THE LONG AND SHORT ON LONG-SHORT

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Long-short is an active portfolio construction discipline that balances long positions in high-expected return securities and short positions in low-expected return securities of approximately equal value and market sensitivity. Because overall market moves are "canceled out" by the movements of the securities held long and sold short, the portfolio is "neutralized" or immunized against changes in the value of the underlying market; it has zero systematic, or beta, risk. The portfolio's performance will reflect the return and risk of security selection. If the selected securities perform as expected, the long-short positions will provide a positive return, whether the market rises or falls.

Long-short construction offers advantages over long-only, advantages that should translate into improved performance for long-short portfolios vis-à-vis long-only constructs. Long-short will be especially advantageous if, as many market observers believe, candidates for short sale are less efficiently priced than candidates for purchase. But the major benefits of long-short do not depend on such greater inefficiency on the short side.

In freeing the portfolio from the underlying market's systematic risk, long-short construction with integrated optimization also frees it from constraints typically imposed on long-only portfolio management. For example, a long-short portfolio can take full advantage of insights on overpriced securities, because its ability to underweight a security is not constrained by the security's weight in the underlying market, as is long-only's. Furthermore, properly optimized long-short portfolios can use offsetting long and short positions to control portfolio residual risk; long-only portfolios must seek to control residual risk by balancing over- and underweighting relative to the underlying market's weights.

Finally, long-short construction enables the investor to separate the return and risk of security selection from the return and risk of the equity market, because the return to a market-neutral portfolio is independent of the equity asset class underlying it. The investor can recapture the equity class return by purchasing stock index futures. The performance of
the long-plus-short-plus-futures, or "equitized," port-
folio will reflect the underlying market's return and
risk plus the return and risk of the long-short portfo-
lio. Alternatively, the investor can purchase other
derivatives, thus transporting the return from stock
selection to other desired asset classes.

Compared with long-only portfolios, then, long-short portfolios offer enhanced flexibility not only in
the control of risk and pursuit of return, but also in
asset allocation. These benefits, of course, must be
weighed against the costs of long-short. Long-short is
often perceived as much costlier and riskier than long-
only, but it is inherently neither. Long-short does expe-
rience some incremental costs relative to long-only;
these include the trading costs incurred in meeting
the demands of long-short balancing, margin require-
ments, and uptick rules, as well as the financial interme-
tiation costs of borrowing shares to sell short. In general, these
costs are not large and should not outweigh the flexibil-
ity benefits of long-short construction.

BUILDING A
MARKET-NEUTRAL PORTFOLIO

Exhibit 1 illustrates the deployment of capital in a
market-neutral implementation of long-short. It
presupposes that the investor has already selected the
securities to be held long and sold short. The stock
valuation and selection process may be traditional or
quantitative, but the outcome should be some listing or
ranking of "winners," or underpriced stocks expected
to perform well, and "losers," or overpriced stocks
expected to perform poorly. The winners are to be
considered for purchase and the losers for short sale.2

Federal Reserve Board regulations require
that short positions be housed in a margin account at
a brokerage firm; the broker will clear all trades and
arrange to borrow the shares to be sold short. Exhibit
1 assumes the investor deposits $10 million with this
corporal prime broker. Because Federal Reserve
Board Regulation T requires at least 50% initial
collateralization of margined positions, the investor
could use this $10 million of capital to collateralize
up to $20 million of securities positions — $10
million of longs and $10 million of shorts.3

In practice, however, the investor will retain
some of the initial capital as a "liquidity buffer" to
meet marks to market on the short positions. Exhibit
1 assumes the investor uses only $9 million of the
initial $10 million to purchase the desired long posi-
tions, which are held at the prime broker. The
broker arranges to borrow the $9 million in securi-
ties to be sold short. Upon their sale, the broker
provides the $9 million in proceeds to the securities' lenders as collateral for the shares borrowed.4

The securities' lenders require full collateral-
ization of the shares they lent. If those shares increase
in value, the borrower (our long-short investor) will
have to arrange payment to the lenders so collateral
continues to match the value of the shares. If the
borrowed shares fall in value, the money will flow in the opposite direction, with the lenders releasing funds to the investor's prime broker account. A liquidity buffer equal to 10% of the account's capital ($1 million at the outset of our example) is generally sufficient to meet these daily marks to market.5

In Exhibit 1, then, the long-short portfolio consists of $9 million in shares held long and $9 million in shares sold short. The portfolio's return will reflect the performances of these long and short positions.

It will also benefit from a cash return stemming from two sources. First, the account will earn interest on the cash held as a liquidity buffer, at approximately the prevailing short-term rate. Second, the $9 million in proceeds from the short sales, posted as collateral with the securities lenders, will earn interest. The lenders will retain a small portion of this interest as a securities lending fee, and the prime broker will retain a portion to cover expenses and provide some profit: the investor's account will receive the rest.6 Although the exact distribution is a matter for negotiation, we will assume the amount rebated to the investor (the "short rebate") approximates the short-term rate.7

Exhibit 2 illustrates the hypothetical one-period performance of the long-short portfolio, assuming bull market and bear market scenarios. The bull market scenario assumes the market (as proxied by the S&P 500) rises 30% over the period, while the long positions rise by 33% and the shorts by only 27%. The long positions are worth $11.97 million at the end of the period, for a gain of $2.97 million, and the shorts are worth $11.43 million, for a loss of $2.43 million.

The long-short portion of the portfolio has a net gain of $0.54 million. This amounts to 6% of the $9 million invested (equal to the spread between the long and short returns), or 5.4% of the initial $10 million.8 In addition, the portfolio receives a short rebate of 5% of the short sale proceeds ($0.45 million) and 5% interest on the liquidity buffer (equal to $0.05 million), for a "cash" return of $0.5 million, or 5% of the initial $10 million. Overall, the portfolio

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<table>
<thead>
<tr>
<th>BULL MARKET</th>
<th>BEAR MARKET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Mid Account</td>
<td><strong>1.</strong> Mid Account</td>
</tr>
<tr>
<td>$9 Long</td>
<td>$9 Long</td>
</tr>
<tr>
<td>$1 Cash</td>
<td>$1 Cash</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>S&amp;P 500</td>
</tr>
<tr>
<td><strong>3a.</strong> Longs</td>
<td><strong>3a.</strong> Longs</td>
</tr>
<tr>
<td>Value: $11.97</td>
<td>Value: $11.97</td>
</tr>
<tr>
<td>Gain: $2.97</td>
<td>Gain: $2.97</td>
</tr>
<tr>
<td><strong>3b.</strong> Shorts</td>
<td><strong>3b.</strong> Shorts</td>
</tr>
<tr>
<td>Value: $11.43</td>
<td>Value: $11.43</td>
</tr>
<tr>
<td>Gain: $0.45</td>
<td>Gain: $0.45</td>
</tr>
<tr>
<td><strong>4.</strong> Spread = 33% - 27% = 6%</td>
<td><strong>4.</strong> Spread = 12% - 8% = 4%</td>
</tr>
<tr>
<td><strong>5.</strong></td>
<td><strong>5.</strong></td>
</tr>
<tr>
<td>Return = +10.4%</td>
<td>Return = +10.4%</td>
</tr>
<tr>
<td>Value = $11.04</td>
<td>Value = $11.04</td>
</tr>
<tr>
<td>Gain = $1.04</td>
<td>Gain = $1.04</td>
</tr>
</tbody>
</table>

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increases in value from $10 to $11.04 million, for a net gain of $1.04 million and a 10.46% return.

The bear market scenario assumes the market falls by 15%, with the long positions falling by 12% and the short positions by 18%. This provides the same return spread as in the bull market scenario. The decline in value of the longs translates into a loss of $1.08 million, while the decline in value of the shorts translates into a gain of $1.62 million. The net gain for the long-short portfolio is, again, $0.54 million, exactly the same result as when the market rose by 30%. Cash returns are the same in both market environments, so overall portfolio results are the same.

The return to the basic market-neutral portfolio, then, consists of three components—dividends on the liquid interest in the liquidity buffer, the rebate from the short sale proceeds, and the return spread between the aggregate long and aggregate short positions in the long-short portfolio. Because the aggregate long positions and the aggregate short positions are of approximately equal value and have equal sensitivity to the underlying market, those portions of their returns that reflect overall market movements (their returns to beta) cancel out. All that is left is the return spread. The return to the long-short portfolio is thus a true reflection of the success of the manager’s stock selection skills.

A QUESTION OF EFFICIENCY

Exhibit 2 assumes symmetric market-relative returns for the long and short positions; that is, in both bull and bear market environments, the longs were assumed to outperform the market by 3% while the shorts were assumed to underperform by 3%. But there are reasons to believe that short-sale candidates—the most overpriced stocks, which offer the least expected returns—may be more common or more mispriced than the underpriced stocks that constitute the candidates for purchase. In that case, one might expect higher excess returns from short positions than from long positions.

Stocks may be overpriced, and overpricing may continue over some non-trivial period, because investors tend toward overoptimism. Several theories and some evidence suggest that this may be the case. Bubbles and fads, for example, may cause investors to bid prices up beyond reasonable valuations (see, e.g., Camerer [1999]). Company practices may also encourage overpricing. Many companies, for example, are eager to publicize good news in a timely manner, but may delay releasing bad news or attempt to disguise it via window-dressing (or, more rarely, common actual fraud). Stock prices may thus reflect good news more quickly and unambiguously than bad news.

Overpricing may also exist because brokers and analysts favor buy over sell recommendations, and focus research efforts on purchase rather than sale candidates. Such bias may reflect an economic rationale: Buy recommendations may elicit more commissions, as all customers are potential purchasers, while commissions from sales will come primarily from customers who already own the stock. Bias may reflect political issues: Publishing negative opinions about a company may jeopardize investment banking relationships and even threaten analyst job security (Reagan [1993]). And it may reflect underlying analyses: Evidence suggests, for example, that brokers may produce overly optimistic earnings estimates, especially for firms with the least stable earnings histories (Huberts and Fuller [1995]). Whatever is in source, the greater the uncertainty about “true” value, the more overpricing is likely. This is because increasing uncertainty leads to increasing divergence of investor opinions. And those investors with the most optimistic opinions will become the buyers, setting security prices (see Miller [1990]). Theoretically, of course, short-sellers should act to keep shares from becoming overpriced; if overly optimistic investors bid up share prices beyond what other investors consider reasonable, those investors should tell short, reducing upward pressure on prices. But short-selling is certainly not as unrestricted as buying long.

Share borrowability and uptick rules make short-selling more difficult than going long. Short-selling is also costlier, because investors do not receive full interest on the proceeds from short sales (and retail investors rarely receive any of the interest). Short-selling may also be legally or contractually restricted for some investors (such as mutual funds, which can take only limited short positions). Other investors may eschew it because they consider it too speculative or morally objectionable.

In fact, short sales have historically accounted for a very small percentage of shares outstanding; short interest on the NYSE has risen only slightly in recent years, from 0.23% at year-end 1980 to 1.32% at year-end 1998. And only a portion of this interest is motivated by security selection; most short sales are undertaken by dealers supplying liquidity or inventories shorting for risk-hedging, tax-deferral, or arbitrage purposes.

In a market in which prices tend to reflect overoptimism on the part of investors and in which
short-selling is restricted de facto and de jure, inefficiencies may be concentrated in overpriced stocks. Short sales of the most overpriced stocks may therefore offer higher positive returns than long purchases of underpriced stocks.

Nevertheless, the benefits of long-short are not dependent upon the existence of greater inefficiencies in overpriced than in underpriced stocks. Rather, they flow from the increased flexibility allowed by short-selling within the context of the long-short portfolio construction process.

**BENEFITS OF LONG-SHORT**

Long-short portfolio construction can offer real advantages over long-only construction in terms of both pursuit of return and control of risk. These benefits stem primarily from the enhanced implementation of investment insights afforded by the removal of index constraints in an integrated optimization of long-short portfolios.

Integrated optimization releases the long-short portfolio from the constraints imposed by an underlying index on the construction of long-only portfolios. Consider, for example, a long-only portfolio whose selection universe is a given market index, and whose performance is measured against that index. By holding every name in the index in proportion to its weight in the index, the portfolio will achieve a return, and a risk level, equivalent to the benchmark. If it expects to achieve a return over and above that of the underlying market index (an excess return), it must be able to overweight, relative to their market index weights, securities that are expected to earn above-average returns, and underweight those expected to earn below-average returns.

Underweighting or overweighting relative to the underlying benchmark, necessary to produce excess return, also introduce benchmark-relative, or residual, risk. The more the portfolio departs from underlying benchmark weights, the greater the probability that its return will not match the return on the benchmark. Control of portfolio excess return and residual risk requires control of underweights and overweightings relative to the benchmark.

Benchmark weights thus have substantial influence on the portfolio’s allocation of capital and can constrain the implementation of investment insights.

Consider a stock that constitutes 5% of the benchmark’s weight. What if the investor expects the stock to offer an above-benchmark return? The investor will want to overweight the stock in the portfolio. Establishing an overweight, however, will require investing more than 5% of the portfolio’s capital, a 1 percentage point overweight, for instance, requires a 6% portfolio position. Furthermore, as the overweighting represents a departure from the benchmark weight, it introduces residual risk. The portfolio’s ability to take an active position in the stock will be constrained both by allocation requirements and by risk considerations. Somewhat counter-intuitively, the portfolio may also have to allocate capital to limit stock underweights. Say the investor wants to underweight a stock that is expected to provide a below-benchmark return. If the stock constitutes 5% of the underlying index, as in the example above, establishing a 1 percentage point portfolio underweight requires holding a 4% portfolio position in the security.

Of course, if the security represents a smaller-capitalization company, less capital is required to establish either an overweight or an underweight, but the portfolio’s ability to underweight a small-capitalization company may be severely restricted. Consider, for example, a stock that makes up 0.1% of the index. The investor can establish a 1 percentage point overweight of this stock by holding a 1.1% portfolio position. Little capital is needed to establish an underweight; the maximum underweight the portfolio can attain is only 0.1% achieved by not holding the stock at all. The latter constraint, however, may become binding if the investor thinks the stock will perform poorly and want to underweight it significantly. The maximum attainable underweight for this stock is equivalent to saying that the portfolio cannot hold more than a 0.1% overweight, a stock that is expected to perform well.

More than a few discussions of long-short portfolios have assumed an identity between an index-constrained long-only portfolio and the long and short portions of a long-short portfolio. In this view, the aggregate longs and the aggregate shorts of long-short construct two separate, index-constrained portfolios. By definition, neither can offer advantages over a long-only portfolio. Together, they may offer diversification benefits over long-only if the return on the long portfolio in excess of the market return and the excess return on the short portfolio are less than perfectly correlated. With integrated optimization, however, a long-short portfolio is not constrained by index weights. Once an underlying index has been used to determine the systematic risks of the candidate securities, its role in long-short construction is effectively over. The offsetting market sensitivities of the aggregate long and aggregate short positions eliminate market sensitivity and the need to consider index weightings in establish-
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The portfolio is not constrained to moving away from or toward market weights in order to pursue return or control risk. Rather, it can allocate its capital without regard to the securities' weights in the underlying market.

To establish a 1% "overweight" or "underweight," it merely has to allocate 1% of its capital long or allocate 1% of its capital short. And because it can short securities, the long-short portfolio can "underweight" a security by as much as investment insights (and risk considerations) dictate. Negative opinions can thus be more freely and fully reflected in long-short than in long-only.

Furthermore, in an integrated optimization, selection of the securities to be held long is determined simultaneously with selection of the securities to be sold short. The result is a single long-short portfolio, not one long portfolio and one short portfolio. Just as one cannot attribute the qualities of water, its wetness, say, to its hydrogen or oxygen components separately, one cannot reasonably dissect the performance of an integrated long-short strategy into one element attributable to long positions alone and another attributable to short positions alone. Only jointly do the long and short positions of long-short define the strategy. Long and short excess returns, or "alphas," are thus meaningless concepts.

Rather than being measurable as long and short performance in excess of an underlying benchmark, the performance of the equity portion of the long-short portfolio is measurable as the overall return on the long and short positions — or the spread between the longs and shorts — relative to their risk. Compared with the excess return/residual risk of long-only management, this performance should be enhanced by the elimination of index constraints, which allows the long-short portfolio increased flexibility to implement investment insights, both long and short.

EQUITIZING LONG-SHORT

The return enhancement afforded by long-short construction reflects the removal of the constraint an underlying index imposes on long-only portfolio construction. Of course, the basic, market-neutral long-short construction also eliminates exposure to the underlying index's risk — and its return. Market return, and risk, can be added back by purchasing stock index futures contracts in an amount equal to the invested capital. The return to the resulting long-short-plus-futures, or equitized, portfolio will then reflect the market return (the change in the price of the futures contracts plus interest) plus the spread on the long-short portfolio. The equitized portfolio will retain the flexibility benefits of long-short construction, reflected in the long-short spread, while also participating in overall market movements.

Exhibit 3 illustrates the deployment of capital

EXHIBIT 3 EQUITIZED LONG-SHORT DEPLOYMENT OF CAPITAL

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EXHIBIT 4
EQUITIZED LONG-SHORT HYPOTHETICAL PERFORMANCE: BULL AND BEAR MARKETS

**BULL MARKET**

1. **Sole Account**
   - **Sell Short:** 5,900 S&P 500
   - **Proceeds:** $66,440
   - **Pledged as Collateral:**

2. **Short Mark:**
   - **Margins:** Value $11,430
   - **Gain:** $2,430

3. **Longs**
   - **+5% Value:** $13,970
   - **Gain:** $2,970

4. **Spread:**
   - **33%-27%**
   - **Gain:** $6,540

5. **Shorts**
   - **+5% Value:** $6,450

6. **Interest on Futures Margin and Cash:**
   - **+5% Gain:** $6,650

7. **Return:**
   - **+35.4% Value:** $12,540
   - **Gain:** $2,540

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**BEAR MARKET**

1. **Sole Account**
   - **Sell Short:** 5,900 S&P 500
   - **Proceeds:** $66,440
   - **Pledged as Collateral:**

2. **Short Mark:**
   - **Margins:** Value $7,380
   - **Gain:** $1,430

3. **Longs**
   - **-12% Value:** $7,080
   - **Loss:** $2,080

4. **Spread:**
   - **-12%-14%**
   - **Gain:** $1,540

5. **Shorts**
   - **+5% Value:** $6,450

6. **Interest on Futures Margin and Cash:**
   - **+5% Gain:** $6,650

7. **Return:**
   - **-9.6% Value:** $3,040
   - **Loss:** $6,960

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for equitized long-short portfolio construction. Note that the major difference between Exhibit 3 and Exhibit 1, other than the addition of the $10 million of stock index futures, is the size of the liquidity buffer. As noted, the liquidity buffer serves to meet marks to market on the short positions; when short positions rise in price, the lenders of the securities sold short need more collateral from the investor's account. With an equitized long-short strategy, however, an increase in the price of the short positions induced by a rise in the overall market should be accompanied by an increase in the price of the futures contracts held long. The marks to market on the futures can offset the marks to market on the shorts.

A smaller liquidity buffer therefore suffices to ensure that short positions will be fully collateralized at all times. Most of the freed-up capital, however, is used to start the futures position. Thus, in Exhibit 3, as in Exhibit 1, $9 million of the initial $10 million investment is assumed available for purchase of securities.

Exhibit 4 illustrates the performance of the equitized long-short portfolio in bull and bear market scenarios, using the same assumptions as Exhibit 2. Returns to the long-short portfolio are the same as in Exhibit 2. Cash returns are also the same, as the reduced interest from the smaller liquidity buffer is combined with the interest earned on the futures margin.

Total returns on the portfolios in Exhibits 2 and 4 differ markedly, however, and the entire difference is attributable to the performance of the overall market, which is reflected in the equitized but not the market-neutral portfolio. Because of its market exposure, the equitized portfolio does not behave the same in both bull and bear market scenarios; it is not market-neutral. Unlike the market-neutral portfolio, the equitized portfolio's overall return will be sensitive to market movements; it will also benefit fully, however, from the return spread on the long-short portfolio.
This result underlines one of the major bene-
fits of long-short — the “transportability” of the
return on the basic, market-neutral long-short port-
folio. In essence, the returns on the long-short port-
folio represent a return to security selection alone,
independent of the overall return to the equity
market from which the securities are selected. This
return, and all the benefits of long-short construc-
tion that it reflects, can be transported to other asset
classes through the use of derivatives. The equity-
ized long-short portfolio transports the return to the
equity asset class, adding the security selection return
(and its associated risk) to the equity market return
(and its risk). Other derivatives (for foreign equity,
for example) can be used to establish other asset
class returns.

The transportability of the long-short spread
has at least two implications for investment manage-
ment. First, it offers the investor the benefits of
being able to separate stock selection skills from asset
allocation decisions. The talents of an equity man-
ger particularly skilled in stock selection need no
longer be confined to an equity market allocation.
They can be transported to virtually any asset class
with established derivative markets.

Second, it implies that the identity of a long-
short portfolio is flexible. The basic market-neutral
construction offers a return (and risk) from security
selection on top of a cash return (represented by the
short rebate); portfolio performance in this case is
appropriately measured as the manager’s ability to
enhance a cash return (at the cost of added risk). When
the long-short portfolio is equitized, however, the secu-
rrv selection return and risk from the long-short port-
folio comes on top of an equity market return, and
portfolio performance is properly measured relative
to the equity index underlying the futures.

Furthermore, long-short is not in and of itself
an asset class. Asset class analyses and optimizations
should not treat long-short as a separate asset class
but as a member of a conventional asset class — cash,
equity, bonds — depending upon the long-short
portfolio’s particular implementation.

TRADING LONG-SHORT

The trading of long-short portfolios is more
complicated than that of long-only. First, the values
and market sensitivities of the aggregate long and
aggregate short positions must be kept in balance on
a real-time basis in order to ensure market neutrality.
Second, the account must meet Federal Reserve,
stock exchange, and individual broker initial and
maintenance margin requirements. Third, marks to
market on short (and, if present, futures) positions
must be satisfied.

In order to ensure overall portfolio neutrality
throughout a trading program, long and short trades
may be speeded up or slowed down relative to their
occurrence in a typical long-only portfolio. Because
short sales are more problematic and more likely to
experience delays that would lead to long-short
imbalances, for example, some long-short managers
start off with their short trades before beginning their
long trading programs. Should imbalances occur,
securities may have to be bought or sold long or sold
short or covered until balance is restored. Derivatives
can also be used to correct temporary imbalances.

At all times, at its establishment and through-
out its life, a long-short portfolio is subject to
margin requirements, as in short positions represent
borrowed shares. As noted earlier, under Federal
Reserve Board Regulation T, establishment of a
short position requires at least 50% margin. Once
established, short positions are subject to less strin-
gent maintenance margins, set by the exchanges or
individual brokers. New York Stock Exchange Rule
43.1, for example, requires collateral equal to 25% of
the value of long position held in a margin account,
and 30% or more of the value of the short posi-
tions.12 In the interests of self-protection, brokers
usually require at least 30% collateralization of all
positions in margin accounts.

An account that falls below maintenance
margin requirements will have to decrease its securi-
ties exposure by covering shorts or selling longs or
increase its capital by adding cash. An account that
meets maintenance margin requirements but not the
initial margin requirement is restricted in the sense
that it can make no transactions that would cause
further reduction in margin, such as shorting addi-
tional shares or withdrawing cash.

Exhibits 5 through 7 illustrate how mainte-
nance of long-short balance, margin requirements,
and marks to market can require portfolio trading.
Exhibit 5 shows the effects on a $10 million market-
neutral (unhedged) portfolio when both long and
short positions either fall in value by 50% or rise in
value by 100%. As the outset, the long-short portfo-
ilio easily meets initial margin requirements, as long
and short positions totaling $18 million ($7 million
long plus $9 million short) are collateralized by $10
million in equity (the longs plus the cash in the
liquidity buffer), for a margin of 55.6%.
### EXHIBIT 5
**MARKET-NEUTRAL LONG-SHORT: TRADING REQUIRED WHEN LONG AND SHORT POSITIONS FALL 50% OR RISE 100%**

<table>
<thead>
<tr>
<th>Initial Values</th>
<th>Return</th>
<th>Gain/Loss</th>
<th>New Values</th>
<th>Action</th>
<th>After-Action Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall or Rise</td>
<td>Fall</td>
<td>Rise</td>
<td>Fall</td>
<td>Fall</td>
<td>Rise</td>
</tr>
<tr>
<td>Long $9</td>
<td>-50%</td>
<td>+100%</td>
<td>-$4.5</td>
<td>$4.5</td>
<td>$18</td>
</tr>
<tr>
<td>Short $9</td>
<td>-50%</td>
<td>+100%</td>
<td>+$4.5</td>
<td>Owed</td>
<td>Owe $4.5 by Lenders</td>
</tr>
<tr>
<td>Cash $1</td>
<td></td>
<td></td>
<td>-$8</td>
<td>$5.5</td>
<td></td>
</tr>
<tr>
<td>Equity $0.0</td>
<td></td>
<td></td>
<td>$10</td>
<td>$10</td>
<td></td>
</tr>
<tr>
<td>Margin 55.6%</td>
<td></td>
<td></td>
<td>111.1%</td>
<td>27.8%</td>
<td></td>
</tr>
</tbody>
</table>

### EXHIBIT 6
**EQUITIZED LONG-SHORT: TRADING REQUIRED WHEN SECURITIES, LONG AND SHORT, AND FUTURES RISE 100%**

<table>
<thead>
<tr>
<th>Initial Values</th>
<th>Return</th>
<th>Gain/Loss</th>
<th>New Values</th>
<th>Action</th>
<th>After-Action Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall or Rise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long $9</td>
<td>+100%</td>
<td>+$5</td>
<td>$18</td>
<td></td>
<td>$18</td>
</tr>
<tr>
<td>Short $9</td>
<td>+100%</td>
<td>-$9</td>
<td>Owed $9</td>
<td>$18</td>
<td>$18</td>
</tr>
<tr>
<td>Cash $0.6</td>
<td></td>
<td></td>
<td>$1.6</td>
<td>$1.2</td>
<td>$1.2</td>
</tr>
<tr>
<td>Equity $9.6</td>
<td></td>
<td></td>
<td>$19.6</td>
<td>$19.2</td>
<td>$19.2</td>
</tr>
<tr>
<td>Margin 53.3%</td>
<td></td>
<td></td>
<td>54.4%</td>
<td>53.3%</td>
<td>53.3%</td>
</tr>
<tr>
<td>Futures $10 + $0.4</td>
<td>+100%</td>
<td>$10</td>
<td>Owed $10 on T-bills</td>
<td>$20 + $0.4</td>
<td>$20 + $0.8</td>
</tr>
</tbody>
</table>

### EXHIBIT 7
**2% LONG-SHORT SPREAD**

<table>
<thead>
<tr>
<th>Initial Values</th>
<th>Return</th>
<th>Gain/Loss</th>
<th>New Values</th>
<th>Action</th>
<th>After-Action Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall or Rise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long $9</td>
<td>+4%</td>
<td>+$0.36</td>
<td>$9.36</td>
<td>Sell</td>
<td>$9.162</td>
</tr>
<tr>
<td>Short $9</td>
<td>+2%</td>
<td>-0.18</td>
<td>Owed $0.18</td>
<td>$9.18</td>
<td>$9.162</td>
</tr>
<tr>
<td>Cash $1</td>
<td></td>
<td></td>
<td>$0.82</td>
<td>Cover</td>
<td>$1.018</td>
</tr>
<tr>
<td>Equity $10</td>
<td></td>
<td></td>
<td>$10.18</td>
<td>Cover</td>
<td>$10.18</td>
</tr>
<tr>
<td>Margin 55.6%</td>
<td></td>
<td></td>
<td>54.9%</td>
<td></td>
<td>55.6%</td>
</tr>
</tbody>
</table>
A 50% decline in the values of the longs and shorts results in the securities' lenders being overcollateralized; they will have to transfer $4.5 million to the long-short account. The liquidity buffer will then be larger than needed. The investor can buy an additional $4.5 million in securities with the additional $4.5 million, restoring the account to its initial values.

A 100% increase in the values of the longs and shorts results, by contrast, in the securities' lenders being undercollateralized; they are short only $9 million in cash proceeds from the initial short sales, but the securities they lent are now worth $18 million. The long-short account must transfer an additional $9 million to the securities' lenders. Taking this sum from the liquidity buffer, however, would result in a deficit of $8 million and leave the overall portfolio undermargined, by brokers' standards, at 27.8%. In order to meet the marks to market on the short positions and reestablish maintenance margin, the investor can sell $9 million worth of securities held long and cover $9 million worth of securities sold short. This will restore the portfolio to its initial starting values.\textsuperscript{13}

Exhibit 6 illustrates the advantages, in terms of trading activity, of equalizing a long-short strategy by purchasing a $10 million position in stock index futures, using $0.4 million of Treasury bills as margin; the initial liquidity buffer is $0.6 million. If, as assumed, the long and short positions as well as the futures position now double in value, the long-short account will owe the securities' lenders $9 million on the marks to market on the shorts, but it will also receive a $10 million positive mark to market on the futures. The securities' lenders can be paid out of this $10 million, with $1 million left over. However, the futures positions, worth double their initial value, are now under-margined by $0.4 million (assuming futures margin dollar requirements double or percentage margins stay the same). Purchasing an additional $0.4 million in T-bills will meet the futures margin and restore the initial long-short portfolio margin. No securities trades are required.

The behavior of the long, short, and futures values in Exhibits 5 and 6 is consistent with the effects of underlying market movements; that is, the equivalent systematic risks of the long and short positions would lead to equivalent value changes in the absence of residual, or non-systematic, risk, and the futures positions would be expected to perform in line with the market underlying the behavior of the long and short positions. We can infer that, even though the return on a basic long-short portfolio is neutral to overall market movements, market movements can have implications for the implementation of long-short strategies; in particular, they may necessitate trading activity.

Of course, one is unlikely to experience market movements of the magnitudes illustrated. More likely market movements would lead to fewer violations of margin requirements and less trading. With a 5% market rise, for example, the initial long and short positions in Exhibit 1 would be expected to increase to $9.45 million, calling for a payment of $0.45 million to the securities' lenders and a reduction in the liquidity buffer to $0.55 million. There would be no violation of margin (margin would be 52.9%), but restoring the liquidity buffer would require selling $0.45 million worth of long positions and covering $0.45 million worth of shorts. Market declines would be even less problematic. A market decline of 20%, in line with what occurred on Black Monday 1987, would lead to a decline in the value of the long and short positions from $9 to $7.2 million and the liquidity buffer's receipt of $1.8 million from the securities' lenders.

Exhibits 5 and 6 assume that returns to the long and short positions are equal. If it performs as expected, however, the long-short portfolio will experience a positive spread between the returns on the securities held long and the returns on the securities sold short, whether the market rises or falls. Exhibit 7 assumes a 2 percentage point return spread between the longs and the shorts. The long positions rise 4% and the shorts 2%. Although these movements lead to no margin violation, payment of the $0.18 million in additional collateral owed the securities' lenders reduces the liquidity buffer below 10% of equity; furthermore, long and short positions are no longer balanced. By selling $0.198 million in long positions and covering $0.018 million worth of shorts, the investor can restore the liquidity buffer to 10% and rebalance the portfolio. Differential returns on long and short positions, then, even if favorable to overall portfolio performance, can induce some trading activity.

EVALUATING LONG-SHORT

Long-short construction maximizes the implementation of potentially valuable investment insights via the elimination of index constraints. Long-short thus offers advantages over long-only. But it also involves complications not encountered
by long-only management, many of which are relat-
ed to the use of short sales.

In choosing a prime broker to act as account

manager can submit a package of trades to a broker
to ensure the broker's capability and creditworthiness.
The prime broker will clear all trades for the long-
short portfolio; although the long-short investor can
execute trades with other brokers, the prime broker
usually assesses a "ticket charge" on such "away"
trades to cover the costs of bookkeeping. The prime
broker will also arrange to borrow stock for short-
ing. In this capacity, the prime broker must be
advised of possible short sales in order to ensure that
the shares are available.

The vast majority of shares are available for
borrowing, but borrowability may be a problem for
some shares, particularly those of small-capitalization
companies. Harder-to-borrow shares may also pose
problems even after they have been obtained for short
sale. This is because shares sold short are subject to
recall by the lender at any time. In most cases, the
prime broker will be able to find alternative lenders
for the securities subject to recall, but if these are not
available, the long-short investor will be subject to
"buy-in" and have to cover the short positions.1

Long-short also incurs costs not encountered by
long-only, again primarily because of shorting.
The financial intermediation cost of borrowing
shorts, which includes the costs associated with
securing and providing lendable stocks, averages 25
to 30 basis points (although harder-to-borrow names
will cost more). It is incurred as a "haircut" on the
short rebate received from the interest earned on the
short sale proceeds.

With equitized long-short, there may be
mismatches between the short rebate, which is based
on overnight rates, and the futures contracts, which
are priced off an equivalent-maturity LIBOR. Such
mismatches can usually be mitigated, however, by
negotiating term deals with the prime broker.

Finally, short sales are subject to various uptick
rules. Securities and Exchange Commission Rule
10a-1, for example, states that exchange-traded shares
may be shorted only at a price that is higher than the
last trade price ("uptick") or the same as the last trade
price if that price is higher than the previous price
("zero-plus-tick"). Uptick rules vary across the differ-
ent exchanges and proprietary trading systems.

Uptick rules can delay, or in some cases prevent,
execution of short sales, resulting in oppor-
tunity costs. Tick tests can be circumvented, but
doing so is expensive. For example, the long-short

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leverage is employed in the former and not in the latter. If one considers management fees per dollar of securities positions, rather than per dollar of capital, there should not be much difference between long-short and long-only.

Furthermore, there can be a substantial "hidden passive" element in long-only portfolios. Only those portions of a long-only portfolio that represent overweightings or underweightings relative to the underlying market or other benchmark index are truly active; the remaining portion of the portfolio constitutes index weightings, which are essentially passive. To the extent the long-only manager's fee is based on total investments, rather than just the active investments, the fee per active dollar managed may be much higher for long-only than for long-short.

Finally, long-short is often portrayed as inherently riskier than long-only. This view in part reflects a concern for potentially unlimited losses on short positions. While it is true that the risk of a short position is theoretically unlimited because there is no bound on a rise in the price of the shorted security, this source of risk is considerably mitigated in practice. It is unlikely, for example, that the prices of all the securities sold short in a long-short portfolio will rise dramatically at the same time, with no offsetting increases in the prices of the securities held long. Also, the trading imperatives of long-short, which call for keeping dollar amounts of longs and shorts roughly equalized on an ongoing basis, will tend to limit short-side losses, because short positions are covered at their prices rise. And if a gap-up in the price of an individual security does not afford the opportunity to cover, the overall portfolio will still be protected, provided it is well diversified.

A long-short portfolio will incur more residual risk than a comparable long-only portfolio to the extent it engages in leverage and/or takes more active positions. A long-short portfolio that takes full advantage of the leverage available to it will have at risk roughly double the amount of assets invested compared with a long-only portfolio. And because it is not constrained by index weights, a long-short portfolio may take larger positions in securities with higher (and lower) expected returns compared with a long-only portfolio. But both the degree of leverage and the "stickiness" of the long-short portfolio are within the control of the investor.

It is ultimately the investor who decides the long-short portfolio's level of residual risk. As noted above, given an initial $10 million, the investor may choose to invest only $5 million long and sell $5 million short, in which case the amount at risk in securities will be identical to that of a $10 million long-only investment. And the investor will determine the stickiness of the positions taken by selecting the desired level of portfolio residual risk. With integrated optimization, long-short selections will be made with a view to maximizing expected return at the desired level of risk; risk will not be incurred without the expectation of a commensurate return. Given the added flexibility it affords in the implementation of investment insights, long-short portfolio construction should be able to improve upon the excess returns available from long-only construction based on the same set of insights, whatever the risk level chosen.

In summary, although long-short is often perceived and portrayed as much costlier and much riskier than long-only, it is inherently neither. Much of the incremental cost and risk is either largely dependent on the amount of leverage employed (transaction costs, management fees, and risk) or conceivably via optimization (security selection risk). Those costs and risks that are not—including the financial intermediation costs of borrowing shares to short; the trading costs incurred to meet long-short balancing, margin requirements, and uptick rules; and the risks of unlimited losses on short positions—do not invalidate the viability of long-short strategies.

Neither should some long-standing prejudices against short-selling. Selling short is not "bad for the economy" or "un-American," as some investors have maintained. In fact, no less a scholar than William Sharpe [1991] has noted, in his Nobel laureate address, that shorting can increase market efficiency and overall economic welfare by allowing for the full expression of negative as well as positive investment opinions.

Nor are long-short portfolios inherently "inscrutable" in an ERISA sense. Appropriately constructed long-short portfolios, with long and short positions used to offset market risk and optimization used to control residual risk, are fully consistent with the prudence and diversification requirements of ERISA.

A meaningful evaluation of long-short calls for an objective balancing of the real costs against the real benefits. Those benefits may reflect greater efficiencies on the short side of the market but are not dependent on them. The benefits arise from the added flexibility that long-short affords in control of risk and pursuit of return, via the elimination of index constraints, and in asset allocation, via the liberation of security selection return from the
underlying equity class return.

Do the benefits outweigh the costs? The

Rewards to a long-short portfolio, like those to any

active strategy, will depend ultimately upon the

insights that underlie its security selections. Good

insights will yield good results, whether to a long-

short or long-only strategy. Long-short can enhance

sharpe ratios, however, by enhancing implementation

of the insights.

ENDNOTES

The author thanks Judith Radbill for her editorial assistance.

Balancing equal dollar amounts long and short is often
desired as a means to achieve market neutrality, and it is also
the optimal investment posture under certain conditions. For simplicity,
assuming the same constant correlation between all securities, long-
short balance is attained when the equation holds:

$$\frac{\rho}{\sigma} = \frac{\rho_{v}}{\sigma_{v}}$$

where \( \rho \) and \( \sigma \) are functions of the correlation, the number of securi-
ties, and the summation of the inverse of the \( \sigma \).

N = \frac{\sum_{i=1}^{n} \rho_{i} \sigma_{i}}{\sigma \rho\sigma

where \( \rho \) and \( \sigma \) are variances of security \( i \)'s return, and

The equation reduces to:

$$\frac{\rho}{\sigma} = \frac{\rho_{v}}{\sigma_{v}}$$

Non-symmetric distributions of security excess returns can lead to the
optimality of long equal to short dollar balances if the summation of the
excess returns is zero. The simplest condition for equal dollar
amounts is a symmetrical distribution of excess returns.

We do not mean to vitiate the importance of the selection
process. The ability to discriminate between stocks that will
perform well and stocks that will perform poorly is the subjective
ability of the investor or failure of any active portfolio. But it is also
beyond the scope of this article.

Regulation T would theoretically permit up to $10
million in total long positions (given the initial $10 million cap-
ital). The purchase of the additional $10 million long would require
a margin loan, which has tax implications for tax-exempt
investors (as discussed later).

Actually, the lenders of the securities said short will
require somewhat more than the proceeds from the short sale to collateral-
ize their loan, in order to protect themselves in the event that the
short-seller cannot meet daily mark to market. In practice, the
security's lender demand 100% of the value of the shares borrowed.
The price broker will arrange for this incremental collateral.

The liquidity buffer must also be available to reimburse
security's lender for dividends on borrowed stock. If the liquidity
buffer is inadequate to meet mark-to-market and dividend demands,
the long-short manager may have no long positions for short
settlement (receiving cash proceeds from the usual three-day settlement period), an expensive proposition, or borrow funds from
the broker, also an expensive option and one that may have tax
consequences for tax-exempt investors.

Retail investors generally do not receive interest on the
cash proceeds from short sales. Institutional investors generally do
receive a substantial portion of the interest on the cash proceeds, but
they do not technically have use of these proceeds. That is, they
cannot decide where to invest the proceeds, nor do the proceeds serve
as equity for determining the margin level of the investor's account at the
point of sale.

While the liquidity buffer must be invested at short-term
rates to ensure availability of funds, there is some room for negotia-
tion in the investment of the short-sale proceeds. Typically overnight
rates are pegged to Fed funds, LIBOR, or broker cash, but the funds
may be commingled for longer terms at higher rates. Investment for
longer terms will subject the proceeds to interest rate risk if the
performance benchmark is linked to a floating rate, but it may reduce
risk for an accumulated long-short portfolio (for instance, if the maturity
of the investment matches that of the stock index futures contracts
used as an equity on the portfolio).

The return spread of 8% is achieved in this example with
a long market exceeding the market return by 3 percentage points and a
short return falling by the market return by 5 percentage points. The
market return is provisioned solely for illustrations and is irrelevant to
the market speed (as will become evident later, in the discussion of
"inverted optimization"). Any pur of long and short returns where
the long outperform the shares by 8% provides the same return spread,
regardless of the market's return.

Such an argument is made by Michael (1993), who asserts that
(below his notation):

$$\frac{\rho}{\sigma} = \frac{\rho_{v}}{\sigma_{v}}$$

the return spread and residual risk of the long positions in long-
short equal the excess return and residual risk of the short positions. He
also implicitly asserts that the excess returns and residual risks of
the long and short positions equal the excess return and residual risk
of an index-committed long-only portfolio. That is:

$$\frac{\rho}{\sigma} = \frac{\rho_{v}}{\sigma_{v}}$$

From these assumptions he concludes that:

$$\frac{\rho}{\sigma} = \frac{\rho_{v}}{\sigma_{v}}$$

where \( \rho \) is the ratio of portfolio excess return to portfolio resid-
ual risk. Thus the long-short portfolio can offer no benefit over a
long-only portfolio except to the extent that the correlation between
the excess returns on its long and short positions is less than one. But such diversification benefits can be obtained by combining any
securities that are less than fully correlated,

A consideration in equalizing a portfolio is the use of a

We assume a futures margin of 406. If the futures margin
is currently set at $125 per contract, it will vary with changes in the market value.

$10.00 shorted shares selling at $50.00 or more, collateral
must equal the greater of $5.00 or 30% of share value, while for
shorted shares selling at less than $5.00, collateral must equal the
greater of $2.50 or share price.

Alternately, the investor could deposit additional
funds to meet the margin call.

Often also occasionally occur short a "short squeeze," in
which speculation buys up inelastic stock to force a buy-in at elevated
prices. This will mean a problem for dedicated short-seller's who take concentrated positions in liquid stocks than for a long-
short investor holding small positions diversified across many stocks.
