Third Quarter 2017 Letter

Welcome to your Q3 2017 quarterly letter from Burr Capital LLC.

Year-to-date, Burr Capital LLC aggregate accounts posted almost 33% compared to 14% for the S&P 500. Our objective is to achieve long-term performance superior to that of the S&P 500. Since Jan '16, the annual compounded rate for Burr Capital LLC is 32%, versus 15% for the S&P 500. Please remember that past performance may not be indicative of future results and individual accounts may vary significantly (please see the **Disclosures** section at the end of this letter for more information). Exhibit 1 provides a summary of results to date:

Exhibit 1

		S&P 500	Burr Capital LLC
2016	1st Qtr (Mar)	1.4%	-2.3%
	2nd Qtr (Jun)	2.5%	8.1%
	3rd Qtr (Sep)	3.9%	11.7%
	4th Qtr (Dec)	3.8%	4.1%
	2016 Full Year	**12.0%**	**22.8%**
2017	1st Qtr (Mar)	6.1%	12.1%
	2nd Qtr (Jun)	3.1%	10.6%
	3rd Qtr (Sep)	4.5%	7.3%
	4th Qtr (Dec)		
	2017 YTD*	**14.2%**	**32.9%**
	Cumulative Results**	**27.9%**	**63.3%**
	Annual Compounded Rate**	**15.1%**	**32.3%**

* For the period 01/17-09/17
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As a reminder, our investing algorithm is based on the simple and repeatable principles of a concentrated portfolio, high active share (i.e., large deviation from the benchmark index), and options hedging.

- Our strategy is scalable because we invest in liquid stocks and generally avoid microcaps and penny stocks. We like to invest in durable businesses with recurring (or recurring-like cash flows), a competitive moat, (realized or unrealized) pricing power and good management. Microcaps rarely fit these criteria (or they wouldn't be microcaps). To those that may argue that investment opportunities don't exist in larger stocks, it's worth noting that the shares of Apple, the most widely covered stock on Wall Street with a market capitalization approaching a trillion, moved 60% from its 52-week low to its 52-week high, presenting ample opportunities for investment outperformance (with appropriate weighting).
- Our strategy is hard to replicate at the institutional level, because larger institutions may not be able to withstand the volatility of a concentrated portfolio with high active share, are loathe to hedge using options, and are less likely to sit on their hands waiting for a fat pitch.

Portfolio Review

In the third quarter, we made several changes to your portfolio. We initiated investments in three new businesses. We will briefly discuss CDW here and leave the others for our year-end review.

Noteworthy **contributors** to performance were CDW, Charter (which we own through our investments in Liberty Ventures and Liberty Broadband) and CommerceHub.

- CDW, a value-added IT reseller, is the 900lb gorilla in its industry (by a factor of two) but has only 5% share in a large fragmented market. Said differently, the addressable market is 20x the size of CDW, presenting a long growth runway. Founded in 1984, CDW was taken public in 1993, acquired by private equity (PE) in 2007, and taken public again in 2013. The quality of this business is underappreciated and patient investors have been amply rewarded over the years. In the period between 1994 and 2007, shares rose at a 25% compound annual rate, before PE stepped in. From 2013 to 2016, shares compounded 30% per annum, driven almost entirely by earnings growth. Even the PE firms that acquired the company at the top of the cycle and held it through the greatest financial crisis of our time made a respectable 9% annual return. Underlying drivers of this business is a long history of stable growth, economies of scale operating a two-sided network, best-in-class productivity, ROIC, and margins. The business is recession-resistant and like any good distributor, working capital boosts cash flow in a downturn. The business is attractive to PE because the business has low capital requirements and can operate with high debt loads. In fact, CDW could pay down its entire debt load in five years. With earnings power of $6.00-13.00 per share (including $2.00 from tax reform), CDW shares, currently trading around $65, could be worth $240 by 2021.
- Charter is effectively an "information infrastructure utility" with recurring cash flows, monopoly-like (unrealized) pricing power and an excellent shareholder-friendly management. Good businesses enjoy positive optionality, and Charter had its share in the form of M&A rumors in the third quarter.
- CommerceHub, an asset-light "arms dealer" in the e-commerce supply chain with no direct comparable firms and a massive untapped addressable market, continued its strong performance in the third quarter. Year-to-date, the shares are up 40% and we continue to see further upside.

Detractors to performance were our oil investment and our options hedges.

- Poor investment decisions usually occur in pairs. In the case of our oil investment, we acquired the shares at the beginning of the year (read our prior letters for context) when optimism that OPEC supply cuts would drive up oil prices was at its peak. When it became clear that we didn't have any edge on oil prices, we sold our shares in August at around the point of maximum pessimism. In September, after we sold our shares, oil enjoyed a remarkable turnaround and was one of the best sectors in the S&P. So we suffered through the downturn and missed the rally. While we derive some solace from harvesting the tax loss, it will serve as a painful reminder to just avoid commodity businesses. For professional investors, there's a constant tension between process and performance and nowhere is it more apparent than in selling losers. Holding on to losers could be a sign of conviction (a fine trait in a value investor) or hubris (a fatal flaw for any investor). Selling could be a sign of humility (an awareness of one's limitations and a healthy respect for the Wisdom of Crowds) or a sign of a "weak hand." Selling is much easier if you're a trader, but it's the hardest thing in the world if you're a value investor.
- Our options hedges hurt us in what turned out to be a highly unusual September. September is seasonally one of the worst times of the year, when the market has suffered average declines as far back as 1950. Downside risk seemed unusually high this year with markets at record levels, a severe hurricane season, and a dysfunctional White House and Congress. Consequently, we were more defensively hedged than usual, entering September. September turned out to be one of the worst months in terms of newsflow. A devastating hurricane season left Puerto Rico's infrastructure in shambles. The US and North Korea, a nuclear state, are on the brink of war. Congress failed once again to pass legislation on a healthcare repeal bill. The Federal Reserve has signaled a rate hike before year-end (rising interest rates tend to be bad for stocks). Apple, the largest member of the market-cap weighted S&P 500 index, declined more than 5% on disappointing pre-sales of the iPhone 8. And yet, the market rose 2% in September! For now, market participants appear willing to look past the risks, focused on resilient corporate earnings, easy monetary policy, and the promise of tax reform.

A Framework with Volatility as a Risk Measure, Under the Extremeness Aversion Hypothesis, Can Lead to Suboptimal Long-term Portfolio Decisions

We had our share of volatility in the third quarter, prompting this section on the relationship between volatility and risk, the underlying math, and human behavior.

Harry Markowitz's 1952 research on *"Portfolio Selection"* established the field of Modern Portfolio Theory (MPT), institutionalized investment management, and spawned the "robo-advisor" industry. The theory recommends a "mean-variance" portfolio strategy to maximize returns for a given level of risk. MPT provides a menu of investment options enabling the consumer to tailor a portfolio to their individual risk tolerances. To achieve a higher return, one must take more risk. To arrive at these insights, Markowitz used "arithmetic mean" as a proxy for "return" and "variance" as a proxy for "risk."

Variance is the square of the standard deviation (i.e., volatility) and measures how much the share price moves around the mean.

In Markowitz's own words: *The concepts "yield" and "risk" appear frequently in financial writings. Usually if the term "yield" were replaced by "expected yield" or "expected return," and "risk" by "variance of return," little change of apparent meaning would result.*

While risk is hard to measure, variance (i.e., volatility) and returns are readily calculated from historical share price data. The mean-variance analysis framework is mathematically elegant and lends itself well to all kinds of statistical analysis. Unfortunately, this framework with its subtle recasting of risk into variance (volatility) can have unexpected consequences when combined with human behavior.

A brief digression on consumer choice

In the 1992 publication *"Choice in Context: Tradeoff Contrast and Extremeness Aversion,"* Simonson and Tversky discuss how humans are influenced by choices. For example, the Extremeness Aversion hypothesis states *"that the attractiveness of an option is enhanced if it is an intermediate option in the choice set and is diminished if it is an extreme option."* Simply stated, when faced with choices, humans tend to pick the middle option preferring compromise to extremes.

Extremeness Aversion in a volatility framework can lead to unintended consequences

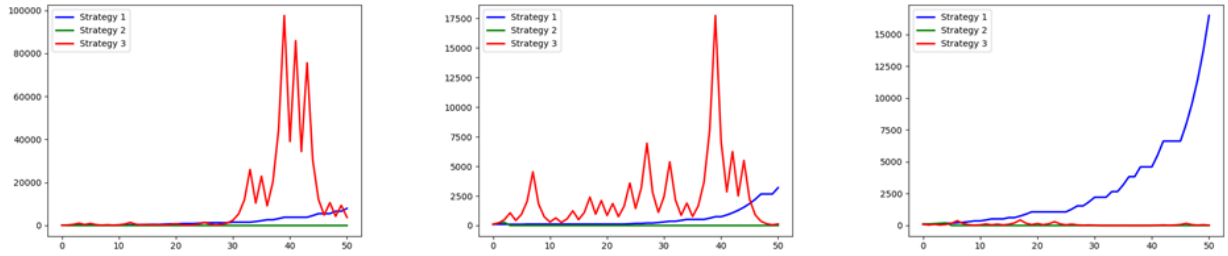
Let's say your financial adviser offers you the following three investment strategies:

- Strategy 1: Expected return of 10% with low volatility
- Strategy 2: Expected return of 13% with medium volatility
- Strategy 3: Expected return of 30% with high volatility

A risk-seeking individual may choose Strategy 3 and a highly risk-averse individual may select Strategy 1. But according to the Extremeness Aversion Hypothesis, consumers may be more inclined to pick the middle option, Strategy 2, with a higher expected return than Strategy 1 but a lower volatility than Strategy 3.

We ran several simulations with these three strategies and the results are illuminating. Think of each simulation as a long-term (50-year, multi-generational, Berkshire Hathaway-like) investment using one of these strategies. Three illustrative simulation runs are shown below (Exhibit 2).

Exhibit 2



What we find is for a sufficiently long investment timeframe, the most "conservative" Strategy 1 (in Blue) produces the *greatest cumulative gains in wealth at the fastest rate.* In contrast, the "compromise" Strategy 2 (in Green), leads to *complete loss of capital, with certainty, over a long enough timeframe.*

To understand why we arrive at these somewhat counter-intuitive results, one must dig deeper into the strategies:

- It turns out that Strategy 1, with the lowest expected return, happens to have the highest *geometric mean* return. Maximizing the arithmetic mean return (as proposed by MPT) is fine for one-off bets but is suboptimal for a compounding series of bets. The body of research starting with Claude Shannon's 1948 paper *"A Mathematical Theory of Communication"* on Information Theory and culminating in Ed Thorp's 1969 paper *"Optimal Gambling Systems for Favorable Games"* provides an elegant answer to portfolio selection. In layman's terms, research shows that if the goal is long-term compounding of wealth then *maximizing the geometric mean (not the arithmetic mean as advocated by MPT) leads to greater wealth creation at the fastest possible rate than any "essentially different" strategy over a long-enough time period.*
- Strategy 2's return distribution includes a scenario where 100% loss of capital can occur. *Even a small probability of a large loss can lead to devastating results over time.* This tail risk is not captured by volatility. If you believe this experiment is contrived (it is, sort of), then imagine investing in a money-market fund that owned Lehman bonds back in 2008.

In summary, it's important to understand what volatility truly measures and what it doesn't. While easy to manipulate mathematically, volatility can be a poor proxy for risk. The concepts discussed here are not new. They were clearly laid out and debated back in the '50s. Yet, somewhat surprisingly, they have been largely forgotten by the broader investment community. *Mean-variance can work for accumulating wealth but geometric mean works for compounding wealth.*

Ed Thorp went on to run a highly successful quantitative hedge fund, perhaps the first of its kind. Given Thorp's quant legacy, I suspect his work lives on in that part of the investment world. Here lies another example where fundamental investors could learn something from the quants (our Q2 2017 letter suggests ways to incorporate quantitative techniques like machine learning into the fundamental investor's toolkit).

Firm Update

There were no material updates to the firm in the third quarter.

Thank you again for your support and please do not hesitate to reach out if you have any questions.

Sincerely,

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DISCLOSURES

Please remember that past performance may not be indicative of future results. The Burr Capital LLC aggregate account is based on the aggregate performance of all client accounts (existing and new accounts opened during the year at various times) except those client accounts that place any restrictions on investing in options. Two personal IRA accounts with restrictions on trading in options were excluded from the aggregate. Burr Capital LLC accepted one outside client in November 2015; returns are therefore computed from 2016 onwards.

Performance of individual accounts may differ significantly from Burr Capital LLC aggregate account, depending on timing of investments, the effects of additions, and the impact of withdrawals from the account. Not all accounts have identical securities and weightings. Portfolio holdings and weightings may vary depending on the size of the account, especially accounts below $200,000. For example, due to liquidity constraints, it may not be possible to own fixed income securities or to implement certain option strategies in smaller accounts.

Figures are unaudited and may not include impact of accrued but unpaid fees for the latest quarter. S&P 500 returns include dividends but do not reflect any fees. Returns are computed on a before-tax time-weighted return (TWR) basis and are net of all paid management fees and brokerage costs. As of 12/30/2016, approximately 55% of the aggregate assets represented non-fee-paying assets.

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