

Budgeting for Risk

To identify and manage durable investment strategies

Abstract:

Standard risk metrics overlook or average away the impact of extreme events. To develop and maintain viable investment strategies, Olsen expands the concept of risk-budgeting to allow for drawdowns and to forestall the suddenly fatal effects of margin requirements. This article promotes the combined application of the Calmar Ratio and a new metric devised by Olsen: ExposureFactor (the cost—in terms of leveraged risk capital—required to earn an average annualized return of 1%). The focus here is on strategic engineering of leverage to reduce risk and realize excess return. Included are critiques of some current risk metrics and an explanation of Olsen's proprietary risk-reducing investment methodology.

Dr. Richard Olsen
CEO
Olsen Ltd.

**233 Seefeldstrasse
Zurich, Switzerland**

Edited by Thomas Grizzard

Budgeting for Risk

To identify and manage durable investment strategies

Risk assessment should focus on the cost of returns and the ability to maintain positions during drawdowns. Metrics that focus on return and the volatility of returns ignore extreme events—which are often triggered by sudden breakdowns in long-standing historical relationships, and exacerbated by market mechanics that force you to close out leveraged positions.

At Olsen we believe accounting for the possibility of extreme events should be a normal part of planning for risk. Trading strategies that rely on fixed correlations of risk and return ignore the dynamics of the marketplace and are inherently risky. More realistic risk analysis factors in worst cases and takes into account how leverage of the underlying strategy affects risk.

Market Mechanics & Risk

During drawdowns, leverage increases exponentially, your ability to open new positions is limited, and relatively small losses can suddenly trigger a margin call.

The trauma of a margin call is not limited to the trader who suddenly forfeits his positions. Margin calls spark price moves, triggering stop-losses for other market participants and creating a domino effect of price movements that have nothing to do with fundamentals.

Olsen's Point of View

- target risk *first*—as a function of worst-case performance AND the funding cost of providing capital to maintain trading positions and, therefore, your investment strategy.
- the most dangerous risks are idiosyncratic: unexpected, extreme, and/or unrelated to fundamentals. Because we consider these risks to be ever-present, we think they are normal.
- leverage can be a catastrophic form of risk. Nothing derails a strategy faster than a margin call—which is often triggered by market mechanics (see above) that displace fundamental economic relationships.

Implications for the Investor

- statistical estimates of risk generally assume that an asset's price changes are *continuous* and *limited in size*. Experience proves otherwise. To reduce the risk of loss, investors must allow for prices that change suddenly and may exceed the range of "normal."
- every risk metric comes with its own host of qualifiers and conditions; choose measures that cut through the fog of reported performance and describe specific behaviors, without averaging away the extremes.
- mind your exposure. During periods of imbalance between buyers and sellers, market makers move prices and adjust spreads to elicit the trading action they desire. A new price becomes the reference point for *every* participant in the marketplace—who

- fluctuations in leverage should be monitored closely. Margin ratios are not static; increases in exposure are a clear signal that should be taken into account as a routine part of managing risk.
- must price his positions to market—potentially triggering a cascade of stop-losses and margin calls...and compounding uncertainty.
- given current pressure to regulate hedge funds, these providers have a choice: submit to bureaucratic, external oversight...or...voluntarily publish margin ratios and other risk metrics (see below) that gauge exposure and the tradeoff between risk and return.

Let's review these implications one by one:

1. Allowing for extremes

Risk is not evenly distributed over time. Standard deviation is the root mean square deviation of the net asset value: it misrepresents the true risk of loss because it averages away the impact of extreme price movements. In response to news announcements, prices can make sudden and dramatic leaps.

Why does this matter? As trading positions are priced to market, unrealized losses are subtracted from equity to determine the available margin. During extreme market moves unrealized losses pile up rapidly, reducing net assets and thus available margin capital. Because margin capital has declined, leverage has *de facto* increased. Any further adverse market move will have an increased negative effect due to the higher leverage. Very soon this situation can get out of hand: the investor runs out of collateral and is forced out of his position during a price extreme—the worst possible moment to close a position.

2. Risk metrics that address the live-or-die moments for your strategy.

We believe a combination of three different metrics is best for determining the risk you can afford and planning a strategy-sustaining level of exposure:

The Calmar Ratio: annual compounded return/largest drawdown

ExposureFactor: the percent of equity required to earn an average 1% return

Torque: the measure of the initial cost of leverage (margin requirement of the market maker plus reserves)

Torque is simple: if you have two strategies with identical Calmar Ratios and ExposureFactors, which do you choose? The one with the higher Torque, i.e., requires less margin capital.

Torque is computed as follows:

$$\frac{1}{\text{Margin requirement (\%)} + \text{drawdown reserve (\%)} + \text{contingency reserve (\%)}}$$

The Calmar Ratio addresses the issue of accounting for extreme scenarios. Expressed a different way, it is the *expected* return divided by the *expected* worst-case scenario. (*The expected worst case is the strategy's biggest drawdown—measured from high-water mark to trough of NAV—over its entire track record.*) Other things being equal, the higher the Calmar Ratio the more attractive the strategy.

The Sharpe and Sortino Ratios focus on something different: return and the volatility of return. From a statistical standpoint those two ratios are better at describing *average* behavior. But representations of average hide the all-important rough spots.

The metric you choose should never omit critical information; and the most critical information is anything that could kill your strategy.

Olsen coined the term “ExposureFactor” for a new way to measure the cost of risk. This is a calculation of the maximum capital requirement (maximum equity exposure) to earn an average 1% return.

It's important to note that ExposureFactor addresses a key characteristic of risk: *the volatility of leverage*. It compares

the expected return with the amount of risk capital required to achieve that return—in bad times as well as good. It can also be a useful tool for comparing and monitoring investment providers and products and, therefore, informing the risk-budgeting process.

ExposureFactor reveals the latent risk that lurks within every leveraged position. The bigger the maximum exposure, the greater the possible damage when you incur a loss. ExposureFactor creates a larger context for analyzing risk by comparing how much exposure must be borne to achieve an average annualized return of one percent. It better represents the overall picture.

Every trading strategy needs funding, i.e., risk capital—or, as described earlier, collateral. The lower the Calmar Ratio, the more risk capital is required to fund the strategy. If the investor understands the funding requirements of the market maker, he or she can infer the commitment of risk capital (calculate the ExposureFactor).

We believe the Calmar Ratio plus ExposureFactor are key elements for risk-budgeting. Together they address:

- primary risk—maximum drawdown vis à vis return, and
- secondary risk—equity required to achieve a given return and maintain the strategy.

If I find strategies with high Calmar Ratios *and* low ExposureFactors I can combine many of them to assemble a portfolio with high diversification. High ExposureFactors alone will limit my choices, and diversification will be lower.

2a. A few caveats about risk metrics, their use and misuse

- Be careful about the conclusions you draw from any data sample:

A basic property of financial markets is clustering; volatility and correlation may remain stable and constant for hours/days/weeks/months/years/decades and then abruptly shift to a new and different level. Typically, we lack sufficient performance history for any trading model to know how it will perform in the wake of such a regime shift.

In financial markets—and in economics in general—there is no objective frame of reference. Every participant in the marketplace subscribes to his subjective metric, believing it to be reliable, and this determines his response to outside events. The more widely accepted these metrics, the more universal and absolute they appear.

But even the most-taken-for-granted relationships are subject to decay and rupture. And, therefore, the metrics we use to gauge them are susceptible to error and false reporting. This has to do in part with the size of the sample (is it long enough to be representative???), *but more with the types of risk our analytical tools are designed to look for and the complexity of financial markets.*

[sidebar:]

How does Olsen minimize risk?

We believe it is possible to reduce investment risk by taking advantage of the signals that result from the way the market works. Market mechanics displace prices and create temporary imbalances that are predictable. Imbalances always denote a situation that must be resolved so that trading can proceed with less uncertainty.

Trend-followers run the risk of being caught in down-drafts (for example, when liquidity suddenly dries up or re-priced instruments take a new, unexpected direction). When traders are stopped out of their positions, prices spike due to the lack of liquidity. We trade counter-trend and provide liquidity which the market inevitably requires.

At the most practical level, we apply the Calmar Ratio and ExposureFactor to our own strategies. More fundamentally, our trading models measure tick-by-tick price changes in search of patterns that can predict successive reactions in the marketplace.

Our models construe different valuable concepts, but two are most important for managing risk: ***the scaling law***, and ***micro-seasonality***.

Scaling describes a relationship that exhibits invariance of scale. **A scaling law** is a basic analytical tool derived from the proven statistical properties of the market itself. It is practical and real, not theoretical. What does it show? That the pattern of volatility measured at 10-minute intervals is similar to that measured at one-hour intervals. And this law holds for periods of up to two months and beyond. It also holds for the frequency with which prices change direction: the pattern for the direction of price changes at one-hour intervals is similar to that for one-day intervals.

Micro-seasonality refers to the weighting of market information according to an adaptable timeframe ("business time" instead of clock time). When few traders are in the market, data is expanded; for more active periods, data is compressed (given greater emphasis). During periods of intense activity we measure changes at higher resolution to capture the full detail of market dynamics.

The scaling law and micro-seasonality are complementary measures that reveal reliable patterns. They allow us to reliably identify price spikes resulting from illiquidity, to make more informed (lower-risk) trades, and to optimize the timing of trades. They create a discipline that gives structure to our trading models and reduces risk.

Our trading models are based on the way markets work—beset by extreme events and irrational jumps in price. They don't rely on fundamentals or a fixed frame of reference but anticipate the much-faster-paced, instantaneous effects of the law of supply and demand...as buyers and sellers seek counterparties to advance their strategies...creating moments of imbalance when we look to achieve incremental gains at the lowest possible risk.

- Question the assumptions behind the performance history: to what extent has there been *ex-post* manipulation or selectivity (including “survivor bias,” where failed strategies are automatically excluded), and you are seeing *the best strategy*—as opposed to *all the strategies* that were originally launched?
- Some strategies are “parameterized” to fit individual instruments; other strategies (such as Olsen’s) are exactly the same, with the same parameters, across all instruments. The latter are more likely to weather very different market environments; strategies with variable parameters require a much longer time to validate.
- VaR (value-at-risk), one of the most common institutional risk metrics, predicts the maximum loss from an asset or fixed portfolio of assets, with a given level of certainty, over a certain period of time—assuming no unusual market conditions during that period. While there are many problems with VaR, as a risk-management tool it is unsuitable for dynamic strategies—like hedge funds—where positions are frequently linked to each other and increased or decreased over relatively short periods of time.

3. Of the risks you can more readily control, leverage tops the list. Why don't investors pay more attention to it?

While leverage is hardly a hidden risk, we seem to prefer considering its promise to its potential downside. In the aftermath of the LTCM crisis, even professional investors were shocked to learn that leverage in that portfolio was a factor of 30. (This means that a 1% price change in the investment instrument translates into a 30% loss or gain for the underlying equity.) If leverage had been a factor of five, things would not have gone so horribly wrong, and LTCM's notoriety would be substantially different.

ExposureFactor can prevent such oversight.

In an alpha-hungry world, linear assumptions about risk and return (the persistence of relatively stable relationships) are obsolete. Serious asset managers concoct strategies they hope will endure, but a margin call quashes the best-laid plans.

High leverage usually results in bigger short-term swings, which should be obvious from analyzing daily NAV. The problem is, many investors look only at monthly data, where short-term swings are smoothed out or hidden. This is especially true when a manager “tunes” his or her style to adapt to the monthly reporting cycle—for example, by taking more risk early in the month and then ratcheting back as the month progresses.

In such a case part of the risk of leverage would in fact be hidden. The moral? The risk parameters of a strategy change during the course of a month; know the Calmar Ratio and ExposureFactor, but follow through by monitoring *on a daily basis* NAV peaks and troughs and how they correlate across sub-strategies in the portfolio.

4. Planning (and budgeting) for risk

The Sharpe Ratio and its variants measure the mean excess return per unit of risk and provide one number that is supposed to quantify risk-adjusted return. This offers limited insight to the asset manager who is building a portfolio from the ground up as it focuses on “mean” risk, hiding the extreme scenario(s). The virtue of the Calmar Ratio is that it focuses the manager on the real world: for every point of expected return, what is the worst that might happen?

At every stage in the allocation process, the manager must make sure he or she has the funding available to execute—and continue to execute—his or her strategy.

The current literature ignores the issue of return as a function of maximum exposure. *Which would seem to be an indispensable step in determining the overall risk profile.*

Increasingly, investors don’t choose one hedge fund manager but seek out multiple providers (to create a fund of funds) to diversify among several risk/return profiles. Assuming that you have vetted providers using the Calmar Ratio, the ExposureFactor enables you to calculate the funding cost of your portfolio. It also makes for smarter risk allocation and enhances your ability to monitor performance and risk vs. cost.

Example:

In constructing your portfolio and choosing the optimal allocation, you first have to ask yourself: *what is the maximum position size of any one strategy that you want to have during an extreme market move?* Based on ExposureFactor you can then determine the maximum return potential while maintaining the exposure constraints. If the maximum position size that you are ready to consider is 100% and the ExposureFactor is 2%, your strategy will generate 2% of return while remaining within

Maximum Exposure?

Total losses for LTCM investors was estimated at \$4.6 billion. Between January and September 1998 the Partnership’s equity fell from \$4.72 billion to \$600 million. No level of expected return could have justified overlooking the possibility of a drawdown this large.

And yet, how much more rigorous is our risk analysis as a result?

the pre-specified exposure constraint of a maximum position size of one times equity.

Because your market maker provides leverage, you do not have to fully fund your account for this strategy. For example, if your market maker offers leverage of 1:10, you need deposit only 10% of equity to maintain sufficient margin for the maximum position size that the program will establish during its lifetime. (This 10% does not take into account that you have to make provisions for realized and unrealized losses of the strategy that may be incurred. If the strategy can lose 2%, then collateral must include a safety margin of an additional 2%. And, finally, there is a contingency reserve of another 2% for unforeseen slippage.)

Constraints:

Maximum exposure for the strategy: 1 times equity

ExposureFactor: 2% annualized return

Calmar Ratio: 1 (100% drawdown relative to annualized return)

Market-Maker Leverage Factor: 1:10

Allocation:

Return Target of Strategy: 2%

Maximum Drawdown: 2%

Maximum Exposure: 1 times equity

Margin Capital: 10% of equity

Draw-down Reserve: 2% of equity

Contingency Reserve: 2%

Free Unallocated Capital: 86%

This investor has unallocated assets of 86% of capital which can be deployed to additional trading strategies. (In choosing additional strategies an important criterion, of course, is non-correlation with existing strategies.)

Choosing your asset classes

In designing your portfolio of investment strategies you have to be aware that margin requirements differ across asset classes. For equity markets, margin requirements are high—typically market makers do not offer a lot of leverage. This implies that any return generated has to be financed by a great deal of capital, using up a large portion of the underlying equity.

OLSEN

The Torque measure is useful in allocating across asset classes. Ideally you want to choose asset classes with high Torque factors (lowest margin requirements) in order to achieve broad diversification among strategies with a maximum amount of capital.

Why does Olsen specialize in currencies?

Every investor and every corporation has currency exposure. Instead of passively accepting this risk, *why not actively manage it?* Our currency products provide portfolio managers, institutional traders, and corporate treasurers with a systematic alternative to reduce risk. We see this as a growth market.

Currencies have an extremely high Torque factor. FX market makers offer their customers high leverage, so strategies can be funded with little capital. Institutional investors are treated even better: they can fund their strategies on the basis of credit alone, without having to set aside capital.

This funding advantage makes currency investments an ideal way to enhance returns in the context of a larger portfolio strategy. Professional investors who cannot invest on credit may still take advantage of a *partially funded account*, which allows them to maximize return per unit of invested capital and to diversify among multiple strategies.

Managing your own expectations

Our basic recommendation is to flop your perception of the opportunity set: ask first, *What risk am I prepared to bear?*, and then *How much risk can I afford?* If you set the limit at a 3% maximum drawdown, *then and only then* calculate the return you can buy at this limit.

As usual, there are other important real-world considerations, such as the maximum loss you can tolerate in one day, one week, etc. (Regardless of long-term strategy, a pension-fund manager who loses 2% in one day will likely be out of a job.) And maximum exposure—where, again, the ExposureFactor can guide you, especially in the case of investment vehicles where leverage is forbidden.

The goal is to actively manage risk so as to generate a higher-capacity rate of return.

Enhanced Risk Budgeting:

$$\text{potential loss} \times \text{leverage} = \text{true risk}$$

OLSEN

Olsen Ltd is a research and development company and investment manager based in Zurich, Switzerland. Olsen has yielded practical applications and managed accounts and third-party products, investing in currencies as a separate asset class or as an overlay to an existing currency exposure.

Copyright © 2009 by Olsen Ltd

All rights reserved. No part of this work may be reproduced or transmitted in any form by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, without permission in writing from the publisher.

Olsen Ltd
Seefeldstrasse 233
8008 Zürich, Switzerland

Phone +41 44 386 4848
Fax +41 44 422 2282

www.olsen.ch