aspequity

Cash Flow Forecasting for Private Assets

Private Assets Cash Flow Modelling

Aspequity's approach to cash flow modeling and forecasting rests on two economically justifiable principles. The first one is that at the end of the full life cycle of a PE deal, the cash flows are expected to be those which would be generated by an analogue public equity investment with similar characteristics: industry, country, leverage, etc. This expectation is reasonable given that a deal liquidation exit is likely an IPO or a strategic buyer purchase. The second principle is the fact that the usual average cumulative cash flows over time for a deal follow a relatively deterministic pattern with empirically observable parameters.

The native capability of our valuation and cash flow engine accommodates several options. All of them focus on the adjustment of public analogue company cash flows to make them aligned with the cash flow norm of a private company investment. It is well documented in the industry and literature that private equity investments follow a particular cash flow "average" pattern known as the J-curve. This is a natural objective and reference point to any private equity fund cash flow forecasting endeavor, regardless whether it is to identify and parametrize this expected pattern, or to introduce a probability distribution of outcomes around that "average" forecasted cashflow schedule.

One option is based on published studies in the literature - *e.g. Kaplan, Schoar et al., Journal of Finance 2005, 2013*, etc. Such studies focus on the measured historical IRRs for a broad universe of funds and fund categories and allow us to express an interim mean cash flow value at any time horizon on the J-curve between fund origination and the expected terminal year horizon as a formulaic percentage of the IRR at that horizon.

Another option to forecast the mean pattern of cash flows over time would be to use a model like the one suggested by *Takahashi and Alexander* (also known as "Yale model" due to its usage in the investment management of Yale endowment fund). A model of this nature prescribes both a forecasted average fund distribution and fund contribution pattern. Since such a model deals directly with cash flows, not returns, there is no need for an intermediate step to establish a formulaic connection between the returns and cash flows, unlike the cash flow forecasting approach based on the studies of Kaplan et al and others. Another convenient feature is that distributions and contributions are independently captured, allowing their expectations to be adjusted according to current and projected market conditions.

A specialized mode of using the Aspequity cash flow engine that is adapted to individual private investment deals rather than fund investments is focused on predicted EBITDA and "exit multiple" inputs. For example the user can provide a vector of EBITDA numbers that they expect will be realized over the life of the deal for each future time horizon, with the possibility to provide an expected exit EBITDA or revenue multiple for the last period, likely resulting in a spike in the end of the "average" cash flow pattern. In this mode of the cash flow engine usage, the "average" trend forecasting is deferred to the end user, but the inherent cash flow "probability distribution" feature of the Aspequity cash flow

engine, as described later, continues to provide valuable insights to the investment manager. This approach is more pertinent to a General Partner who already has a view of the future evolution of the cash flows over time, but would also like to know more about the chances of the actual cash flows to diverge from their expectations.

The BOSTON Model

While all of the above options are available through the Aspequity cash flow engine, the default and recommended mode of operation is another model. This is the *Bow Speed Time Option Normalized* cash flow model (BOSTON) developed by Aspequity. The BOSTON model is related but distinct from the Takahashi and Alexander model. It is the preferred version for utilization in our engine for two reasons. First, empirically, it provides better fit to observable fund distribution and contribution behavior that assures high confidence in the model parameters for the broad universe and varieties of private asset funds. Secondly, it recognizes, by design, that while underlying deals do become ripe for liquidation throughout the portfolio of a fund at certain rate over time, the general partners can control the rate with which they put the deals to the market. The BOSTON model parameterizes the fund distributions and contributions using similar variables as Takahashi and Alexander, but introduces an additional degree of freedom for the fund to adjust the number of deals that it decides to liquidate in a given time period. As acknowledged by Takahashi and Alexander themselves, their model was designed for the specific funds in which their organization invests and may not be the right solution for funds in which other organizations participate as limited partners. It was our objective to combine the intuition of their model with our own research insights resulting in a robust approach that addresses the vast majority of investors in private equity partnerships. That resulted in an approach that is both founded on sound economic principles and that carries broad empirical support.

Another key differentiator of the Aspequity methodology is the introduction of a probability distribution around the forecasted “average” cash flow pattern. That is made possible by analyzing and forecasting the volatility of the underlying investments using best-of-breed third party risk models and infusing this information onto the forecasted “average” cash flow schedules. This generates a more informed investment performance picture, reflecting the inherent uncertainty of investment cash flows. This feature is indispensable for all investors in a partnership. Limited Partners are interested to have a measure of the magnitude of potential cash flow shortage in relation to their future liabilities (plan redemptions, pension outlays, planned capital expenditure, future unfunded commitments in other partnerships, etc.) General Partners are interested to know the amount and variation of future distributions in order to optimize the capital call schedules and deal flow, as well as plan the capital resources of their firm in the most efficient way over time.

The Aspequity cash flow capability is a key component in our private investment risk-aware valuation model *EXPLO* which offers a rigorous quantitative approach to valuation compliant with the guidelines of AICPA and IPEV. Due to the technological advantage of our software and models, the cash flows and asset value scenario probability distributions are explored under a sextillion (10^{21}) possible future

realization paths in a matter of seconds, per investment. The insights and capability of our service are unprecedented and unparalleled in the industry.

Model Performance

The ultimate metric of a cash flow model quality is how well it predicts the realized periodic distributions and contributions. Figures 1 and 2 present predicted vs. realized quarterly cash flows for a pooled portfolio of sample funds. Our objective was to capture robust out-of-sample statistical significance of the predicted the cash flows for any period, rather than produce a perfect fit of the in-sample observations. The latter is the objective of complex econometric techniques and machine learning algorithms which construct elaborate functions reproducing the *sample observations* almost exactly. In-sample fit is about what has happened in the past, and forecasting is about the future. The higher the number of predictor relationships in a model and the higher the model complexity, the lower the probability that the output of the model will actually hold out of sample. In addition, the complexity of a solution obscures the intuition behind the relationship between the predictor and predicted variables. This, by definition, reduces the confidence which investment management professionals can place on this output to utilize in the decision making or reporting process. What makes transparency of even higher importance is that the model output has to be communicated to relatively less technical stakeholder audience like board committees and plan sponsors.

The appropriate testing of the model performance should further reflect the periodicity which most closely matches the uses and sources of liquidity to the investor. For example, a testing procedure on *cumulative* rather than *periodic* cash flows would make the former appear unduly superior. This is due to the diversification of model errors over the lifetime of the funds. At the same time the periodic model prediction will matter more to the investor since there will be tangible adverse consequences from the magnitude of unplanned mismatches of the predicted and realized cash flow in any given period. Thus, a test on the quality of the *cumulative* cash flow forecasts does not answer the right question. Likewise, since most investors in private assets focus on quarterly planning and reporting, test on annual cash flows will also be off the mark in terms of addressing the insights of key interest to the investor.

Evidently, the Aspequity cash flow model addresses very well all of these model quality considerations.

Contacts

Please contact us for a demo and to find out more at info@aspequity.com

Figure 1. *Linear Coefficient of Predicted to Predictor variable: 0.98. T-statistic: 11.5*

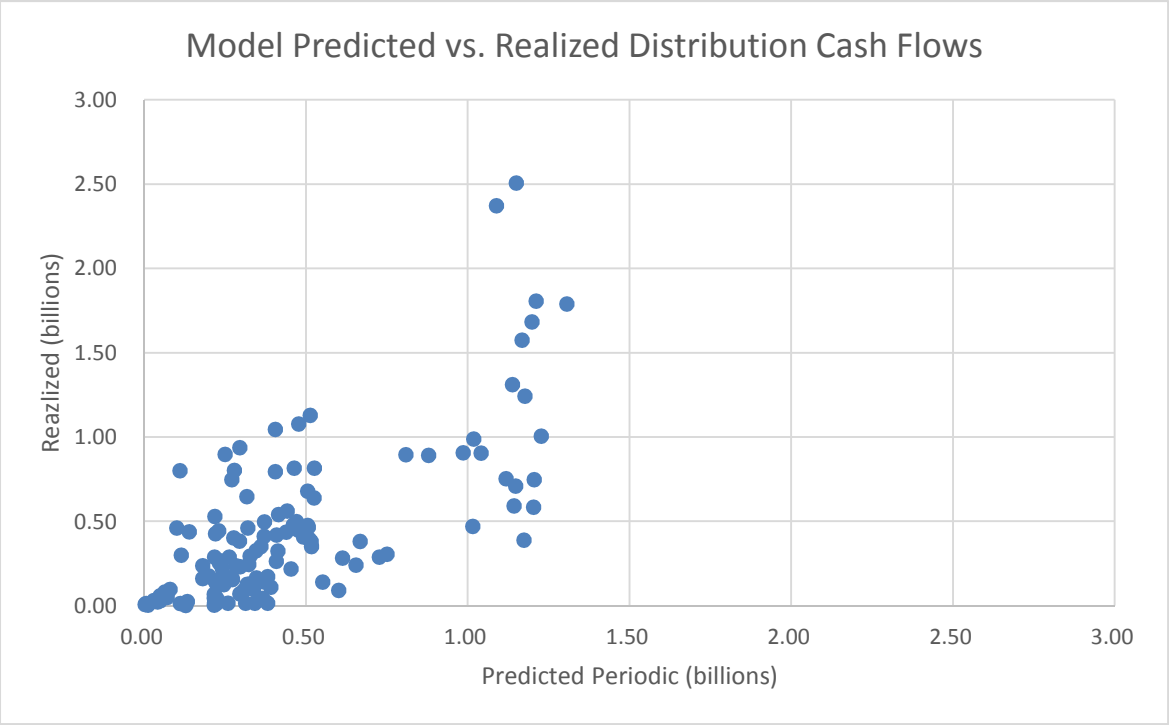


Figure 2. *Linear Coefficient of Predicted to Predictor variable: 0.81. T-statistic: 9.6*

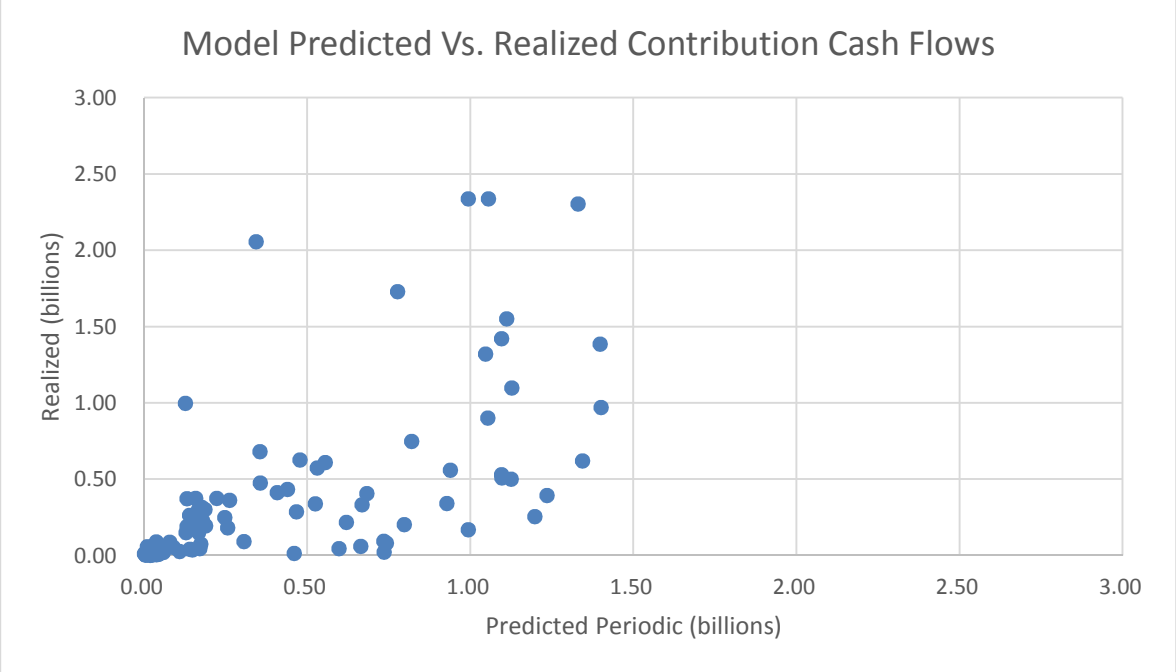
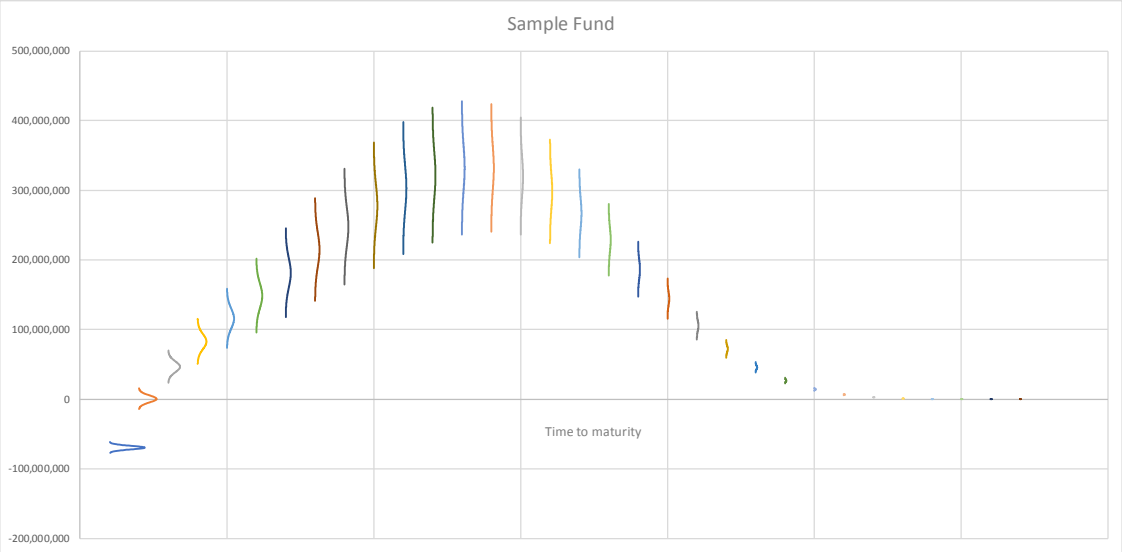


Figure 3. *Sample Cash Flow Forecast Report*

Portfolio:	Sample Fund	Model:	BOSTON
As of date:	2019xxxx	Base currency:	USD

Cash Flow Forecast



Cash Flow Forecast Details

Period	lower 99%	lower 95%	lower 90%	lower 75%	high 75%	high 90%	high 95%	high 99%	average
Q1	-75,269,915	-73,682,570	-72,624,225	-71,036,880	-67,862,075	-66,274,730	-65,216,500	-63,629,040	**-69,442,405**
Q2	-11,101,548	-7,567,495	-6,052,899	-3,023,707	4,044,412	7,073,604	8,588,200	12,122,265	**517,080**
Q3	28,984,945	34,170,870	36,763,890	41,431,280	51,803,245	56,470,635	59,582,190	64,249,580	**46,624,105**
Q4	57,814,985	64,873,570	69,217,235	75,732,905	89,849,960	96,908,430	100,709,180	107,767,765	**82,798,620**
Q5	83,312,440	92,426,190	97,552,660	106,096,815	125,463,850	134,008,350	139,133,900	148,247,650	**115,787,750**
Q6	108,089,075	119,359,650	125,884,750	136,561,350	160,288,150	170,965,900	177,491,000	188,761,000	**148,432,800**
Q7	132,619,150	146,641,100	153,956,250	166,759,200	196,022,100	208,823,900	216,140,200	230,162,150	**181,398,700**
Q8	158,443,550	174,506,750	183,154,750	197,981,700	231,342,050	246,169,000	254,818,150	270,880,200	**214,670,500**
Q9	184,604,900	202,487,400	212,353,250	229,002,950	266,000,750	282,649,300	293,132,700	311,015,200	**247,509,900**
Q10	209,024,000	228,344,000	239,212,650	257,326,300	298,382,450	316,496,100	327,363,600	346,684,750	**277,861,850**
Q11	230,683,100	250,882,850	262,425,400	281,469,400	324,176,950	343,222,100	354,764,650	374,963,250	**302,830,650**
Q12	247,570,850	268,621,600	279,956,000	299,928,050	343,108,250	363,079,150	374,414,700	395,465,450	**321,525,050**
Q13	258,991,500	279,680,000	291,008,650	310,219,400	353,565,200	372,774,800	384,103,450	404,791,950	**331,898,050**
Q14	262,454,150	282,108,800	293,029,200	311,372,850	352,430,150	370,774,950	381,694,200	401,785,850	**331,907,250**
Q15	256,038,300	274,386,550	284,122,450	301,347,150	338,791,150	356,015,850	366,126,650	384,100,000	**320,073,750**
Q16	241,474,700	257,317,100	266,325,050	281,235,950	314,784,900	329,694,650	338,703,750	354,546,150	**298,014,450**
Q17	218,735,750	232,396,600	240,097,000	252,764,250	281,080,700	293,749,100	301,448,350	315,110,350	**266,926,500**
Q18	189,764,950	200,808,400	206,901,100	217,183,250	240,412,100	250,694,250	256,786,950	267,830,400	**228,800,550**
Q19	156,492,000	164,972,100	169,698,600	177,623,250	195,419,500	203,344,150	208,070,650	216,691,050	**186,523,100**
Q20	122,426,700	128,703,400	132,083,250	137,974,700	150,914,500	156,804,800	160,184,650	166,461,350	**144,445,750**
Q21	90,433,815	94,744,360	97,089,785	101,083,275	110,084,555	114,078,160	116,486,950	120,733,900	**105,584,835**
Q22	62,450,635	65,219,030	66,778,660	69,352,130	75,122,830	77,696,300	79,255,930	82,024,325	**72,237,940**
Q23	40,002,060	41,649,780	42,562,765	44,121,360	47,550,430	49,109,025	50,022,010	51,669,730	**45,836,125**
Q24	23,549,470	24,450,725	24,953,965	25,796,570	27,692,690	28,535,295	29,038,650	29,951,520	**26,744,745**
Q25	12,589,395	13,042,725	13,294,575	13,714,325	14,654,565	15,074,315	15,326,165	15,779,495	**14,184,560**
Q26	6,010,567	6,211,507	6,321,539	6,510,518	6,926,738	7,115,706	7,225,749	7,426,677	**6,718,657**
Q27	2,503,930	2,582,555	2,625,439	2,697,820	2,860,430	2,932,811	2,976,591	3,054,320	**2,779,136**
Q28	889,972	915,619	929,867	954,089	1,007,663	1,031,886	1,046,134	1,071,782	**980,881**
Q29	258,657	265,575	269,444	275,991	290,498	296,971	300,840	307,833	**283,208**
Q30	57,421	58,862	59,664	61,001	64,002	65,339	66,141	67,582	**62,502**
Q31	8,628	8,829	8,940	9,128	9,546	9,735	9,846	10,047	**9,337**
Q32	665	680	688	701	731	744	752	767	**716**