Global Momentum Strategies: A Portfolio Perspective

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ABSTRACT

We provide practical perspectives on momentum investing in stocks internationally. First, momentum is generally more profitable on the long side than on the short side, making it accessible to a broad range of institutional capital. Second, both price and earnings momentum profits are significant globally. Third, internationally, earnings momentum is distinct from price momentum, and using price and earnings momentum in conjunction produces larger economic profits. Fourth, momentum profits have weaker co-movements across markets than market indices. Interestingly, while market correlations are much higher in down markets than in up markets, momentum correlations are low in both market conditions. Fifth, momentum strategies do not differ appreciably in profitability between up and down markets, which means timing is less important to momentum traders. Finally, momentum strategies are not riskless–historically there have often occurred periods of several months where they have netted low or negative returns. Altogether, these findings suggest that momentum is useful in international portfolio management, but its implementation should be thoughtfully considered.

The simple investing strategy of buying prior winning stocks and selling short prior losers appears significantly profitable in the U.S. both statistically and economically. Since the Jegadeesh and Titman [1993] study of U.S. stock returns, substantial "out-of-sample" evidence of price momentum has amassed.[1] Furthermore, Chan, Jegadeesh, and Lakonishok [1996] show that a similar strategy based not on returns but on past earnings is a separate and distinct source of profitability in the U.S.[2] Our analysis extends this evidence in a global setting in 40 markets for price momentum and in 34 for earnings momentum by analyzing several key issues: the separation of the long-side positions from the short-side positions; the interaction between price and earnings momentum; the relation between momentum strategies across markets; and momentum's sensitivity to global market conditions, extreme events, and seasonality.

While there have been many attempts to explain momentum profits with increasingly complex risk factor models, these attempts have largely failed.[3] Relatively little research has focused on understanding the practical risk faced by an investment practitioner implementing momentum. Recent exceptions are two studies of the implementability of momentum in the face of bid-ask spread and price impact costs, Korajczyk and Sadka [2004] and Chen, Stanzl, and Watanabe [2002]. The goal of this paper is to examine some of the practical implementation risks and challenges that managers might face when using momentum strategies in global setting. The approach we take here may also be useful in examining properties of other more complicated investment strategies.

Our results, in brief, are as follows. Momentum is potentially useful even for investors who are only able to take long positions. Ignoring transactions costs, an investor investing $1 in European securities in 1975 would have earned $15.06 in low past 6-month return securities, as compared to $66.01 in market

indices, or $192.66 in high past return securities.

Price and earnings momentum profits are large and positive on a global basis. Both the past short-term increases in earnings and prices are important for generating excess returns. A strategy going long on stocks in the top 20 percent of both past return and earnings growth and short stocks with the lowest returns and earnings growth produces positive returns in 29 of 32 markets: 13.45 percent per year in the U.S. and 10.41 percent in the rest of the world.

From the perspective of a U.S. money manager, we examine the correlation between U.S. momentum strategies and those in other countries; we compare these correlations to correlations between market indices. The result indicates that international momentum investors have larger benefits of diversification than international index investors. The correlations of both price and earnings momentum strategies are much lower than market correlations. Furthermore, when the U.S. market experiences negative returns, market correlations dramatically increase, but momentum correlations are not higher in down markets. In addition, momentum strategies pay off when markets are up and down and when the economy is contracting and expanding.

While momentum strategies are not superficially risky in terms of time-series average exposure to traditional risk factors, they are far from pure arbitrage. We closely examine the time-series of momentum profits in geographical regions and in the U.S. and find that, occasionally, momentum strategies have earned -20 percent per month. In a few months, these returns are also accompanied by negative returns in preceding months and even negative returns in other regions at the same time. While these occurrences are rare, they are worthy of caution, especially for leveraged investors. We find that for some countries these negative returns cluster in January.

From cumulative returns of momentum strategies, we find that at times,

momentum does not work for extended periods. After 1975, there occurs a 33-month period in the U.S. and a 60-month period in Asia where momentum strategies generally lost money. Overall, our results highlight the usefulness of momentum but also some areas of caution in implementation.

DATA AND METHODOLOGY

U.S. monthly stock return data include common shares of all NYSE and AMEX listed firms available from CRSP. For non-U.S. data, we obtain 39 countries from Datastream International that have at least 50 non-financial stocks (from both dead and alive firm lists). We begin coverage in 11 markets in 1975 but by February 1995 all countries except Egypt have coverage for price momentum strategies. Earnings momentum strategies begin in February 1976 for the U.S. and begin in February 1987 for many other countries.

To attenuate effects of possible data errors from Datastream, we follow Griffin, Ji, and Martin [2003] and screen the data in the following manner. We exclude preferred shares (except in countries where preferred shares are the main share class, such as Brazil), convertible shares, warrants, investment certificates, participation certificates, units, mutual funds, and foreign-listed shares. In countries with multiple share classes, we try to select the most representitive share class by using widely-traded shares with ordinary voting rights and openness to foreign investment. Industry classification code is further used to exclude non-common securities. Whenever the return index of a stock appears the same at least four times consecutively, we keep the first value and code the rest of repeated values as missing. If any monthly return is over 1000%, it is coded as missing.[4] Further details regarding the methodologies are provided in Griffin, Ji, and Martin [2003], wherefrom some of the analyses here are adapted.

For price momentum strategies, we follow the most widely reported results focusing on a six-month ranking period, over which winners and losers are determined, and a six-month investment period, over which winners are held and losers sold short. To avoid microstructure distortions for price momentum strategies, we focus on results using the common practice of skipping a month between portfolio ranking and investment periods. We follow these strategies every month so that strategies of six varying vintages are simultaneously in effect at all times.

For earnings momentum, similar to Chan, Jegadeesh and Lakonishok [1996], over a six-month period, we take the change in the consensus one-year earnings forecast and scale it by the price at the end of the period. Stocks are ranked based on this measure and held for the following six months. For both price and earnings momentum strategies, we use strategies that examine the top (winner) and bottom (loser) 20 percent of stock returns because some countries simply do not have enough stocks for the common decile designations. For ease of comparison, we report annualized profits which are simply monthly profits multiplied by 12.

PRICE AND EARNINGS MOMENTUM RETURNS BY COUNTRY AND REGION

Viability

Due to the short-sales constraint, it is crucial to identify the source of momentum profitability before the strategy becomes utile to institutional investors. To ascertain this, we denominate each stock return in dollars and investigate the growth path of investing $1 in various portfolios beginning in August 1975. Subsequent analysis, however, simply uses local currency

EXHIBIT 1 ABOUT HERE

returns.

Exhibit 1 demonstrates that winner stocks outperform their respective market indices in all regions, and the return differential is quite significant. For instance, ignoring transactions costs, continuously investing in the U.S. would have generated $142.29 from winner stocks and $33.87 from the value-weighted market index (versus $7.27 from loser stocks). Interestingly, stocks that were past losers outperform the market in the Americas and Asia, possibly because the momentum stocks are typically of much smaller capitalization, which may have earned a premium compared to large cap in these regions. In Europe and the U.S., loser stocks underperform corresponding market indices. The fact that much of the returns come simply from investing long in winner stocks suggests that (ignoring transactions costs) momentum strategies are potentially profitable even for short-constrained institutional capital.

Returns

Exhibit 2 displays average winner minus loser profits for both price and earnings momentum strategies for each country in local currency. Countries with statistically significant momentum profits are indicated by striped bars. Winner minus loser portfolios are largely profitable around the world, with Asian countries displaying the weakest momentum profits. Outside of the U.S., both African countries, all six American countries, 10 of 14 Asian countries, and 14 of 17 European countries display positive price momentum profits over the period. Earnings momentum strategies produce positive returns in 27 of 34 markets and are significantly negative in no markets.

EXHIBIT 2 ABOUT HERE

To allow for noisiness of individual country data, we also report regional averages where the time series for each region is formed as the equally-weighted average of all countries in the region. The average annual price momentum profits in percent are 19.62, 9.41, 3.83, and 9.21 in Africa, Americas (excluding

the U.S.), Asia, and Europe, respectively. It is interesting to note that the price momentum profits for Asia are decidedly weaker than those around the world. Earnings momentum profits are 10.87, 4.45, and 4.16 percent per year in the Americas (excluding the U.S.), Asia, and Europe. Across all countries, the average momentum profit is 7.98 percent per year for price strategies and 5.10 percent for those based on earnings. In sum, both price and earnings strategies are large and pervasive across most countries and regions.

Are Price and Earnings Momentum Distinct?

One question that naturally arises is on the importance of using distinct price and earnings momentum strategies. If such strategies are merely profiting from the same securities, then they are redundant. To examine this issue, we sort securities independently according to both their past earnings and returns, and then examine price momentum profits within past earnings groups and vice-versa. Because our data outside of the U.S. begins in 1987 or later and the bivariate strategies require allocating the stocks into more portfolios than the univariate strategies, profits to these strategies are quite volatile. Hence, statistical significance may be hard to detect.

EXHIBIT 3 ABOUT HERE

Within earnings momentum groups, the average price momentum strategy earns positive profits in all American markets and all but one European market; it earns positive profits in 5 of 13 Asian markets and insignificantly negative profits the other Asian markets. In Europe and in the U.S., price momentum strategies are profitable within low, medium, and high past earnings growth groups. Aggregating across all markets, price momentum profits are 4.89, 6.13, and 7.90 percent per year in stocks within low, medium, and high earnings momentum.

Within past return groups, earnings momentum strategies are on average profitable in all but one American market, one Asian market, and one

European market. Earnings momentum strategies are positive and significant in low, medium, and high past return momentum groups in both Asia and Europe. Interestingly though, earnings momentum is least profitable in the medium price groups in both Asia and Europe. Across all markets, earning momentum profits are 4.59, 3.10, and 7.50 percent per year within low, medium, and high return groups.

These findings show that after conditioning on the same sets of stocks and the same time period, earnings momentum strategies are much more profitable than price momentum in Asia, but outside of Asia, price momentum is, in general, slightly more profitable. While earnings momentum strategies are more profitable in stocks that also exhibit price momentum, these strategies are not driven by price momentum. Additionally, price and earnings momentum are separate and profitable phenomena.

Quantitative investment houses are likely to use, among other considerations, both price and earnings momentum for stock selection. We examine the returns to a joint strategy of buying stocks that are in the top 20 percent of price and earnings momentum and shorting stocks that are in the bottom 20 percent of both categories. The last column in Exhibit 3 shows that these strategies are substantially more profitable than the univariate strategies (from Exhibit 2). Trading on both price and earnings momentum yields an annual return of 5.79 in Asia, 13.34 in Europe, and 13.45 in the U.S. While these profits are small in emerging markets (which also typically have fewer securities to choose from) the average annual return is 13.70 percent in developed markets. It is important to note that these are just simple strategies and that more complex trading strategies using other stock characteristics could likely generate even higher returns. Overall, these results show that price and earnings momentum strategies, while related, have independent variations which are economically and statistically important.

Next, we turn to examining the time-series relation between price and earnings momentum strategies. To ensure that the earnings momentum strategy is not drawn from the same set of securities as price momentum strategies, we examine earnings momentum strategies only using stocks with "medium-sized" past returns (stocks whose recent prior returns rank in the top or bottom 20% in each country are excluded). Henceforth we refer to this strategy as constrained earnings momentum.[5]

EXHIBIT 4 ABOUT HERE

Exhibit 4 shows that the time series of price and constrained earnings momentum profits generally have positive correlations below 0.40. Interestingly, Indonesia has the largest positive correlation, while China, Denmark, France, Greece, and Portugal have negative correlations. In the U.S. and the world excluding the U.S., the correlation is 0.338 and 0.398, respectively. Hence, the results in Exhibits 3 and 4 demonstrate that, while the price and earnings momentum profits are related, there is clearly useful information in each.

THE INTERNATIONAL DIVERSIFICATION AND TIMING OF MOMENTUM STRATEGIES

We next turn to the relation between country strategies across markets. We first examine raw correlations and then these correlations in up and down markets.

Correlations

For a global portfolio manager, the correlation of momentum strategies across countries is crucial. If momentum strategies exhibit a higher degree of co-movement than pure passive diversification strategies, then momentum may be costly to implement as a strategy component.

We calculate the correlation between U.S. momentum strategies and momentum strategies abroad and also the correlation between market indices. In Exhibit 5, the correlation of each country's market index with the U.S. index appears on the $x-$axis, and the correlation of each country's price momentum strategy with the U.S. price momentum appears on the $y-$axis. Developed markets appear as solid circles, whereas emerging markets are hollow circles.

EXHIBIT 5 ABOUT HERE

As shown by the benchmark line of 45-degree in Panel A of Exhibit 5, in only two emerging markets is it the case that the correlation between U.S. and international price momentum profits are higher than the market correlation. Emerging market strategies generally exhibit lower momentum correlations than those of developed markets. These lower correlations in emerging markets could be attributable to noisier profits due to fewer securities forming each portfolio in emerging markets, or simply that emerging market momentum is more distinct from that in the U.S. The average correlation between European price momentum profits and those in the U.S. is 0.328 as compared to the correlation between the European market and the U.S. of 0.590. Similarly, the correlation between the Asian momentum strategies and that in the U.S. is 0.198 as compared to 0.559 between an equally-weighted Asian market index and the U.S. market. Our developed market average correlation is 0.177. Using a sample of firms that among other differences excludes international companies with market caps below the NYSE 25 percentile, Naranjo and Porter [2004] find a slightly higher developed market average for the U.S. of 0.31, leading us to conjecture that correlations for momentum strategies using larger cap stocks (where institutions have a higher propensity to invest) will likely have somewhat higher correlations. Our results are similar in spirit to the finding of Asness, Liew, and Stevens [1997] that momentum strategies from international indices have a low correlation of 0.13 with U.S. momentum strategy profits. Griffin, Martin, and Ji [2003] show that the U.S. correlations

are generally above those for other countries.

In unreported results, we also calculate market-neutralized momentum profits that extract market exposure. The residual is computed with respect to the foreign market, so in effect the reported correlation is between the U.S. market and a delta-hedged foreign country momentum strategy as shown by Grundy and Martin [2001]. These correlations show a similar, weaker relation between momentum strategies across countries.

Panel B of Exhibit 5 shows correlations between constrained earnings momentum strategies with the U.S. as compared to market correlations. Earnings momentum strategies generally produce even lower correlations than price momentum strategies. Overall, Asian earnings momentum strategies have a correlation near zero and European momentum strategies have a correlation of 0.229 with U.S. earnings momentum strategies. Both price and earnings momentum strategies have much lower correlations than investing purely in market indices. Momentum strategies appear to achieve substantial international diversification benefits.

Correlations and Market Conditions

Diversification matters more when investments go bad. There is existing evidence that international markets provide less diversification benefits in down markets than in up markets. If international momentum strategies are more highly correlated in down markets, then the strategy carries additional risks. In Exhibit 6 we plot the relation between market and either price or earnings momentum when the U.S. market return is above or below zero.

EXHIBIT 6 ABOUT HERE

Panel A shows that when the U.S. market is up, market correlations (between the U.S. and other countries) are quite low and price momentum correlations are similarly low. The average correlation between Asian (European) price momentum profits and those in the U.S. is 0.167 (0.373] as

compared to a correlation between the markets and the U.S. of 0.311 (0.292]. Panel B shows that when the U.S. market is down, market correlations are quite high but price momentum correlations are similar to those in Panel A. The correlation between the Asian (European) momentum strategies and that in the U.S. is 0.259 (0.20] as compared to 0.543 (0.648] for an equally-weighted Asian (European) market index and the U.S. market.

Panels C and D report the correlations for earnings momentum strategies in up and down markets and show that earnings momentum strategies are generally not more highly correlated in months when the U.S. market is down. These results show that market-wide diversification benefits are lower when the market goes down; nonetheless, momentum strategies remain effective diversification mechanisms.

When Do Momentum Strategies Pay Off?

Our analysis above examines diversification and market conditions but not payoffs. Investors tend to focus on portfolio performance more in down markets. If momentum strategies lose money in these periods, then their use to active portfolio management clearly diminishes. In the mean time, if the average premium on momentum is due to economic risk related to market movements, then momentum should earn negative returns during periods of negative market returns and positive returns in periods of positive market movements.

EXHIBIT 7 ABOUT HERE

Exhibit 7 shows average price (Panel A) and earnings (Panel B) momentum profits during periods of positive market movements (striped bars) and negative market movements (solid bars). Panel A shows that during periods of negative market-wide returns, price momentum earns positive returns in 35 of 40 markets; in contrast, it earns positive returns in only 26 markets during periods of positive market movement. In Asia, momentum profits are slightly

negative during up-market months, but 6.60 percent per year in down-market months. For all markets, the average momentum return is 8.45 percent per year in down markets and 5.72 in up markets. Price momentum profits are, if anything, slightly *larger* during periods when market returns are negative.

We also examine the performance of constrained earnings momentum strategies in different market conditions. Earnings momentum strategies are positive in 24 of 32 countries in up markets and 21 of 32 in down markets. Because the earnings momentum strategies are constrained to the middle price group, the profits are low; nevertheless, profits are overall positive in both down and up markets, and larger in down markets than in up markets.

If momentum were related to economic distress risk, one might expect to see negative momentum profits when that risk is realized — i.e., in periods of low or negative GDP growth. We examine momentum profits in 22 markets for which the OECD provides GDP data. Exhibit 8 displays regional average price and earnings momentum profits in quarters of positive and negative GDP growth.

EXHIBIT 8 ABOUT HERE

In Panel A of Exhibit 8, the average price momentum profit for developed countries is 9.15 per year for down-GDP periods and 3.69 for up-GDP periods. Momentum profits are large in periods of positive GDP growth but positive and even larger in periods of negative GDP growth. Constrained earnings momentum strategies are positive in both up and down markets in Asia and the U.S., but slightly negative in down markets in Europe and highly negative in down markets in the Americas, which may be due to the scarcity of observations (only Mexico).

Overall, price and constrained earnings momentum strategies are profitable in periods of high and low market and GDP growth but price momentum strategies are slightly more profitable during periods of negative market returns and GDP growth. Earnings momentum strategies are positive in peri-

ods of negative market growth and near zero during periods of negative GDP growth. These results provide strong evidence that momentum can be a valuable investment strategy for portfolio managers who are particularly sensitive to market conditions.

MOMENTUM RETURNS OVER TIME

The Time Series

We next turn to the simple time series of momentum returns in all the major regions to see if they exhibit any unique features. We also plot corresponding market returns for comparison purposes. In contrast to previous exhibits, the returns in Exhibit 9 are not annualized but monthly raw returns. Exhibit 9 demonstrates several interesting caveats about momentum. First, in comparison to market returns, regional price momentum strategies are less volatile. The monthly standard deviation of momentum strategies is 3.40 in Asia and 1.65 in Europe as compared to 4.95 and 4.21 for the Asian and European equally-weighted market return over the same period. Nevertheless, this volatility for momentum strategies translates into large returns in some months.

EXHIBIT 9 ABOUT HERE

Second, momentum strategies are risky in the sense that they are sometimes autocorrelated near some extremely negative returns. For example, the largest negative return of -18.31 for Asian momentum strategies is in November 1998. However, prior to that month momentum earned -12.71 in October and -5.34 in September, but 1.3 percent in August and 5.11 in December of that year. The momentum returns around other negative months are not nearly so bad. The second largest negative momentum return of -13.64 is in February of 1998 and the returns are -2.68 and -3.29 in the months before and after the month. However, the returns are 3.76, 4.36, and 6.14 in April, May, and

June of the year 1998. For Europe, the largest negative return of -8.05 is in February 1992 and is preceded by a 1.01 percent monthly return and followed by a small -2.41 return. For the U.S., the largest negative return of -20.44 is in February 1992 as well, and the monthly return in January is -14.92, but in December of 1991, the return is 9.60. The second largest loss for momentum strategies is -20.24 in January 1992. Here, the February return is near zero and the previous December realized a 9.24 percent return.

Third, momentum strategies occasionally earn large negative returns in the U.S. and other regions at the same time. For a momentum investor, the fact that both U.S. and European momentum strategies had their worst realization in February 1992 is troubling. This month in 1992 was also somewhat bad for Asian strategies (-5.52 percent return). Nevertheless, this clustering of large negative momentum profits is generally not the case in other months. For example, the large negative return for momentum strategies in January 1992 and October 1978 saw returns close to zero in Europe and Asia. Additionally, the large negative returns to Asian momentum strategies in late November 1998 were accompanied by positive returns of 3.5 and 3.35 in Europe and the U.S., respectively.

These findings highlight the potential for momentum to sometimes earn large negative returns in consecutive months within a region and earn negative returns in the same months across regions. Nevertheless, we also examine the total returns of a global momentum strategy that takes equal positions in each market with at least 100 securities. The monthly standard deviation of the world strategy is 1.65 as compared to 4.05 for a similarly constructed world index. The largest negative returns to this equally-weighted global strategy are only -6.10 in February 1991 and -5.57 in November 1998. This demonstrates that, on average, a global momentum strategy is much less volatile than a U.S. or regional-only strategy.

January Returns

The large negative returns in January highlight the importance of examining the effect of January returns across countries. Because tax and reporting year-ends do not end in December in all countries, reversals due to window dressing or tax-loss selling may not simultaneously occur in January. The returns to price and earnings momentum strategies in Exhibit 10 show that some markets such as Egypt, Taiwan, and the U.S. exhibit rather large negative January returns to price momentum strategies. Overall returns are negative in January for 16 of 40 markets. Earnings momentum strategies are also negative in many markets in January. Before implementing momentum strategies, managers may want to consider possible tax-loss and portfolio rebalancing effects.[6]

EXHIBIT 10 ABOUT HERE

Long-Run Returns

To examine momentum from a longer-term perspective, we now plot the cumulative returns to price momentum strategies around the world in Exhibit 11. Three interesting patterns emerge. First, momentum strategies generally experience an upward trend that is the strongest in the U.S. followed by Europe. Second, the positive correlations between momentum strategies in the U.S. and other regions show up clearly over longer horizons as momentum profits across regions generally seem to move in the same direction over longer horizons. One extreme example is from November 1979 to February 1980 when momentum strategies in all regions experienced phenomenal returns. Lastly, momentum strategies can experience periods longer than a year when they are unprofitable. In the U.S., momentum strategies lost money from December 1990 until November 1993. In Asia, there was a five-year period from July 1989 to November 1995 when momentum strategies were down.

EXHIBIT 11 ABOUT HERE

CONCLUSION

This paper investigates practical issues regarding both price and earnings momentum in an international setting. First, momentum profits are not just driven by short positions; taking long positions in stocks with high past returns would have generated long-run buy-and-hold returns much greater than market indices. Second, both price and earnings momentum yield economically large profits in a variety of markets. Third, while price and earnings momentum profits are correlated, there is incremental information from both; strategies using both past returns and earnings earn higher profits than using each alone. Fourth, foreign momentum strategies are generally much less correlated with U.S. momentum strategies than the corresponding stock market index is correlated with the U.S. market index; momentum strategies benefit more from diversification than market index strategies. Unlike market indices, momentum profits are not more highly correlated across countries in down markets.

Our fifth interesting observation is that momentum is present when markets go up and down and even when the economy is expanding and contracting. Finally, momentum strategies are volatile. While momentum profits are less volatile than their market or regional indices, they are occasionally associated with large negative returns. In some markets these negative returns cluster in January. Even regional momentum strategies can sometimes earn negative returns for 3-5 years.

Our findings suggest that momentum is worth serious consideration for active portfolio managers. However, it is important to note that both execution and price impact costs may vary substantially across markets and are not considered here. Our findings indicate that future work should focus on understanding predictors that may influence the time-series variation in mo-

mentum profits. Additionally, our positions are simply univariate strategies that did not consider traditional tilts such as growth and value. Asness [1997] and Daniel and Titman [1999] show that U.S. momentum profits are greater in growth stocks. Moreover, patterns such as market capitalization, turnover (Lee and Swaminathan [2000], and analyst coverage (Hong, Lim, and Stein [2000]) which have been found to be related to price momentum in the U.S. may also be related abroad. Indeed, in work we have done for a follow-up paper, we find that international momentum profits are related to many firm characteristics. While the use of more complicated strategies has the potential to boost momentum profits, it can also eliminate these profits if applied incorrectly.

We hope to see future research uncover more complete explanations for momentum. We also reserve a note of caution—given the wide attention that momentum has received, one must wonder how increasing amounts of capital seeking to exploit this phenomenon will affect its profitability.

ENDNOTES

We thank Will Goetzmann, Kent Hargis, and seminar participants at Bernstein Investment Research and Management, Baruch College, and the University of Connecticut for comments.

[1] Price momentum is economically large in many European markets (Rouwenhorst [1998]), small but positive in many emerging markets (Rouwenhorst [1999]), and furthermore present in some Asian markets (Chui, Titman, and Wei [2000]).

[2] Vandell and Parrino [1986] demonstrate that a model with earnings momentum as the major component substantially outperforms the U.S. market. Scott, Stumpp, and Xu [2003] document earnings momentum in all major markets they examine (France, Germany, Japan, the UK, as well as the U.S.); yet, Hong, Lee, and Swaminathan [2003] document positive and significant earnings momentum profits in only 6 of 11 international markets.

[3] Jegadeesh and Titman [1993], Grundy and Martin [2001], Naranjo and Porter [2004], and Griffin, Ji, and Martin [2003], among others, respectively, show that the CAPM, time-varying extensions of the CAPM, three-factor, and popular macroeconomic models cannot explain the source of momentum profits.

[4] Such processing, in spirit, coincides with the main steps outlined in Ince and Porter [2004], which has some additional corrections, such as dropping all observations when the end of previous month price is less than $1.00.

[5] The returns to these constrained earnings momentum strategies are shown in the medium past return group in Exhibit 3.

[6] See Grinblatt and Moskowitz [2004] for a more detailed discussion of the seasonal patterns of momentum and explanations for these patterns in the U.S.

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EXHIBIT 1

The Worth of $1 Investment in Price Winner, Loser and Market: 1975-2000

For each month t, stocks in each country are ranked into quintile groups based on their dollar returns over the six months $t-7 \ldots t-2$. The momentum strategy buys the winner quintile and sells short the loser quintile, and holds these positions for the six months $t \ldots t+5$. A time series for each region is constructed from the monthly equally-weighted average of all countries in the region. Depicted for each region is the time series of the portfolio's worth from investing $1 in winner, loser portfolios and the market. Transaction costs are ignored. The sample period runs from the first available date for each country through December 2000, except: June 1999 for Peru and August 2000 for Argentina.

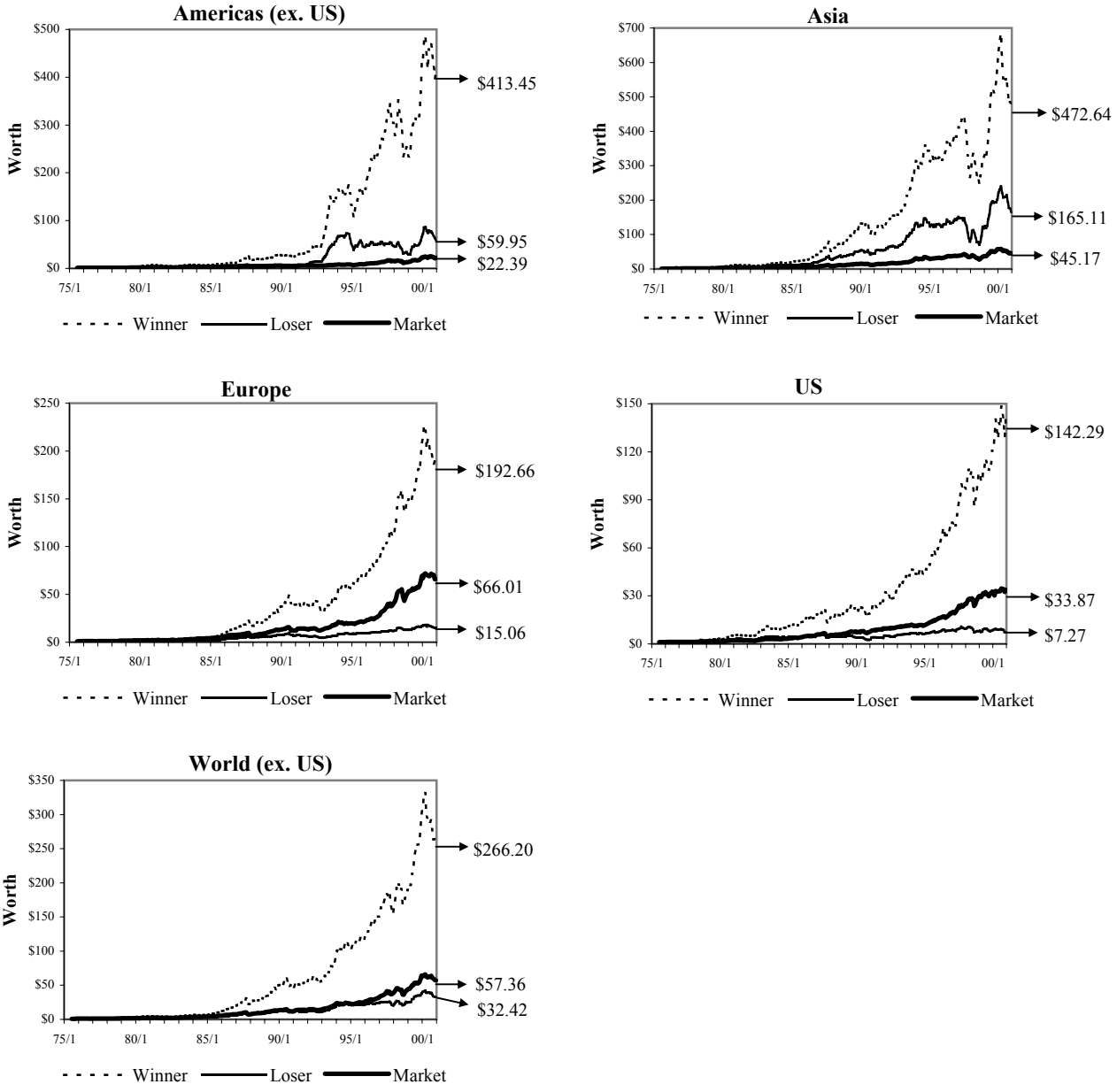


EXHIBIT 2
Momentum Profits by Country and Region

Price momentum portfolios are formed similar to Exhibit 1, except that local currency returns are used to evaluate past return performance. Depicted is the annualized price momentum profit, in percentage. Striped bars indicate statistical significance at the 5% level. For earnings momentum, over a six-month period, we take the change in the consensus one-year earnings forecast and scale it by the price at the end of the period. Stocks are ranked based on this measure and held for the following six months. Also depicted for each country is such earnings momentum return, in local currency.

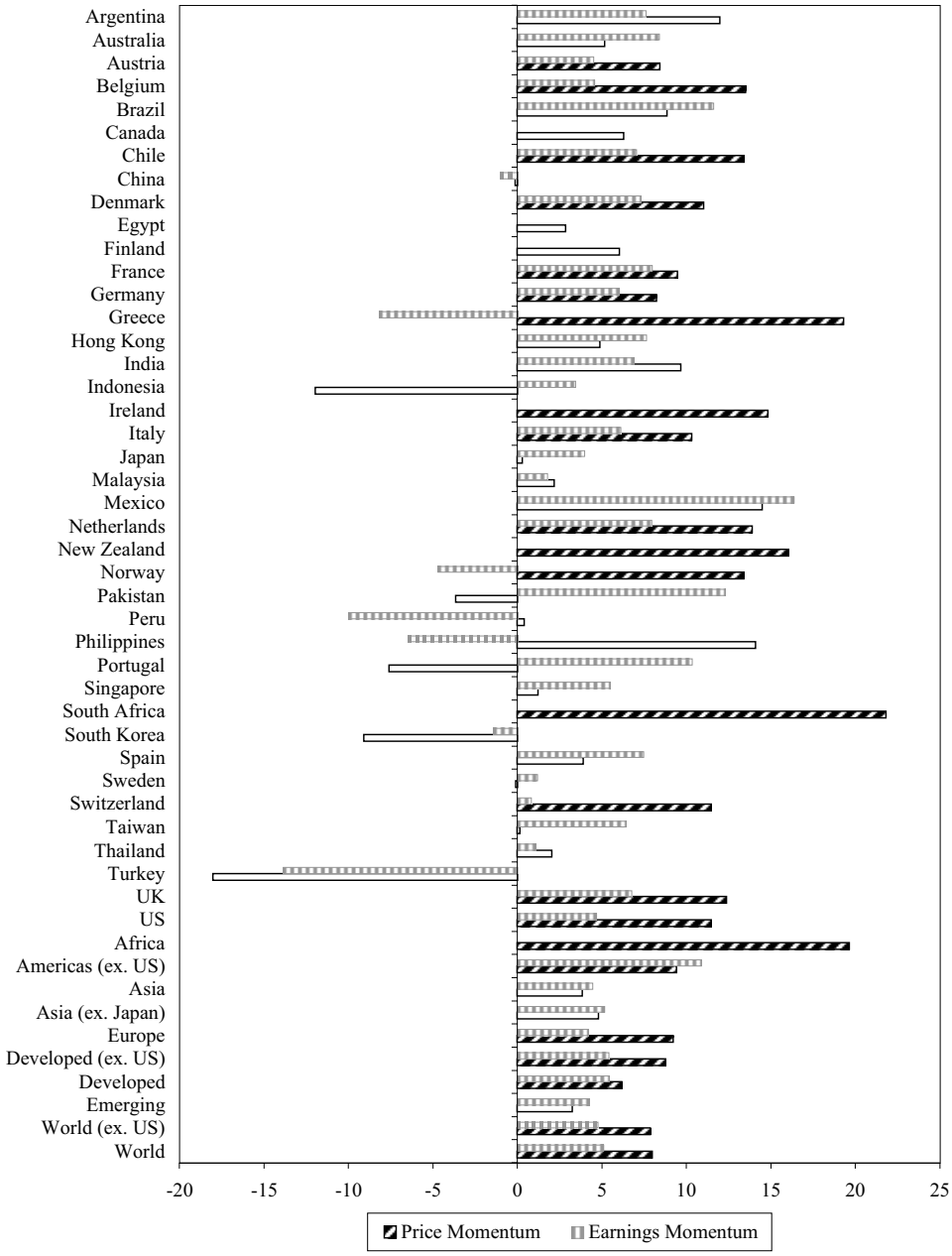


EXHIBIT 3
The Interaction of Price and Earnings Momentum

For each month t, stocks in each country are ranked into quintile groups based on their local currency returns over the six months $t-7 \ldots t-2$. The medium three groups are combined to form one group. In the mean time, stocks are also independently sorted into similar groups based on earnings revision, as in Exhibit 2. The momentum strategy buys the Winner group, sells short the Loser group, and holds these positions for the six months $t \ldots t+5$. The first column shows this difference for the low earnings momentum group, the second column for the middle earnings momentum group, and the third column for the high earnings momentum group. The average of these three differences is also reported. Significant profits at 5% level are denoted $*$. The middle columns of the table reports, for each price momentum group, differences in earnings momentum portfolio return E_{hi} - E_{lo}. The far right column reports profits for strategies that long in stocks that are both high earnings and price momentum and short stocks that have both low past earnings and low prior returns. The profits start as early as February 1976 for the U.S., and February 1987 for other countries.

	Price Momentum Sort Power of $(P_{\text{hi}} - P_{\text{lo}})$ within Earnings Momentum Groups				Earnings Momentum Sort Power of $(E_{\text{hi}} - E_{\text{lo}})$ within Price Momentum Groups				Combined Strategy
	$P_{\text{hi}} - P_{\text{lo}}$				$E_{\text{hi}} - E_{\text{lo}}$				$P_{\text{hi}}, E_{\text{hi}} -$
Region/Country	E_{lo}	E_{md}	E_{hi}	Avg	P_{lo}	P_{md}	P_{hi}	Avg	$P_{\text{lo}}, E_{\text{lo}}$
Argentina	20.97	5.42	14.35	13.58	5.96	14.26	-0.66	6.52	20.31
Brazil	24.28	24.38	-3.14	15.17	14.25	7.62	-13.16	2.9	11.11
Chile	30.11*	10.79*	6.48	15.79*	8.01	5.25	-15.61	-0.79	14.49
Mexico	19.91	-20.53	1.02	0.13	17.15	7.55	-1.74	7.65	18.17
Americas (ex. US)	24.49*	12.79	-2.32	11.66*	15.3	7.43	-11.51	3.74	12.98
Australia	13.93	1.07	6.34	7.11	17.42	6.10*	9.83*	11.11*	23.76*
China	11.92	-0.09	-5.86	1.99	8.84	7.75	-8.94	2.55	2.98
Hong Kong	-0.78	-6.06	5.26	-0.53	7.47	6.55*	13.51*	9.18*	12.74
India	16.59	10.72	25.44*	17.58*	1.29	3.48	10.14	4.97	26.73*
Indonesia	1.64	-20.15	-13.53	-10.68	14.06	-5.91	-1.11	2.35	0.53
Japan	-7.07	-3.88	-0.25	-3.74	2.75	5.00*	9.57*	5.77*	2.50
Malaysia	-2.93	-4.18	-2.17	-3.1	2.78	0.9	3.54	2.41	0.61
Pakistan	-16.43	-6.7	-22.2	-15.11	23.31	3.74	17.53	14.86	1.10
Philippines	-17.45	-35.91	-14.68	-22.68	2.73	-20.63	5.49	-4.14	-11.96
Singapore	-1.48	0.31	3.43	0.75	2.34	3.34	7.25	4.31	5.77
South Korea	-11.45	-13.38	-6.19	-10.34	-1.02	1.5	4.24	1.57	-7.21
Taiwan	-8.71	-2.99	0.04	-3.89	5.7	2.02	14.46*	7.39*	5.74
Thailand	0	2.93	-1.59	0.45	4.8	-2.3	3.21	1.9	3.21
Asia	-3.06	-4.65	-1.02	-2.91	6.81*	2.97*	8.85*	6.21*	5.79
Asia (ex. Japan)	-3.02	-4.13	-1.34	-2.83	8.60*	3.57*	10.28*	7.49*	7.26
Austria	4.09	2.37	-2.11	1.45	18.13	6.13	11.92	12.06*	16.01
Belgium	0.94	8.95	16.27	8.72	-1.32	1.96	14.01*	4.88	14.96
Denmark	18.06*	6.07	15.65*	13.26*	1.35	1.93	-1.06	0.74	17.00*
France	11.81*	1.43	12.05	8.43*	7.57	6.17*	7.81*	7.18*	19.62*
Germany	7.81	6.23*	7.82	7.29*	3.86	5.92*	3.87	4.55*	11.68*
Greece	3.9	14.1	15.81	11.27	-13.18	-10.77	-1.27	-8.4	2.63
Italy	0.86	4.44	13.06*	6.12	1.28	3.26	13.4*	6.01*	14.34*
Netherlands	5	17.78*	-5.63	5.72	25.43	7.97*	14.80*	16.07*	19.80*
Norway	-12.48	16.78	7.44	3.91	-0.54	-2.92	19.38	5.31	6.89
Portugal	15.13	-13.27	14.82	5.56	15.45	9.38	15.14	13.32*	30.27*
Spain	9.13	0.53	-8.5	0.39	10.25	4.13	-7.38	2.33	1.76
Sweden	-11.16	3.22	-8.31	-5.42	4.22	2.12	7.08	4.47	-4.08
Switzerland	18.22*	14.35*	11.53*	14.70*	4.75	-0.68	-1.94	0.71	16.28*
UK	6	15.97*	8.36*	10.11*	4.81	4.89*	7.17*	5.62*	13.17*
Europe	6.26*	7.76*	7.67*	7.23*	5.67*	3.53*	7.08*	5.43*	13.34*
US	7.44*	9.38*	11.06*	9.29*	2.38	2.13*	6.01*	3.51*	13.45*
Developed (ex. US)	4.46	5.14*	6.06*	5.22*	6.85*	4.46*	8.45*	6.59*	12.91*
Developed	5.69*	7.65*	9.11*	7.48*	4.59*	3.55*	8.01*	5.38*	13.70*
Emerging	-1.84	-4.15	-4.91	-3.64	7.66*	2.37	4.59	4.87*	2.75
World (ex. US)	3.01	2.36	3.66	3.01	6.76*	3.55*	7.40*	5.90*	10.41*
World	4.89*	6.13*	7.90*	6.27*	4.59*	3.10*	7.50*	5.06*	12.39*

EXHIBIT 4
The Correlation Between Price and Earnings Momentum

Price momentum portfolios are formed as in Exhibit 2. To construct constrained earnings momentum portfolios in month t, stocks are first sorted into quintile groups based on their local currency returns over the six months $t-7 \ldots t-2$; those between 20% and 80% breakpoints are further sorted into quintile groups based on earnings revision. The earnings momentum strategy buys the winner quintile, and sells short the loser quintile, and holds these positions for the six months $t \ldots t+5$. These are the price and constrained earnings momentum strategies for the rest of the analysis. Depicted below is the correlation between price and earnings momentum profits; striped bars indicate statistical significance at 5% level.

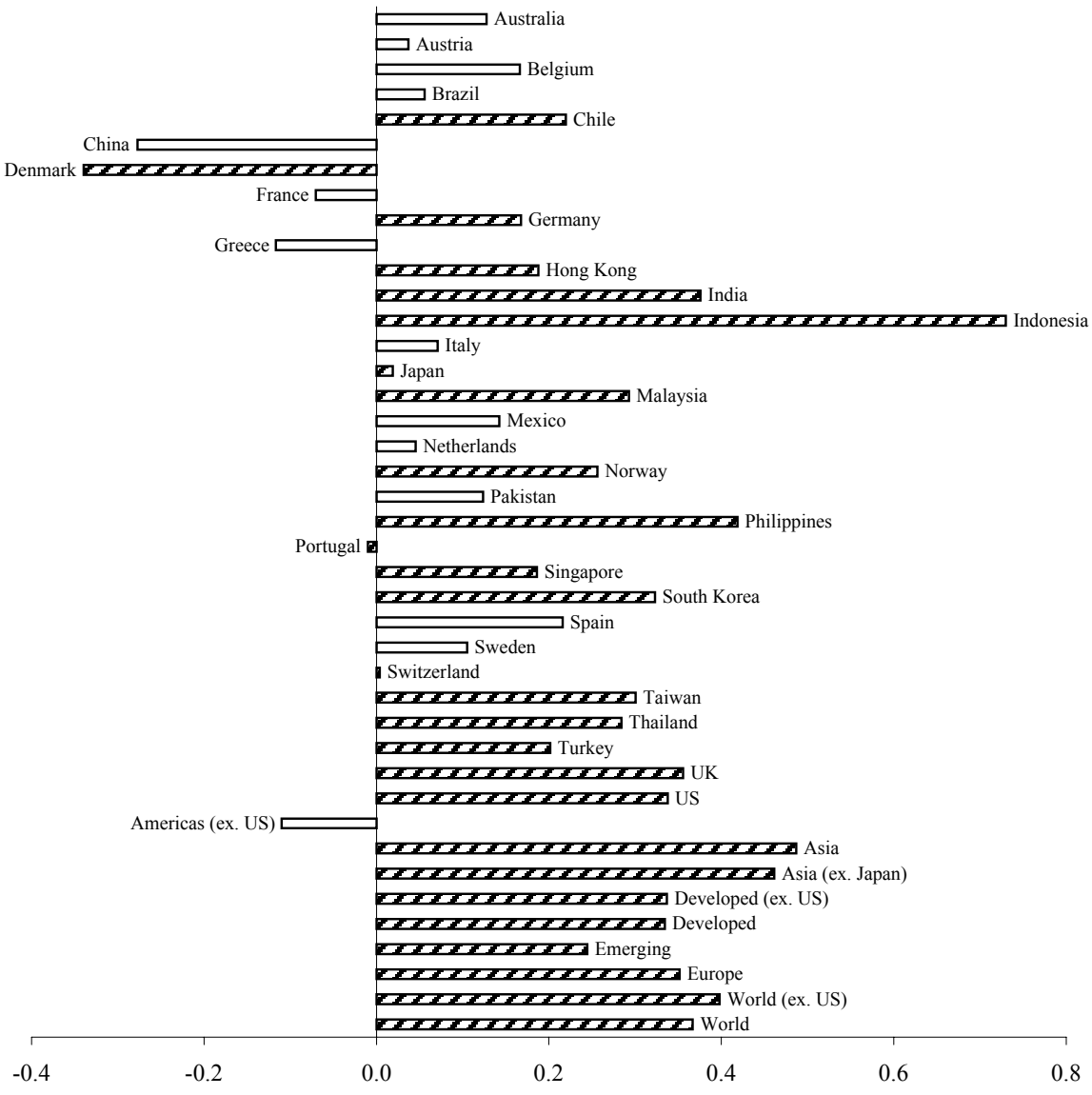
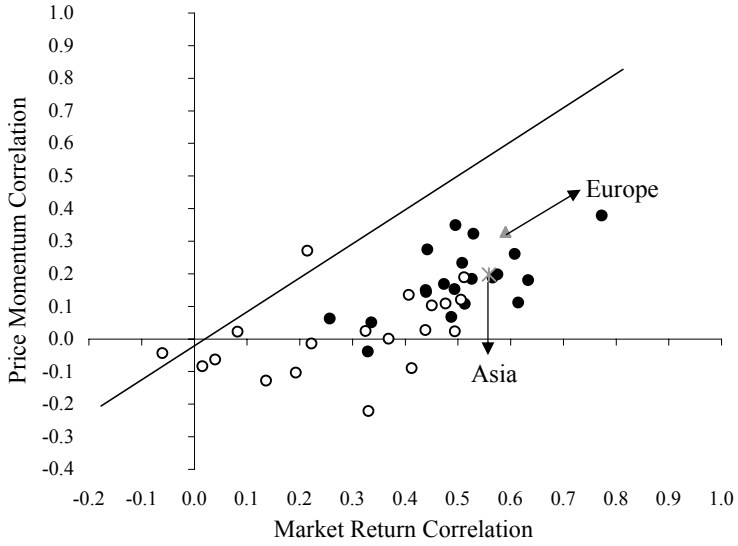


EXHIBIT 5
Momentum Correlation v. Market Return Correlation

The correlation of each country's momentum profit with the U.S. momentum profit is plotted on the y-axis of Panel A and the correlation of each country's market index return with the U.S. market return is plotted on the x-axis. Emerging countries appear as hollow circles and developed countries appear as solid circles. Similar relation is demonstrated for earnings momentum in Panel B. The 45-degree line demonstrates where momentum correlations and market index correlations are of equal magnitude.

Panel A: Price Momentum Correlation v. Market Return Correlation



Panel B: Earnings Momentum Correlation v. Market Return Correlation

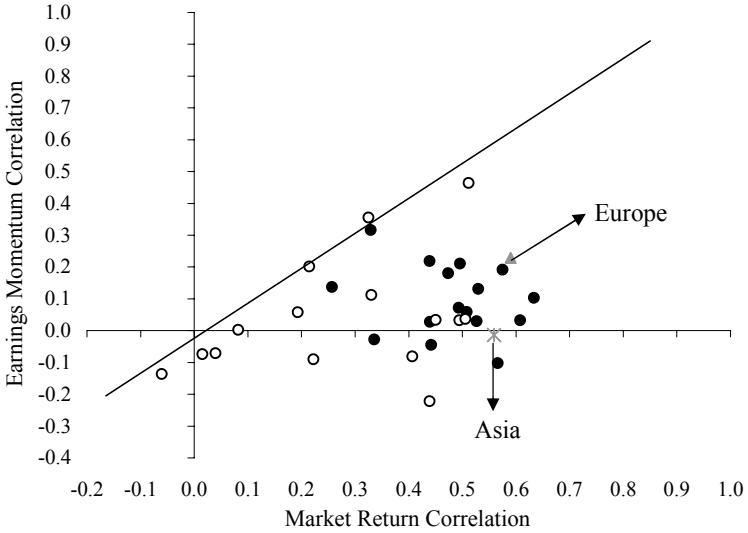
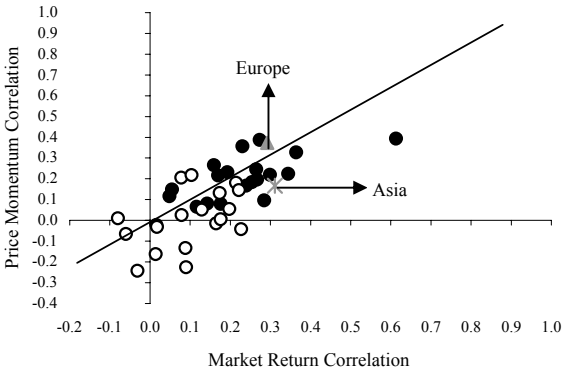


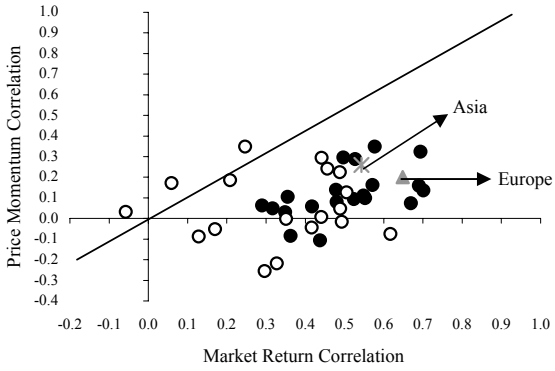
EXHIBIT 6
Correlations in Up and Down Markets

When the U.S. market return is positive, the correlation of each country's momentum profit with the U.S. momentum profit is plotted on the y-axis of Panel A, and the correlation of each country's market index return with the U.S. market return is plotted on the x-axis. Emerging countries appear as hollow circles and developed countries appear as solid circles. Panel B illustrates such pattern when the U.S. market is down. Similar relation is demonstrated for earnings momentum in Panels C and D, respectively. The 45-degree line demonstrates where momentum correlations and market index correlations are of equal magnitude.

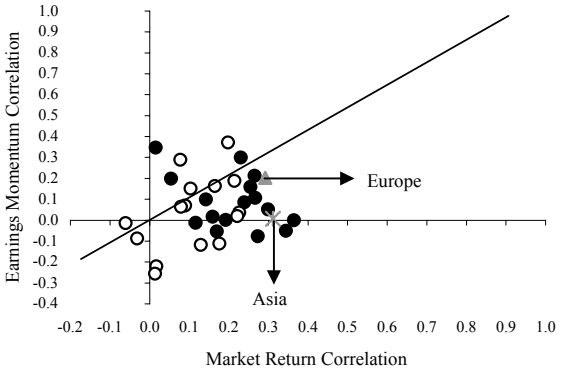
Panel A: U.S. Up Market: Price Momentum Correlation v. Market Return Correlation



Panel B: U.S. Down Market: Price Momentum Correlation v. Market Return Correlation



Panel C: U.S. Up Market: Earnings Momentum Correlation v. Market Return Correlation



Panel D: U.S. Down Market: Earnings Momentum Correlation v. Market Return Correlation

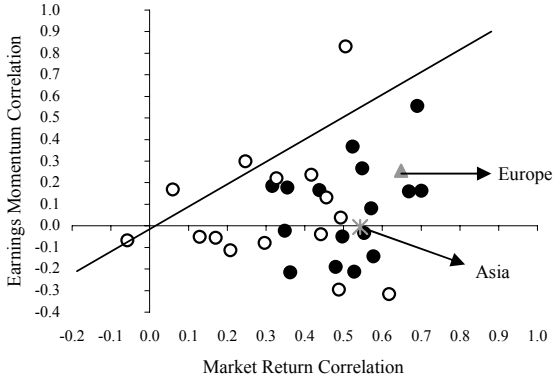


EXHIBIT 7
Momentum Investing and Market States

Panel A shows annualized average momentum profits in down and up market states based on contemporaneous market index returns. Hollow and solid bars are down and up market states, respectively. Panel B depicts earnings momentum profits.

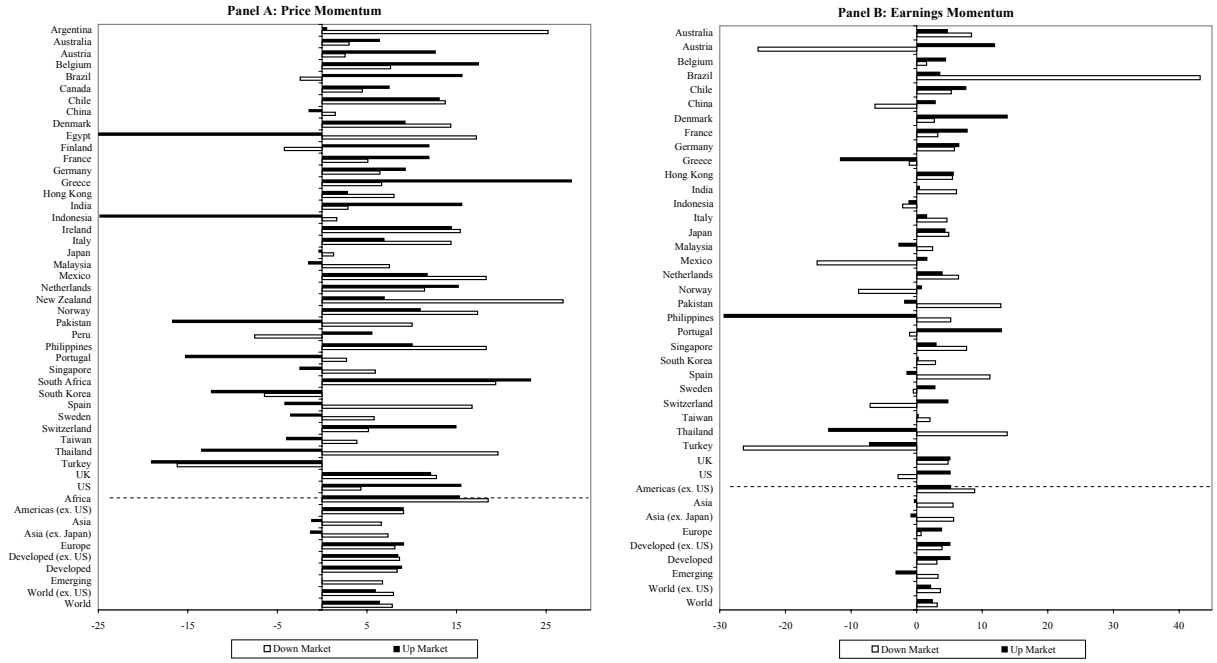
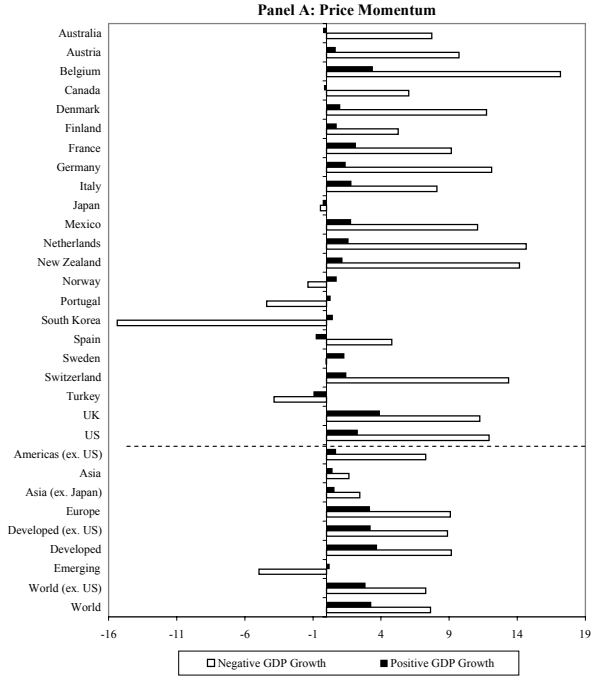


EXHIBIT 8
Momentum Investing and Macro-economic States

Panel A shows annualized average momentum profits in economic contraction and expansion states based on quarterly real GDP growth. Hollow and solid bars are negative and positive GDP growth states, respectively. Panel B depicts earnings momentum profits.



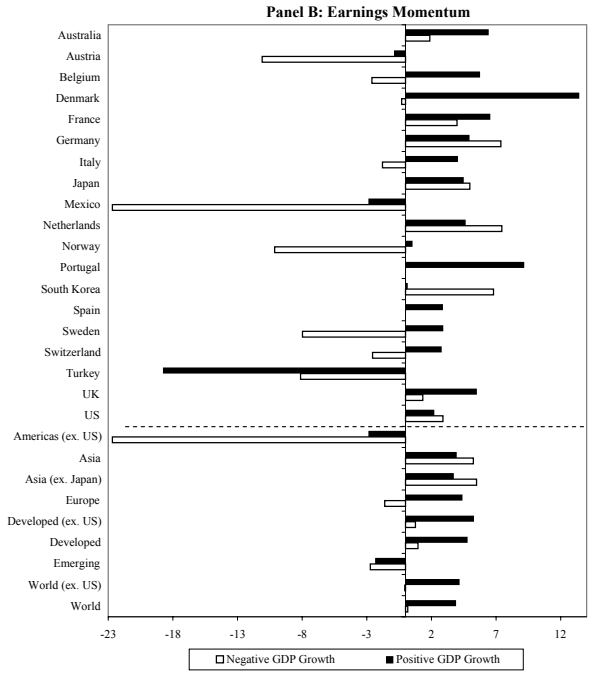
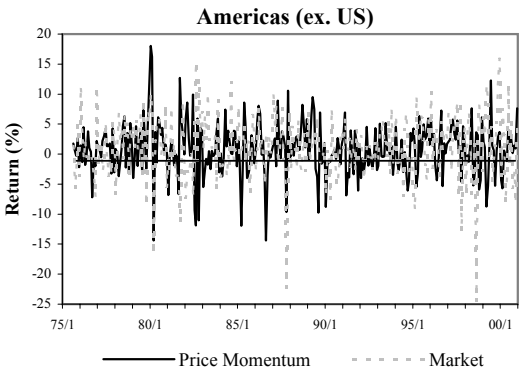
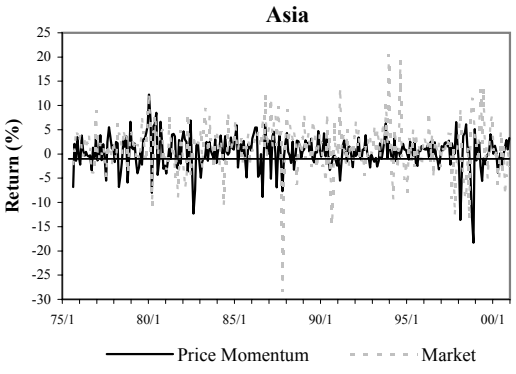
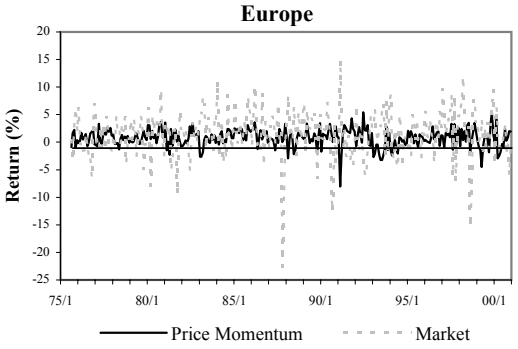


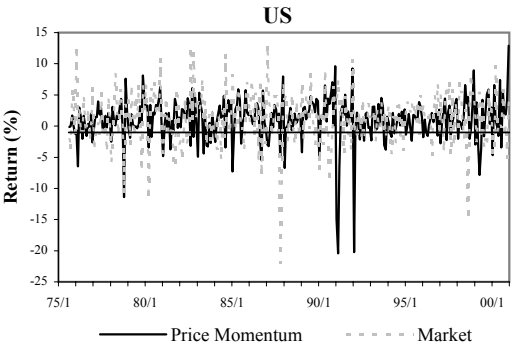
EXHIBIT 9
Price Momentum Profits and Market Returns

Depicted for each region is the time series of monthly price momentum profits and market returns, in percentage. The sample period runs from the first available date for each country through December 2000, except: June 1999 for Peru and August 2000 for Argentina.









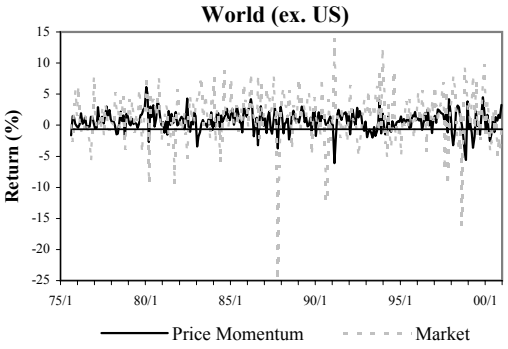


EXHIBIT 10
Momentum Profits in January by Country and Region

Depicted for each country and region is the average price momentum profits in January (in percentage). Also depicted is earnings momentum profits.

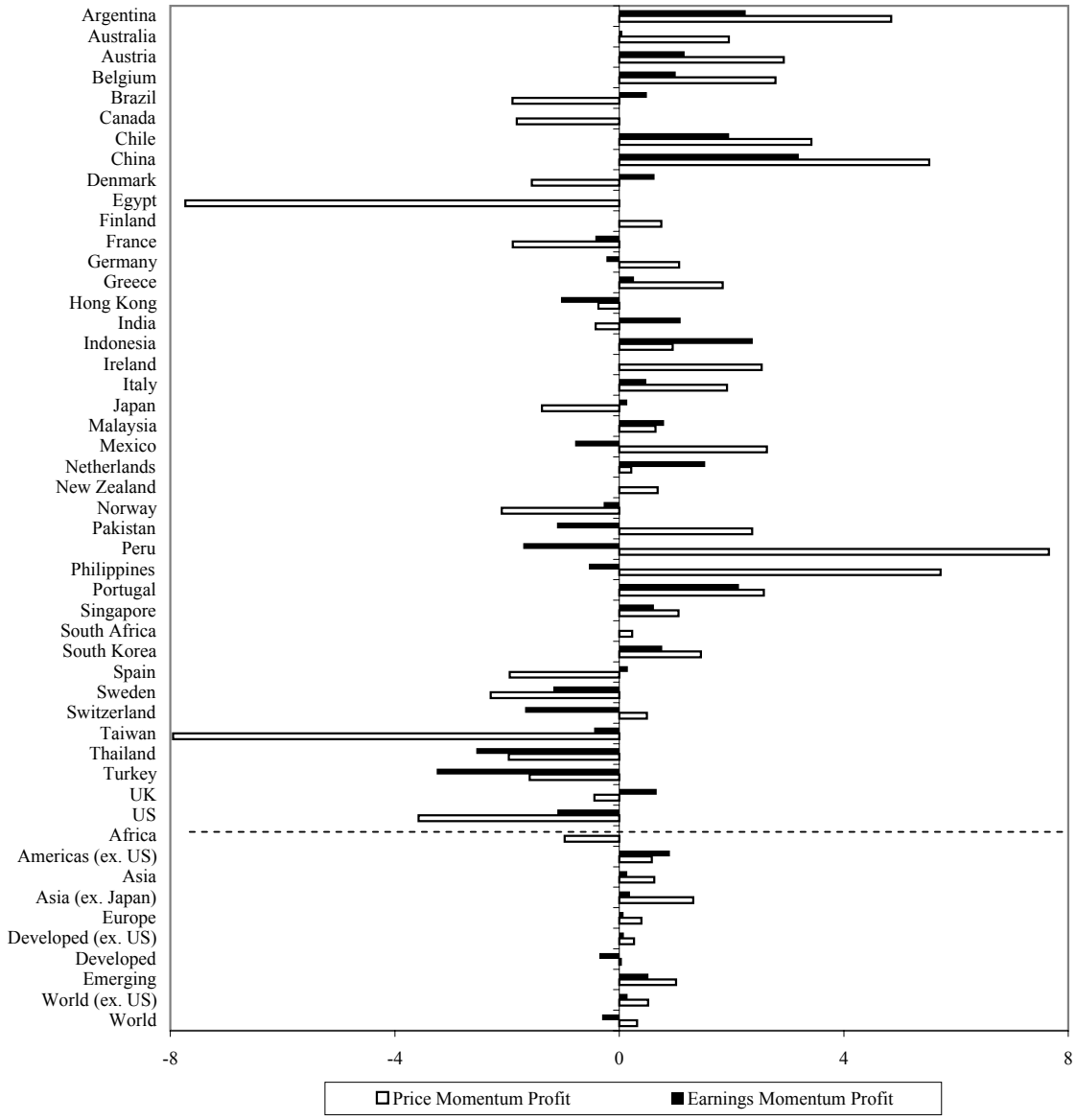


EXHIBIT 11
Cumulative Price Momentum Returns

Depicted is the time series of cumulated U.S. and regional price momentum returns, in percentage. These regional series are equally-weighted averages across countries in the region and constructed as described in Exhibit 2.