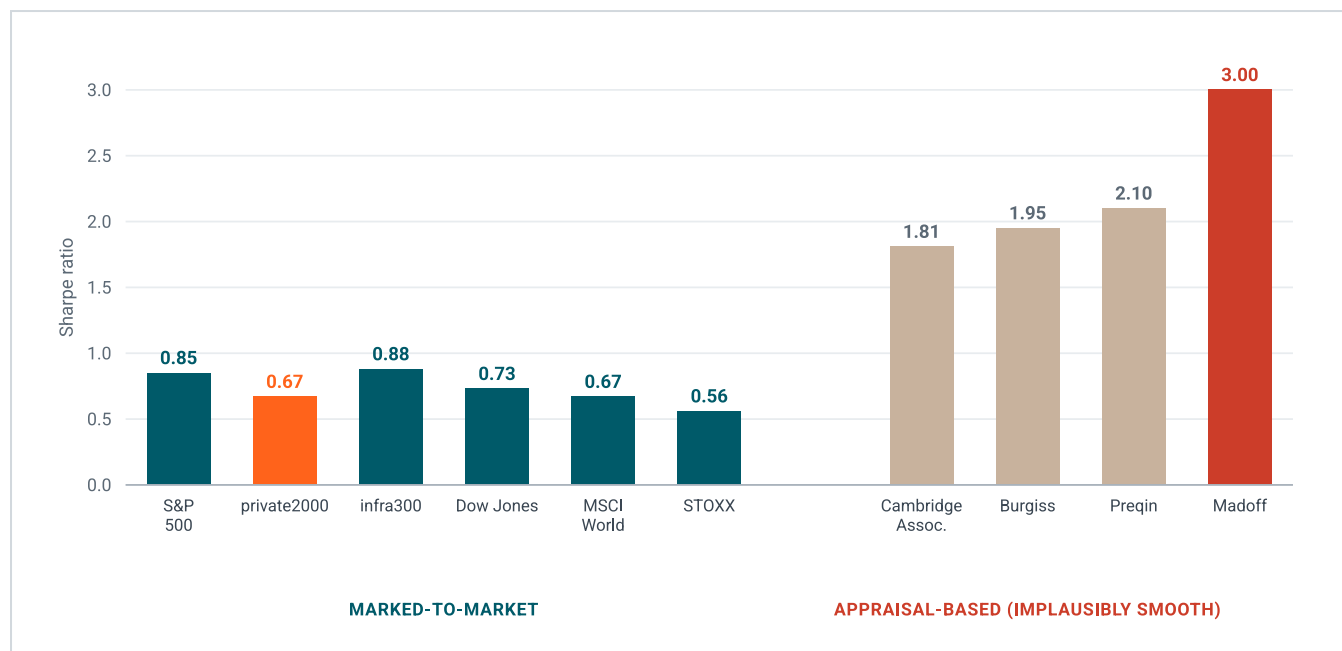
Another way to gauge staleness is to compare Sharpe ratios — excess return per unit of risk — across asset classes. Indices with stale NAVs show artificially low volatility and hence extremely high, even implausible, Sharpe ratios. As Figure 6 shows, the private2000® has a Sharpe ratio of 0.67, almost identical to the MSCI World Index, whereas appraisal-based private-market indices such as Cambridge Associates, Burgiss and Preqin report Sharpe ratios well above 1.5.

WHY MARKING TO MARKET MATTERS

Appraisal NAVs can resemble Ponzi-scheme returns

Because appraisal-based indices smooth their reported NAVs, their Sharpe ratios climb to levels closer to a fabricated track record than to any genuinely marked-to-market asset class. The private2000®, priced to market, sits firmly among real capital-market indices.

■ **FIGURE 6 · SHARPE RATIO OF MONTHLY TOTAL RETURNS (USD), 2013–2024**



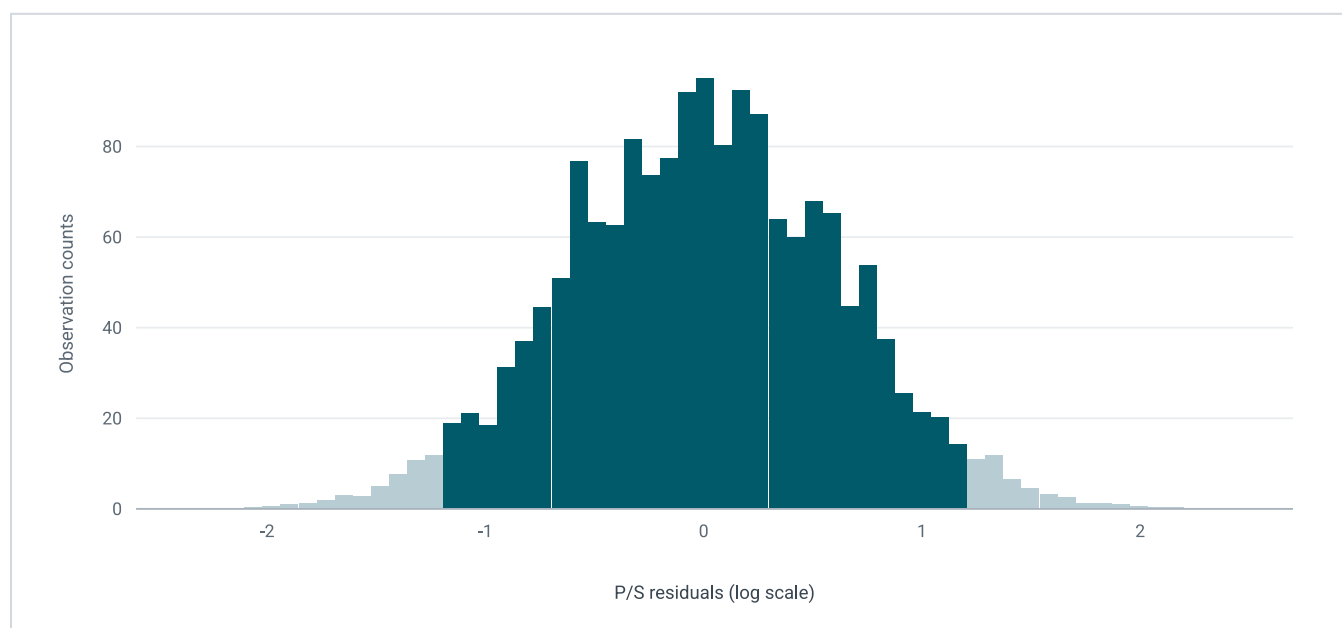
Risk-free rate assumed at 1%. The “Madoff” reference marks the implausible territory that smoothed, appraisal-based series approach.

Source: Scientific Infra & Private Assets, private2000® and Infra300® monthly index returns, 2013–2024, with public and appraisal-based index data.

Model residuals

Our factor model is built to capture the systematic effect of observable factors on valuation and to leave out the idiosyncratic noise in transactions. Diagnosing the residuals shows whether that objective is met. Figure 7 presents the model residuals: the average error is centred on zero and the distribution is, at least visually, close to Gaussian – white noise, with a zero mean, symmetry around the mean and an approximately normal shape.

■ **FIGURE 7 · DISTRIBUTION OF MODEL RESIDUALS, FACTOR MODEL OF LOG(P/S)**



Residuals in the shaded core fall within roughly ± 1.2 log units of zero; the symmetric, bell-shaped spread is characteristic of white noise.

Source: calculated using 10,000+ deals from PitchBook, Capital IQ, FactSet and other primary sources, 1999–2022.

Application: Anchoring Comparables

Shadow pricing the universe

The most obvious application of the privateMetrics factor model is to transplant the estimated factor prices onto the characteristics (factor loadings) of other unlisted companies and compute their valuation as the linear sum of the products of factor prices and characteristics. Because the model is updated monthly with the latest transactions, factor prices — and therefore the valuations of a large sample of unlisted companies — are refreshed each month.

To see how the monthly update works, consider a large, profitable, highly levered retailer taken private in an expensive transaction during the month. The factor prices update — specifically for size, profitability, leverage and the retail sector — in a way that explains the newly observed valuation while remaining path-consistent (near current levels) and time-consistent (explaining the price now more than at any past point). When those updated factor prices are applied to an unlisted company similar to the retailer, it experiences a similar valuation change.

The privateMetrics database holds PECCS® classifications and financial information for hundreds of thousands of private companies, all shadow-priced each month using the latest calibration. Table 6 shows the mean factor loadings in the database from June 2013 to May 2024.

■ TABLE 6 · AVERAGE FACTOR LOADINGS FOR PECCS® ACTIVITY CLASSES, JUNE 2013 – MAY 2024

PECCS® ACTIVITY CLASS	SIZE (USDM)	GROWTH	PROFIT	LEVERAGE	MATURITY (YRS)	COUNTRY RISK (BPS)
Education & public	115.6	3.6%	10.5%	0.2	47.6	1.7
Financials	112.7	9.3%	29.1%	2.0	27.6	38.1
Health	40.7	4.9%	10.4%	0.2	33.3	30.7
Hospitality & entertainment	80.8	8.1%	14.9%	0.8	30.2	63.6
Information & communication	95.6	10.6%	29.4%	0.4	22.9	85.6
Manufacturing	77.5	9.5%	10.5%	0.4	32.2	113.5
Natural resources	176.8	9.7%	23.5%	0.7	23.1	90.1
Professional & other services	88.2	8.9%	16.2%	0.8	27.7	64.0
Real estate & construction	42.2	8.4%	9.6%	0.4	33.1	59.3
Retail	89.3	7.5%	6.7%	0.3	31.2	88.7
Transportation	75.5	6.7%	11.8%	0.5	31.6	87.9

Source: privateMetrics® database of Scientific Infra & Private Assets, June 2024.

Using these loadings, a valuation multiple — the ‘shadow price’ — is estimated for each asset each month, corresponding to the systematic, market-driven component of its price. Each shadow price represents the typical price of an asset with the same factor exposures; it does not integrate any idiosyncratic, asset-specific aspect. Because the model prices accurately on average, once aggregated these shadow prices also represent the average price of a market segment accurately.

Table 7 shows the number of shadow prices the model computes in a single month (May 2024). Since June 2013, the start of the dataset, this amounts to over 40 million monthly prices for more than 900,000 unique private companies.

10,000+ Unlisted private-company transactions in the calibration dataset	900k+ Unique private companies shadow priced	40M+ Monthly shadow prices computed since June 2013	618,848 Shadow prices computed in May 2024 alone
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■ **TABLE 7 · SHADOW PRICES COMPUTED FOR PECCS® ACTIVITY CLASSES, MAY 2024**

PECCS® ACTIVITY CLASS	SHADOW PRICES (MAY 2024)
Education & public	15,371
Financials	2,740
Health	19,385
Hospitality & entertainment	31,972
Information & communication	18,605
Manufacturing	132,457
Natural resources	37,755
Professional & other services	84,665
Real estate & construction	90,237
Retail	167,047
Transportation	18,614
Total	618,848

Source: privateMetrics® database of Scientific Infra & Private Assets, June 2024. With so much data, it becomes possible to build comparables that are both robust (accurate on average) and granular (matching the profile of the investment of interest).

Anchoring price comparables

Once computed, shadow prices can be used to build genuine comparables for investment due diligence and asset valuation. The comparables method requires assets with characteristics similar to the one being evaluated, including market segments and risk profile. Because privateMetrics shadow prices are accurate on average, sufficiently numerous and continuously updated, they allow the creation of comparables that truly share the characteristics and risk profile of any asset under consideration.

Figure 8 illustrates this. After choosing a combination of market segments — here, a manufacturing company in the US in May 2024 — the risk-factor exposures (size, growth, leverage, profitability and maturity) are adjusted to obtain the most relevant comparable, or Anchor, multiple. From there, any number of adjustments can reflect the idiosyncratic dimensions of the investment not captured by the average market multiple — for example the quality of management, a specific supply-chain disruption, or legal issues affecting past products.

■ FIGURE 8 · EXAMPLE OF A MARKET-MULTIPLE ANCHOR, CONTROLLING FOR TIME, PECCS® PROFILE, GEOGRAPHY AND RISK-FACTOR PROFILE

SEGMENT / FACTOR	EXPOSURE	EBITDA MULTIPLE (MAY 2024)	DATA POINTS
Global market EBITDA multiple	—	17.4x	75.6k
MARKET SEGMENTS			
United States	—	17.3x	49.9k
B2B	—	—	—
Manufacturing	—	18.8x	22.4k
RISK-FACTOR PROFILE (WITHIN THE SEGMENTS)			
Size	Medium exposure	18.1x	4.5k
Growth	High exposure	16.4x	4.5k
Leverage	Neutral exposure	18.7x	4.5k
Profitability	Med-high exposure	18.6x	4.5k
Maturity	Low exposure	18.9x	4.5k

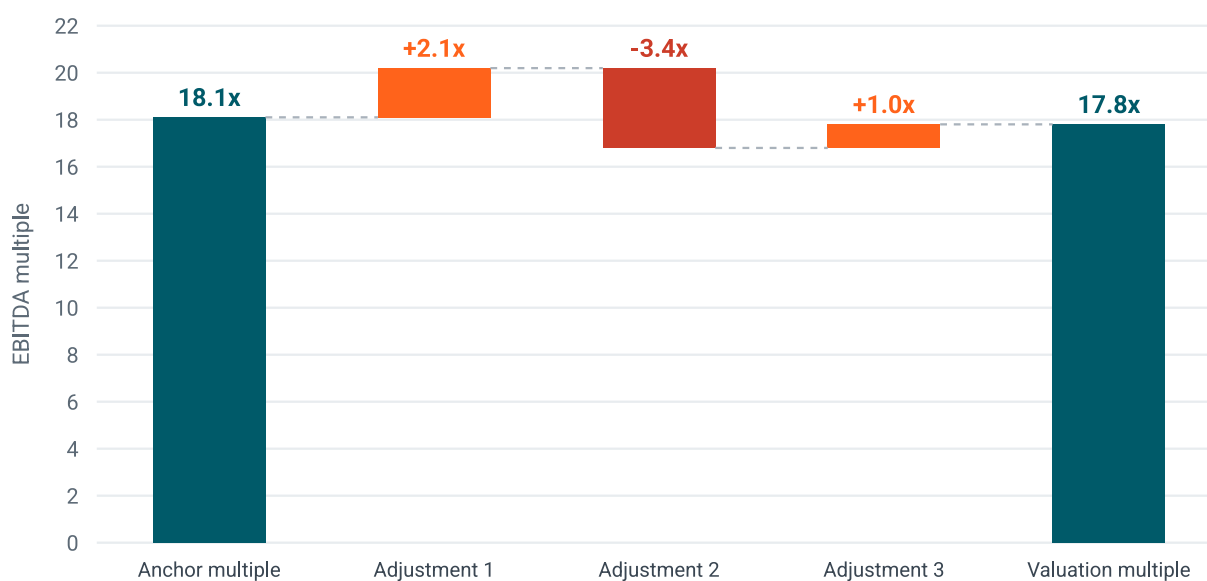
18.1x

Market Valuation Anchor (MVA) multiple — before asset-specific adjustments

17.8x

Final valuation multiple after illustrative adjustments

ILLUSTRATIVE ADJUSTMENTS TO THE MARKET ANCHOR



The valuer starts from the Anchor multiple (18.1x) and applies transparent, documented adjustments for asset-specific factors to reach the final valuation multiple — here 17.8x, a net -0.3x.

A quantitative, model-based approach to private-asset valuation offers several advantages:

- **Robust.** The calculation is customised to the segments and risk-factor profile of the asset of interest while relying on enough data points.
- **Transparent.** The factors contributing to the valuation are explicit and defined, grounded in an economic rationale (higher profits imply higher value, all else equal) that is documented to be persistent.
- **Dynamic.** On each valuation date a fresh market benchmark can be used, anchored to the asset's risk profile and adjusted for asset-specific elements. Unlike traditional approaches, the NAV never becomes stale — it is anchored to a continuously evolving private-market benchmark.
- **A clear systematic / idiosyncratic split.** Anchoring separates market-level from asset-level risk and dispenses with the need to assume an 'illiquidity premium', because the inputs come from the same illiquid markets in which the assets are priced, not from listed markets.
- **Consistent with fiduciary duty.** NAVs that are neither stale nor smoothed let investors measure and manage risk and report valuations fairly to final investors in pension, insurance and wealth-management products.

Appendix

privateMetrics & IFRS

IFRS 13, 'Fair Value Measurement', provides specific guidance on using market data — particularly data from the principal market — to measure fair value. privateMetrics is designed to follow that guidance closely in all its key aspects.

1 · Principal market

IFRS 13. The principal market is the market with the greatest volume and level of activity for the asset that an investor can access; fair value must reflect the price in that market.

privateMetrics. privateMetrics addresses the principal market through its global coverage of private assets. In early 2024 this meant transactions from over 100 countries involving more than 10,000 unique private companies. Using the factor prices gleaned from those transactions, privateMetrics prices unlisted companies in more than 140 countries — over 600,000 valuations in early 2024 — while the flagship indices cover the 30 most important private markets, determined independently.

2 · Unit of account

IFRS 13. The unit of account is the level at which an asset is aggregated or disaggregated for recognition purposes. IFRS 13 does not dictate it but requires the fair-value measurement to be consistent with it, so value aligns with how the asset is recognised and reported.

privateMetrics. privateMetrics measures the value of private equity investments accessed through vehicles ranging from closed- and open-ended funds to retail life-insurance products. It therefore takes the private company as the unit of account and values the equity shares that may be owned in such firms — a company-level focus consistent with the PECCS® taxonomy.

3 · Use of market data

IFRS 13. Fair value must use the inputs that participants in the principal market would use — inputs customary in that market, seen from the perspective of independent, knowledgeable and willing participants who are not compelled to transact.

privateMetrics. privateMetrics uses principal-market data to derive Market Anchor metrics: private equity entry and exit transactions to calibrate a valuation model that uses the characteristics of the asset, interest rates at the time of valuation in the relevant country, and public-market inputs as factors. The characteristics include financial and accounting data plus the PECCS® taxonomy, closely mimicking the information market participants rely on when transacting.

4 · Choice of valuation technique and market-based inputs

IFRS 13. Valuation techniques should maximise relevant observable inputs and minimise unobservable ones. Calibration matters most when conditions change or new markets develop — large interest-rate moves, or macro shocks such as COVID-19 — so inputs and techniques must be updated to reflect current principal-market information.

privateMetrics. privateMetrics uses the market method and maximises observable transaction data through a parsimonious factor model that captures asset-price dynamics. The model is re-calibrated monthly, and a yield curve is recomputed on each valuation date from the latest Treasury and interest-rate data, alongside contemporaneous public-market valuation levels. Taking account of the latest transactions as well as changes in interest rates and public markets ensures the estimated fair value reflects all current information from the principal market.

5 · Consistent calibration of valuation techniques

IFRS 13. Calibration adjusts the technique so that, at the measurement date, its outcome matches the transaction price; subsequent measurements use a consistent methodology, recalibrating as needed. Fair value should reflect a potential exit price at the time of valuation, not at some future date.

privateMetrics. privateMetrics calibrates its model to the most recent private equity transactions, interest-rate data and public-market data, matching average observable transaction prices. Subsequent shadow prices for the same companies use a consistent technique and an updated calibration on each valuation date.

6 · Hierarchy of inputs

IFRS 13. IFRS 13 prioritises observable inputs (Levels 1 and 2) over unobservable ones (Level 3). Where observable principal-market inputs exist they are used without modification; Level 3 inputs reflect the assumptions market participants would use, based on the best information available.

privateMetrics. privateMetrics relies on Level 3 information to produce a best estimate of the Market Valuation Anchor (MVA) — the value of a typical company with the same PECCS® and systematic risk-exposure profile. Company-specific adjustments are then added by individual users. privateMetrics applies a consistent framework, re-calibrating monthly to reflect the latest information.

7 · Adjustments

IFRS 13. Adjustments to the technique may be necessary so that fair value reflects what knowledgeable, willing parties would exchange at the measurement date under current conditions.

privateMetrics. The Market Valuation Anchor, representing the systematic drivers of a private company's value, is designed to allow adjustments focused on asset-specific characteristics. This enables a clear separation between systematic and asset-specific adjustments and supports both continuous updating to market and transparent documentation of asset-specific choices.

8 · Disclosure

IFRS 13. Extensive disclosure is required for measurements using significant unobservable (Level 3) inputs, including the valuation process, the sensitivity of the measurement to those inputs, and the effect of measurement uncertainty.

privateMetrics. privateMetrics provides detailed reporting: the loadings and returns of each factor affecting the valuation multiple, and the range of values arising from possible changes in the factors – a measure of measurement uncertainty that supports the scenario stress testing required by various regulations.

Issues with raw reported valuation data

Lack of recent transaction data

To illustrate the severity of the data-paucity problem, Table A1 shows the typical number of data points available at any given time. From MSCI's private-capital quarterly holdings data (formerly Burgiss), only about 150 recent transactions – roughly 13% of what is reported – are actually observed in a given quarter, and some sectors are barely represented.

■ **TABLE A1 · UNDERLYING DATA CAPTURING RECENT TRANSACTIONS (MEDIAN EBITDA MULTIPLES, BURGISS Q2 2022)**

SECTOR	ALL MULTIPLES		ENTRY MULTIPLES		EXIT MULTIPLES	
	COUNT	MEDIAN	COUNT	MEDIAN	COUNT	MEDIAN
All sectors	1,209	12.4x	114	10.1x	43	12.2x
Communication services	62	13.8x	7	11.0x	2	N/A
Consumer discretionary	195	11.0x	14	7.6x	10	12.4x
Health care	203	14.1x	22	12.1x	9	14.2x
Industrials	270	10.5x	29	9.1x	11	12.0x
Information technology	259	15.7x	23	11.1x	6	12.3x
Materials	62	10.6x	9	9.5x	1	N/A

Source: MSCI/Burgiss Q2 2022 report.

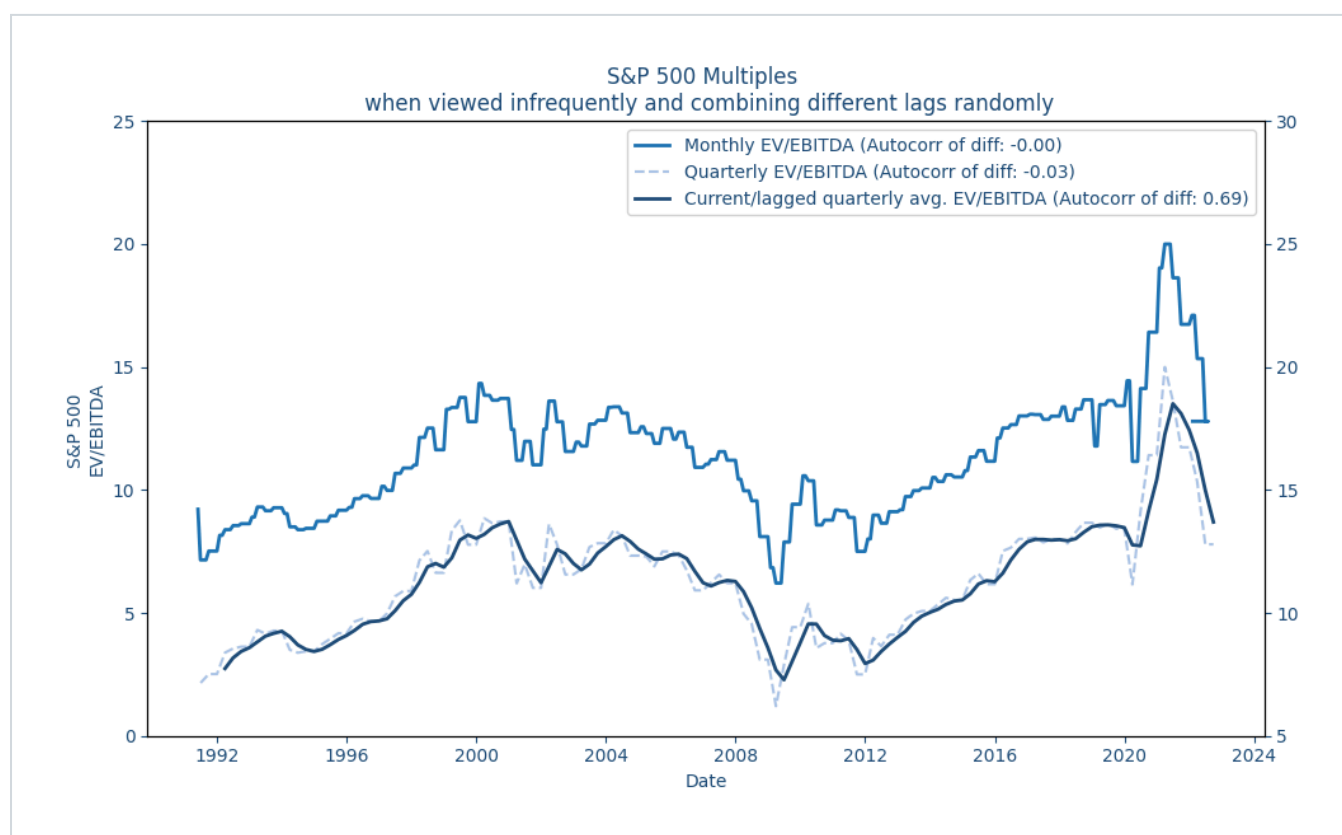
Flaws in reported data

Reported data such as the 'all multiples' columns above combine GP-appraised valuations with actual transactions, making the aggregate an amalgamation of methods, assumptions and decision-makers. Even isolating the reported valuation multiples, they remain problematic for several well-documented reasons:

- **Not current.** Collection, reporting and aggregation lags leave multiples stale, lagged and asynchronous; when GPs use static assumptions such as a fixed IRR discount rate, multiples can stay unchanged for several quarters.
- **Smoothed.** Behavioural biases make reported valuations smooth and unrealistically low in volatility across quarters, masking the risk of the asset class.
- **Not granular or robust.** Multiples at a highly aggregated sector or region level are hard to apply to a specific asset without ad-hoc adjustments; large valuation differences between subsectors mean an aggregated multiple can produce a very high error.
- **Combine disparate modelling approaches.** Reported data reflects models applied by many individual GPs and analysts using variable assumptions and methods; because every asset is unique, those differences do not cancel out and instead introduce bias.

Smoothness also creeps in when valuations on different dates are combined — as when a provider aggregates NAVs from funds reporting on different month- or quarter-ends. Figure A1 illustrates the timeliness and smoothness problem together: monthly EV/EBITDA multiples of all S&P 500 stocks have an autocorrelation of differences of zero; the same series measured only quarterly shows a similar pattern with an autocorrelation near zero; but mimicking how appraisal data is aggregated — assigning a random weight between 0% and 30% to the current and three lagged quarters — produces a very smooth series with a high autocorrelation of 0.69.

■ **FIGURE A1 · BIASES FROM COMBINING VALUATIONS OF DIFFERENT LAGS**



Source: calculated from Bloomberg data on the S&P 500 index.

Using reported appraisals leads to large errors

Applying reported data to private-market transactions exposes the granularity and robustness problems. Using the Q2 2022 MSCI/Burgiss median EV/EBITDA values, we compute an implied price for over 120 PitchBook deals and take the absolute error against actual deal-implied EVs. Table A2 shows these errors by PECCS® activity: they exceed 50% in most activities, indicating the reported values are not robust.

TABLE A2 · ERRORS USING REPORTED MULTIPLES

ACTIVITY	ABSOLUTE ERROR
Information & communication	56%
Transportation	95%
Manufacturing	73%
Real estate & construction	81%
Hospitality & entertainment	113%
Retail	60%
Professional & other services	68%
Utilities	96%
Health	46%
Financials	55%
Natural resources	33%
Education & public	30%
All deals	74%

TABLE A4 · ERRORS USING PUBLICLY LISTED MULTIPLES

ACTIVITY	ABSOLUTE ERROR
Information & communication	70%
Transportation	107%
Manufacturing	78%
Real estate & construction	143%
Hospitality & entertainment	179%
Retail	54%
Professional & other services	109%
Utilities	207%
Health	45%
Financials	355%
Natural resources	11%
Education & public	48%
All deals	103%

Source: 120 PitchBook deals in 2022; MSCI/Burgiss Q2 2022 report (Table A2) and Damodaran (NYU) 2022 dataset (Table A4). For sectors without estimates, aggregate medians are used.

The granularity problem is starkest within a single sector. Table A3 applies the aggregate healthcare multiple to selected healthcare deals: Health Care Equipment & Supplies consistently commands higher EV/EBITDA than Health Care Providers & Services, so a single aggregate multiple produces systematically varying errors across the two sub-activities, whichever quartile is used.

■ **TABLE A3 · VALUATION ERRORS ON HEALTHCARE DEALS USING REPORTED MULTIPLES**

COMPANY	SUB-ACTIVITY	DEAL MULTIPLE	EBITDA (USDM)	AVG. ABS. ERROR
HEALTH CARE EQUIPMENT & SUPPLIES				
Natus Medical	Equipment & supplies	22.8x	48.6	37%
Artel	Equipment & supplies	28.0x	5.0	48%
IntriCon	Equipment & supplies	51.2x	4.3	72%
HEALTH CARE PROVIDERS & SERVICES				
Hanger	Providers & services	12.2x	100.7	26%
Probo Medical	Providers & services	15.0x	30.0	18%
Tivity Health	Providers & services	19.5x	157.7	26%

Source: PitchBook healthcare deals, 2022; MSCI/Burgiss Q2 2022 report. Average absolute error is taken across the upper, median and lower reported multiples.

Public-market proxies do not help

Private companies are inextricably linked to the economy — they face market demand, obtain financing, weather business cycles and access capital markets for exits — so they are exposed to the same factors as listed companies. Yet there are significant differences that make public peers poor valuation proxies:

- **Disappearing public companies.** Since the 1997 peak in listings, the number of listed companies has shrunk for several reasons (Doidge et al., 2018), creating a selection effect that makes listed valuations different from private ones.
- **Different characteristics.** A key source of value creation in private equity is leverage; using public peers may fail to capture its effect on valuation correctly (Chingono & Rasmussen, 2015).
- **Diversification.** Private-market investors typically run concentrated strategies, whereas diversifying is cheap in public markets — making a perfectly diversifiable asset a poor proxy for a less diversifiable one.

Using the same 2022 PitchBook deals, we compute an implied EV from publicly listed EV/EBITDA multiples (Damodaran’s widely used NYU dataset, 91 sub-sector multiples). Mapping these to PitchBook activities, the errors (Table A4, above) are even larger than for reported data: half the sectors exceed 100%, indicating private companies transacted at far higher multiples than their listed peers in 2022 — with financials (355%) and utilities (207%) the most extreme.

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