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Much recent discussion has focused on relaxing the long-only constraint in traditional long-only portfolios while keeping beta at one. Such a strategy may be appealing to investors who find typical hedge funds too risky or lacking transparency, but consider the alphas of their long-only portfolios a little too low. The increased interest in higher returns is probably attributable to the current low yield environment and to the heightened awareness of systematic risk in equity investing.

Several articles have demonstrated the benefits of relaxing the long-only constraint. Grinold and Kahn [2000]; Jacobs, Levy, and Starer [1998, 1999]; and Brush [1997] presented theoretical arguments on gains from relaxing the long-only constraint, while Clarke, de Silva, and Sapra [2004]; Litterman [2005]; and Martielli [2005] more or less quantified the benefits using simulated portfolios. Litterman's simulation, for example, showed that a strategy of 125% long and 25% short positions increased annual alpha from 4.7% to 6.5% for a similar tracking error of around 3.5%.

On theoretical grounds, their results and conclusions are hardly surprising. In a long-only portfolio, the most one can underweight a stock by not holding it is its weight in the benchmark. Most large cap benchmarks include many smaller stocks with negligible weights. For example, at the end of 2004, the bottom 100 names in the S&P500 accounted

for a total weight of only 2.89% in the index, or less than 3 bps per stock on average. This significantly constrains a portfolio manager's ability to take a meaningful bet against any of these stocks no matter how unattractive it may be. When the long-only constraint is relaxed, a manager can more efficiently allocate active risk, achieving a higher expected return for a given level of risk.

In the mean-variance framework, the benefits of short sales are fairly intuitive since relaxing any constraint lifts the efficient frontier. The practical argument in the past against short selling was largely based on trading cost and other expenses associated with short sales (Michaud [1993]). However, with trading cost substantially lower now than a decade ago, the argument for relaxing the long-only constraint in traditionally long-only portfolios has become stronger.

In this article, we examine another aspect of the issue that we believe has not been adequately addressed by either the proponents or opponents of short sales, namely, the impact of short sales on the downside risk of a portfolio. Downside risk is relevant because stock returns are positively skewed in that they are limited to -100% on the downside but unlimited on the upside. Common stock is essentially a call option on the underlying company's assets. The loss from a long position in a stock is capped at the amount invested in the stock, but the potential loss from shorting a stock is

unlimited. In fact, downside risk has always been associated with hedge funds. Agarwal and Naik [2000], for instance, show that a large number of equity-oriented hedge fund strategies exhibit significant left-tail risk, a risk that is ignored in the commonly used mean-variance framework.

It is worth pointing out that this asymmetry in distribution of returns is more pronounced for smaller stocks, which are also largely responsible for the gains from relaxing the long-only constraint. In other words, at the individual stock level one cannot completely circumvent the potential downside risk without foregoing the benefit from using short sales. However, in the context of a portfolio it is typical for a portfolio manager to offset short positions in small stocks with long positions in other small stocks, keeping the total market cap exposure of the portfolio close to that of the benchmark. So the exposures to outsized returns attributable to market cap can be neutralized in a size-constrained, net 100% long portfolio.

However, there may be other sources of exposure to skewness in a portfolio manager's alpha factors, which may result in predictable skewness in portfolio alphas. In this article, we evaluate two such factors, P/E and estimate revision, which are widely used in one form or another by investment managers. We look first at the correlation between these factors and skewness of returns at the stock level, and then in optimized portfolios. We compare alpha characteristics of long-only strategies to those with short sales.

We find that both high P/E and low P/E stocks exhibit significantly positive skewness in their returns. The alphas of a long-only optimized strategy that overweights low P/E stocks and underweights high P/E stocks exhibit small, insignificant positive skewness. Relaxing the long-only constraint does not have a clear effect on the skewness of alphas. The skewness coefficient of alphas slightly increases in the strategy with 120% long positions and 20% short positions (+120/-20), but decreases in the strategy with 150% long positions and 50% short positions (+150/-50).

Unlike P/E, we find that estimate revisions are correlated with skewness of returns. Specifically, stocks with negative earnings estimate revisions exhibit statistically significant positive skewness in their returns, while stocks with positive earnings estimate revisions do not. However, by the virtue of the law of large numbers, in a portfolio with tight constraints on risk exposures such skewness in

stock returns is largely diversified away. Although the alphas of estimate revision strategies that buy stocks with positive revisions and sell stocks with negative revisions are negatively skewed, the skewness is small and statistically insignificant. Furthermore, relaxing the long-only constraint does not have significant impact on the skewness of portfolio alphas. As in the P/E strategy, the skewness coefficient of portfolio alphas first increases then decreases as the amount of short sales increases.

Our main conclusion is that even though shorting a stock presents unlimited potential loss and even though a manager's short sale candidates may exhibit statistically significant positive skewness in their returns, in a risk-controlled diversified portfolio, the impact of short sales on the skewness of the portfolio's alpha distribution is very limited. Our findings provide additional support for relaxing the long-only constraint in the traditional long-only portfolios.

P/E AND SKEWNESS OF STOCK RETURNS

We use monthly returns on stocks in the S&P Super Composite from February 1994 through July 2005. February 1994 is the first month for which we have constituent data for the composite. We select this universe because it is large enough for evaluating the impact of short sales on the skewness of portfolio alphas, but it does not include micro caps that may be very illiquid and impracticable for shorting.

At the beginning of each month over the interval, we rank all stocks in the sample into quintiles based on market capitalization and industry-adjusted forward earnings-to-price ratio. Forward earnings per share are weighted average of earnings per share forecasts for the current unreported and for the next fiscal year at the time when the stocks are ranked. We exclude from our sample stocks that are not covered by any analyst.

Exhibit 1 shows the mean, median and skewness coefficient of monthly returns for each of the 25 groups of stocks formed on market capitalization and earnings-to-price quintiles. Over the interval, small stocks outperformed large stocks; the stocks in the smallest size quintile had an average monthly return of 1.49% compared to 0.93% for the largest quintile. Low P/E stocks also outperformed high P/E stocks, with the average monthly return declining monotonically from 1.68% for the cheapest quintile to 0.84% for the most expensive quintile. Also, as indicated by the skewness coefficient,

EXHIBIT 1

Mean, Median and Skewness of Monthly Returns on Size-P/E Portfolios

At beginning of each month from February 1994 through July 2005, we rank all stocks in the S&P Super Composite into quintiles on market capitalization and on forward price-to-earnings ratio. The figures reported here for each of the resulting 25 groups are the mean, median, skewness coefficient and number of observations of monthly returns on stocks in that group. An asterisk on the skewness coefficient indicates that the skewness is statistically significant under the sign test.

P/E	Size					
	1 (small)	2	3	4	5 (large)	All
1 (low)	2.13(mean)	1.77	1.37	1.37	1.45	1.68
	1.68(med)	1.32	1.26	1.65	1.51	1.50
	0.47*(skew)	0.72*	0.45	-0.32	-0.34	0.45*
	(6170)	(4965)	(4455)	(3384)	(2928)	(21902)
2	1.61	1.29	1.54	1.36	1.24	1.40
	1.22	1.14	1.31	1.37	1.26	1.26
	0.97*	0.43	0.28	0.10	0.21	0.56*
	(5278)	(5504)	(4900)	(4872)	(5210)	(25764)
3	1.07	0.89	1.15	1.37	0.83	1.06
	0.70	0.98	1.10	1.27	1.13	1.05
	0.58*	0.32	0.29	0.42	-0.40	0.29
	(4463)	(5294)	(5143)	(5402)	(5610)	(25912)
4	0.97	1.00	1.03	1.21	0.65	0.97
	0.51	0.92	0.74	1.01	0.77	0.82
	0.60*	1.17	0.17	0.33	-0.15	0.47*
	(3887)	(4716)	(5516)	(6000)	(5645)	(25764)
5 (high)	1.32	0.80	0.60	0.75	0.70	0.84
	0.26	0.56	0.62	0.68	0.70	0.60
	1.08*	1.65	0.07	0.73	0.23	0.89*
	(4070)	(3478)	(3932)	(4299)	(4504)	(20283)
All	1.49	1.17	1.15	1.22	0.93	1.19
	0.97	1.01	1.03	1.18	1.03	1.05
	0.78*	0.81*	0.25*	0.30	-0.07	0.55*
	(23868)	(23957)	(23946)	(23957)	(23897)	(119625)

stock returns are generally positively skewed, particularly for smaller stocks.

Under the null hypothesis that the distribution of stock returns is symmetric, the asymptotic distribution of the skewness coefficient is normal with mean zero and a known variance. However, as a test of symmetry, the skewness coefficient is very sensitive to tail observations, which we know is a problem with stock returns. We thus choose to use the sign test statistic as illustrated in Gastwirth [1971]. Under the null hypothesis, the number of observations

below the mean has a binomial distribution. With the normal approximation to the binomial, the number of observations between the mean and the median has a normal distribution with mean zero and variance of $N/4$.

In Exhibit 1, an asterisk on the skewness coefficient indicates that the skewness of returns on stocks in that cell is statistically significant at the 95% level under the sign test. The monthly returns for the smallest three quintiles are all significantly skewed, while those for stocks in the larger two quintiles are not. This is not surprising since

stocks of smaller companies should exhibit more option-like features. The relationship between skewness and P/E is not clear, although the skewness coefficient for the highest P/E quintile is larger than the rest.

ESTIMATE REVISION AND SKEWNESS OF STOCK RETURNS

Exhibit 2 reports similar statistics for 25 groups of stocks formed based on size and earnings estimate revision.

Analyst estimate revisions are calculated using a diffusion measure, which is the number of net upward revisions in the previous three months divided by the total number of estimates when the stocks are ranked. The revisions for the two fiscal years are weighted in the same way as in Scott, Stumpp, and Xu [2003a, 2003b] who, like many others, have shown that estimate revisions are serially correlated and tend to predict subsequent returns. Over this interval, the correlation between estimate revision and subsequent stock performance was very weak. This was

EXHIBIT 2

Mean, Median and Skewness of Monthly Returns on Size-Estimate Revision Portfolios

At beginning of each month from February 1994 through July 2005, we rank all stocks in the S&P Super Composite into quintiles on market capitalization and on past three month earnings estimate revision. The figures reported here for each of the resulting 25 groups are the mean, median, skewness coefficient and number of observations of monthly returns on stocks in that group. An asterisk on the skewness coefficient indicates that the skewness is statistically significant under the sign test.

Estimate Revision	Size					
	1 (low)	2	3	4	5 (high)	All
1 (very negative)	1.80(mean)	1.23	1.18	1.01	0.85	1.31
	1.04(med)	0.87	0.84	0.87	0.95	0.79
	0.76*(skew)	1.28	0.42	0.07	0.04	0.72*
	(6702)	(4409)	(3794)	(3375)	(3252)	(21532)
2 (negative)	1.34	1.07	0.95	1.08	0.63	1.04
	0.53	0.77	0.87	1.10	0.75	0.79
	1.14*	0.99	0.21	-0.13	-0.29	0.75*
	(5481)	(4588)	(4477)	(4127)	(3928)	(22601)
3 (neutral)	1.06	1.16	1.02	1.18	1.01	1.09
	0.90	1.09	0.96	1.19	1.02	1.05
	0.28	0.48	0.03	0.71	0.01	0.32
	(6204)	(7103)	(7.80)	(7029)	(6988)	(34404)
4 (positive)	1.79	1.29	1.16	1.41	1.09	1.32
	1.31	1.07	1.15	1.29	1.26	1.22
	0.71*	0.53	0.27	0.21	-0.47	0.34
	(3526)	(4631)	(4902)	(5541)	(5727)	(24327)
5 (very positive)	1.62	1.12	1.59	1.35	0.91	1.29
	1.33	1.14	1.36	1.27	0.95	1.19
	0.49	0.19	0.27	0.50	0.25	0.34
	(1995)	(3226)	(3693)	(3885)	(4002)	(16761)
All	1.49	1.17	1.15	1.22	0.93	1.19
	0.97	1.01	1.03	1.18	1.03	1.05
	0.78*	0.81*	0.25*	0.30	-0.07	0.55*
	(23868)	(23957)	(23946)	(23957)	(23897)	(119625)

due mainly to the perverse relation between estimate revision and subsequent returns in more recent years. Our focus here, however, is not on effectiveness of revisions in predicting stock performance, but on the impact of relaxing the long-only constraint on the skewness of portfolio alphas.

Compared to P/E, estimate revision seems to have a stronger, negative correlation with skewness. The skewness of returns on stocks in the two negative revision quintiles is positive and statistically significant under the sign test, while the skewness for the zero and positive revision quintiles, albeit positive, is not significant. As shown in Exhibit 2, the significantly positive skewness of returns on stocks with negative revisions is mainly attributable to small caps. The smallest and lowest revision group had an average monthly return of 1.80% and a substantially smaller median of 1.04%.

The positive skewness of negative revision stocks is intriguing, yet not completely surprising. It is well documented that estimate revisions are serially correlated. So for a stock with negative estimate revision, the odds are for the downward trend to continue. Since investors likely expect the downward revisions to continue, when the trend does reverse and revisions turn positive, there is likely an asymmetric pop in stock price. In other words, the asymmetry of probabilities causes a positively skewed distribution of returns. The opposite is true for stocks with positive revisions, which would tend to cause negative skewness in their returns. However, this tendency to negative skewness is more than offset by a stock's more fundamental feature of being a call option on the firm's assets, which results in positive skewness in stock returns in general.

EFFECT OF SHORT SALES ON PORTFOLIO ALPHAS

To examine the impact of short sales, we compare the average, median and skewness of the realized alphas of a monthly-optimized long-only strategy with those of +120/-20 and +150/-50 strategies for similar levels of tracking error. The expected alphas we use in the optimizations are based on a naïve P/E strategy and an estimate revision strategy, respectively. This is different from some prior studies that have used either randomly generated or proprietary alphas (Clarke, de Silva, and Saprà [2004]; Litterman [2005]). We choose to test with a P/E model and an estimate revision model because they represent two of the popular alpha factors which money

managers use in picking stocks. We think our results have more practical implications than if we use a set of randomly generated alphas. We decide not to use our proprietary alphas because the results may be subject to the nuances in our rather complicated stock selection model.

Specifically, at the beginning of each month we assign an alpha of -2%, -1%, 0%, +1% or +2% for each of the P/E or estimate revision quintiles. The maximum active position is 1% for each stock, industry and sector. In addition, we also cap the maximum active weight on each of the five size buckets at 1% relative to the S&P500 index. We first optimize the long-only strategies, selecting a risk aversion coefficient that results in an annualized portfolio tracking error of around 3%. For the +120/-20 and +150/-50 strategies, we increase the risk aversion coefficient so that the optimized portfolios have approximately the same level of tracking error as the long-only ones.

Exhibit 3 shows the results from the simulations of the P/E strategies. The long-only portfolio has an average monthly alpha of 0.26% and a median of 0.14%. The best and worst alphas are 2.82% in January 2001 and -1.99% in December 1999, respectively. These numbers suggest that the alphas are positively skewed. Indeed, the skewness coefficient is 0.12, but statistically insignificant under the sign test.

In the +120/-20 strategy, the average monthly alpha is 0.39%, 50% higher than in the long-only strategy, and the median is 0.33%. The skewness coefficient also increases to 0.25, but again is statistically insignificant. The best and worst monthly alphas are 3.20% and -1.72%, respectively, but the worst month is June 1998, different than in the long-only strategy. In December 1999, which is the worst month for the long-only strategy, the +120/-20 strategy has its fourth worst monthly alpha of -1.38%.

When the maximum amount of short sales increases to 50%, the average alpha increases to 0.50% per month, with a median of 0.45%. The best and worst months are same as in the +120/-20 strategy, with alphas of 2.83% and -1.64%, respectively. Interestingly, however, the difference between the mean and median is smaller than in both the long-only and +120/-20 strategies. The skewness coefficient of 0.07 is insignificant and the lowest among the three strategies.

The absence of any significant skewness in alphas of the three P/E strategies is not inconsistent with the results in Exhibit 1, which shows no clear correlation

EXHIBIT 3

Impact of Short Sales on Alphas of P/E Strategies

At the beginning of each month, we assign each stock in the S&P Super Composite an alpha of -2% , -1% , 0% , 1% , or 2% , depending on which forward P/E quintile it falls into. We then construct portfolios against the S&P500 index using a quadratic optimizer. The results here are characteristics of the monthly alphas of the three strategies that vary in the maximum amount of short sales allowed. In all optimizations, the maximum active weight is 1% on each stock, industry, sector, and size bucket.

	Long Only	120% long / 20% short	150% long / 50% short
Mean	0.26	0.39	0.50
Median	0.14	0.33	0.45
Best (month)	2.82 (1/2001)	3.20 (1/2001)	2.83 (1/2001)
Worst (month)	-1.99 (12/1999)	-1.72 (6/1998)	-1.64 (6/1998)
Skewness Coef.	0.12	0.25	0.07
Annualized Stdev. (tracking error)	2.9	3.0	2.8

between P/E and skewness of stock returns. But as shown in Exhibit 2, estimate revision seems to be negatively correlated with skewness. Since estimate revision strategies overweight stocks with positive revisions and underweight those with negative revisions, we expect the alphas of those strategies to be negatively skewed.

Exhibit 4 shows the results. The long-only revision strategy has an average and median alpha of 0.20% and 0.27% , respectively. The best month is December 1998 with an alpha of 2.38% , and the worst is January 2001 with an alpha of -3.19% . Contrary to the long-only P/E strategy, these numbers suggest a negative skewness in the distribution of alphas. Indeed, the skewness coefficient of the alphas is -0.49 , but statistically insignificant under the sign test.

When the long-only constraint is relaxed, the average alpha predictably increases, to 0.30% a month in the $+120/-20$ strategy and 0.35% in the $+150/-50$ strategy. As in the P/E strategies, there is no clear impact of leverage on the skewness of distribution of the alphas. The skewness coefficient is larger, but still statistically insignificant,

in the $+120/-20$ strategy, and smaller in the $+150/-50$ strategy.

Since estimate revision is correlated with price momentum, the negative skewness of alphas on the estimate revision strategies is consistent with the findings of Chen, Kim, and Xu [2003], who showed that the returns of high price momentum portfolios are negatively skewed. They suggest that negative skewness is a measure of downside risk, and investors demand a premium for bearing that risk. This would explain why historically stocks that have had good price momentum seem to continue to outperform subsequently.

The alphas of the three revision strategies are obviously highly correlated, but as in the P/E strategies, they do not all have the same best and worst months. Both the $+120/-20$ and $+150/+50$ strategies have their best month in June 1998 with an alpha of 2.64% and 3.19% , respectively, while the long-only strategy has its best month in December 1998 with an alpha of 2.38% . Similarly, both the long-only and $+120/-20$ strategies have their worst month in January 2001 with an alpha of -3.19% and

EXHIBIT 4

Impact of Short Sales on Alphas of Estimate Revision Strategies

At the beginning of each month, we assign each stock in the S&P Super Composite an alpha of -2%, -1%, 0%, 1%, or 2%, depending on which estimate revision quintile it falls into. We then construct portfolios against the S&P500 index using a quadratic optimizer. The results here are characteristic of the monthly alphas of the three strategies that vary in the maximum amount of short sales allowed. In all optimizations, the maximum active weight is 1% on each stock, industry, sector, and size bucket.

	Long Only	120% long / 20% short	150% long / 50% short
Mean	0.20	0.30	0.35
Median	0.27	0.33	0.34
Best (month)	2.38 (12/1998)	2.64 (6/1998)	3.19 (6/1998)
Worst (month)	-3.19 (1/2001)	-3.01 (1/2001)	-2.63 (11/2002)
Skewness Coef.	-0.49	-0.68	-0.32
Annualized Stdev. (tracking error)	2.8	2.9	2.9

-3.01%, respectively, but the 150/50 strategy has its worst month in November 2002 with an alpha of -2.63%.

It is worth noting that there is clearly some negative correlation between the alphas of P/E and revision strategies. For example, January 2001 is the best performance month for all three P/E strategies, but is the worst month for the long-only and the +120/-20 estimate revision strategies. Similarly, in June 1998 both leveraged P/E strategies have their worst monthly alphas, but both leveraged revision strategies have their best alphas. The correlation coefficient between the alphas of the long-only P/E strategy and the long-only estimate revision strategy is -0.31, statistically significant.

CONCLUSION

In this article, we examine the impact of relaxing the long-only constraint on the characteristics of portfolio alphas of a P/E strategy and an estimate revision strategy. We are particularly interested in whether allowing short sales increases the downside risk, a fear that many of us

may have despite the amount of discussion devoted to the topic recently.

We find a negative correlation between earnings estimate revision and skewness of stock returns. This results in a negative skewness in the distribution of alphas of estimate revision strategies that buy stocks with positive estimate revisions and sell stocks with negative estimate revisions. However, in a risk-controlled diversified portfolio, this negative skewness is statistically insignificant and does not seem to increase when the long-only constraint is relaxed.

Value investors who use P/E ratios to pick stocks have even less to worry about the downside risk from relaxing the long-only constraint. At stock level, both the high and low P/E stocks exhibit returns that are significantly positively skewed. In our simulations, we find that the alphas on a strategy that buys low P/E stocks and sells high P/E stocks exhibit positive, albeit small and statistically insignificant, skewness. Relaxing the long-only constraint does not have any significant impact on the skewness of portfolio alphas.

We conclude that even though shorting a stock presents unlimited potential loss, and even though a manager's short sale candidates may exhibit statistically significant positive skewness in their returns, in a risk-controlled diversified portfolio, the impact of short sales on the skewness of the portfolio's alpha distribution is very limited. We view our results as evidence that relaxing the long-only constraint in traditional long-only portfolios does not cause higher downside risk.

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