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Size, Value, and Momentum in International Stock Returns

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Abstract

In the four regions (North America, Europe, Japan, and Asia Pacific) we examine, there are value premiums in average stock returns that, except for Japan, decrease with size. Except for Japan, there is return momentum everywhere, and spreads in average momentum returns also decrease from smaller to bigger stocks. We test whether empirical asset pricing models capture the value and momentum patterns in international average returns and whether asset pricing seems to be integrated across the four regions. Integrated pricing across regions does not get strong support in our tests, but local models for three regions (North America, Europe, and Japan) provide passable stories for local average returns, which is consistent with integrated pricing within these regions.

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Banz (1981) finds that stocks with lower market capitalization (small stocks) tend to have higher average returns. There is also evidence that value stocks, that is, stocks with high ratios of a fundamental like book value or cash flow to price, have higher average returns than growth stocks, which have low ratios of fundamentals to price (Rosenberg, Reid, and Lanstein (1985), DeBondt and Thaler (1985), Fama and French (1992), Lakonishok, Shleifer, and Vishny (1994)). U.S. stock returns also exhibit momentum: stocks that have done well over the past year tend to continue to do well for a few months (Jegadeesh and Titman (1993)). The value premium (higher average returns of value stocks relative to growth stocks) and momentum are also observed in international stock returns (Chan, Hamao, and Lakonishok (1991), Fama and French (1998), Rouwenhurst (1998), Asness, Moskowitz, and Pedersen (2009)).

Fama and French (1993) propose a three-factor model to capture the patterns in U.S. average returns associated with size and value versus growth,

$$(1) \quad R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_iSMB(t) + h_iHML(t) + e_i(t).$$

In this regression, $R_i(t)$ is the return on asset i for month t , $RF(t)$ is the riskfree rate, $RM(t)$ is the market return, $SMB(t)$ is the difference between the returns on diversified portfolios of small stocks and big stocks, and $HML(t)$ is the difference between the returns on diversified portfolios of high book-to-market (value) stocks and low book-to-market (growth) stocks. In an attempt to also capture momentum returns, Carhart (1997) proposes a four-factor model for U.S. returns,

$$(2) \quad R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_iSMB(t) + h_iHML(t) + w_iWML(t) + e_i(t),$$

which is (1) enhanced with a momentum return, $WML(t)$, the difference between the month t returns on diversified portfolios of the winners and losers of the past year.

Regressions (1) and (2) are commonly used in applications, most notably to evaluate portfolio performance (Carhart (1997), Kosowski et al. (2006), Fama and French (2010)). In the initial paper on the three-factor model, however, Fama and French (1993) find that, although it captures the size and value patterns in post-1962 U.S. average returns better than the CAPM, there are holes in the model's

explanation of average returns. There is a large literature on momentum, but we know of no evidence on how well the Carhart four-factor model captures momentum patterns in average returns.

This paper examines international stock returns, with two goals. The first is to detail the size, value, and momentum patterns in average returns for major developed markets. Our main contribution is evidence for different size groups. Most prior work on international returns focuses on large stocks. Our sample covers all size groups, and tiny stocks (microcaps) produce some of the most interesting results. Our second goal is to examine how well (1) and (2), and an extension of them, capture average returns for portfolios formed on size and value or size and momentum. We examine local versions of the models in which the explanatory returns (factors) and the returns to be explained are from the same region. To develop perspective on whether asset pricing is integrated across regions, we also examine models that use global factors to explain global and regional returns.

There is a literature on integrated international asset pricing, ably reviewed by Karolyi and Stulz (2003). The papers closest to ours are Griffin (2002) and Hou, Karolyi, and Kho (2009). We add to their work in many ways. For example, Griffin (2002) examines whether country-specific or aggregate versions of (1) better explain returns on portfolios and individual stocks in the U.S., the U.K., Canada, and Japan. We use 23 countries. Hou, Karolyi, and Kho (2009) do not examine how value premiums and momentum returns differ across size groups and whether the size patterns in average value premiums and momentum returns are captured by local and international asset pricing models – our main tasks.

Section I discusses the motivation for the asset pricing tests. Section II describes the data and variables. Section III presents summary statistics for returns. Sections IV and V turn to tests of asset pricing models. Section VI summarizes the results and presents conclusions.

I. Motivation

Regressions (1) and (2) are motivated by observed patterns in returns. They are examples of empirical asset-pricing models; that is, they try to capture the cross-section of expected returns without specifying the underlying economic model that governs asset pricing. When we propose regressions like

(1) or (2) as empirically motivated asset-pricing models, the hypothesis is that the regression slopes for the explanatory returns capture the cross-section of expected returns, so the true intercepts are zero for all left-hand-side (LHS) assets. This in turn implies that the portfolios on the right hand side (RHS) span the *ex ante* mean-variance-efficient (MVE) tangency portfolio that can be created from all assets (Huberman and Kandel (1987)). If we find a set of explanatory portfolios that spans the MVE tangency portfolio, we capture the cross-section of expected returns, whatever the underlying model generating asset prices.

That the true MVE tangency portfolio can be used to describe expected returns on all assets is, on the most general level, an algebraic result (e.g., Roll (1997)). By way of economic motivation, the MVE tangency portfolio has a role in all versions of Merton's (1973) ICAPM, including the CAPM of Sharpe (1964) and Lintner (1965). Specifically, the MVE tangency portfolio is always one of the "multifactor efficient" portfolios relevant for choice by investors (Fama (1996)). Thus, in an ICAPM world, using the tangency portfolio to describe expected returns has economic content.

Empirical asset pricing is empty if the search for the MVE tangency portfolio is unrestricted. There is, after all, a tangency portfolio for any set of assets. To make empirical asset pricing interesting, restrictions must be imposed. The restrictions focus on parsimony. Models like (1) and (2) ask whether a small set of RHS portfolios, directed at patterns in average returns observed over long periods, capture the MVE tangency portfolio implied by the expected returns and return covariances of assets.

We study international returns, and the goal is to examine two related issues; (i) whether parsimonious empirical asset pricing models capture the value and momentum patterns in international average returns, and (ii) the extent to which asset pricing is integrated across markets. The task faces bad model problems. Any model is an approximation to the pricing process, and so likely to be rejected in tests that have power. For example, the general form of the model may be incorrect; that is, there may be no version of the RHS explanatory returns that spans the MVE tangency portfolio of interest.

Alternatively, the bad model problem may be the absence of integrated asset pricing in the region covered by the RHS returns. Thus, suppose we have the correct asset pricing model; that is, applied to the

broadest region in which asset pricing is integrated, the model's RHS portfolios span the MVE tangency portfolio for the region. Then if we regress the excess returns on any assets from the integrated pricing region on the model's RHS returns for the region, we get intercepts that are indistinguishable from zero. But we expect intercept tests to reject if we use explanatory returns for narrower or broader regions.

For example, suppose the true model generating asset prices is the CAPM and pricing is globally integrated. Then β s with respect to the global market portfolio explain expected returns on all assets, but local versions of the CAPM should not work. For example, β s with respect to the U.S. market portfolio should not explain expected returns on all U.S. assets. On the other hand, if markets are not globally integrated, the global CAPM should fail even if a local CAPM prices assets in each market.

We shall see that power is often a problem in tests of these predictions. We sometimes have too little and sometimes we have too much. When the dependent and explanatory returns in our asset pricing regressions are for the same region (local or global), the tests typically have power because the regression fits are tight (R^2 is high). As a result, we shall see some formal rejections of models that in economic terms seem to be reasonable approximations. On the other hand, when the RHS portfolios are global and the LHS assets are local (that is, restricted to one of the four regions), the regressions fit less tightly and power is often a problem. Perhaps as a result, we shall see tests in which we fail to reject global models that seem far off target in explaining local average returns.

The results from the tests for global integration are at best mixed, which opens the door for local models. Moreover, we shall see that in tests to explain local LHS returns, local RHS returns produce tighter fits and more precise parameter estimates than global RHS returns. Thus, even if global models produced clean evidence of integrated pricing, local models may be attractive in applications to explain local LHS returns as long as the local RHS portfolios produce a passable approximation to the MVE tangency portfolio for local assets. For example, even with integrated global pricing, a passable local model that uses RHS returns for North America may be attractive for evaluating the performance of a

mutual fund that holds only North American stocks because the local model provides more precise alpha estimates than the global model.

We examine local asset pricing models for each of our four regions. The tests of local models typically have power. Nevertheless, the local models perform rather well in capturing the returns on local portfolios. We take this to be good news for potential applications of such models.

II. Data and Variables

Our international stock returns and accounting data are primarily from Bloomberg. The sample period for all 23 countries we examine is November 1989 to September 2010. There are other sources for international returns on big stocks prior to 1989, but our goal is to extend the international evidence to small stocks. The cost is a rather short 20+ year sample period. All our returns are in U.S. dollars and monthly excess returns are returns in excess of the one-month U.S. Treasury bill rate (from CRSP).

To ensure that we have plenty of stocks in each of the LHS portfolios, we combine our 23 developed markets into four regions: (i) North America (NA), which includes the United States and Canada; (ii) Japan; (iii) Asia Pacific, including Australia, New Zealand, Hong Kong, and Singapore (but not Japan); and (iv) Europe, including Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. We also examine global portfolios that combine the four regions. On average, North America, Europe, Japan, and Asia Pacific account for 47.3%, 30.0%, 18.4%, and 4.3% of global market capitalization.

Parsimony in the choice of regions is important in the power of our tests, but we also want regions in which market integration is a reasonable assumption. It seems reasonable to assume that the U.S. and Canada are close to one market for goods and securities during our sample period. The countries of Europe are almost all members of the European Union, and those that are not formal members (e.g., Switzerland) participate in most of the EU's open market provisions. In terms of countries with mutually open markets, the (rather small) Asia Pacific region is most questionable, and we shall see that it is a problem in some of our tests.

In each region, we sort stocks on size (market cap) and momentum, and on size and the ratio of book equity to market equity (B/M). In our previous work on U.S. stocks (Fama and French (1993)) we use NYSE breakpoints for size and B/M, to avoid sorts that are dominated by the plentiful but less important tiny Amex and NASDAQ stocks. For the same reason, in our current tests we use B/M and momentum breakpoints based on large stocks and size breakpoints that are percents of aggregate market cap chosen to avoid undo weight on tiny stocks.

Specifically, the explanatory returns in our asset pricing tests are for portfolios constructed from 2x3 sorts on size and B/M or size and momentum. At the end of June of each year t we sort the stocks in a region on market cap and B/M. Big stocks are those in the top 90% of market cap for the region, and small stocks are those in the bottom 10%. (For North America, 90% of market cap corresponds roughly to the NYSE median, used to define small and big stocks in Fama and French (1993).) The B/M breakpoints in the 2x3 sorts for the four regions are the 30th and 70th percentiles of B/M for the big stocks of a region, where, as in Fama and French (1993), book value is for the fiscal year ending in calendar year $t-1$ and market cap is for the end of December of calendar year $t-1$. The global portfolios use global size breaks. Because we worry about differences in accounting rules across the four regions, however, we use each region's B/M breakpoints to allocate its stocks to the global portfolios. Similarly, we use regional momentum breakpoints (described below) when forming global size-momentum portfolios.

For each region, the intersection of the independent 2x3 sorts on size and B/M produces six portfolios, SG, SN, SV, BG, BN, and BV, where S and B indicate small or big and G, N, and V indicate growth, neutral, and value (bottom 30%, middle 40%, and top 30% of B/M) respectively. We compute monthly value-weight returns for each portfolio from July of year t to June of $t+1$. The size factor, SMB, for a region is the equal-weight average of the returns on the three small stock portfolios from the 2x3 size-B/M sorts for the region minus the average of the returns on the three big stock portfolios. For each region, we construct value – growth returns for small and big stocks, $HML_S = SV - SG$ and $HML_B = BV - BG$, and HML is the equal-weight average of HML_S and HML_B .

As in Fama and French (1993), at the end of June of each year we also construct 25 size-B/M portfolios for each region, to be used as LHS assets in asset pricing regressions. The size breakpoints for a region are the 3rd, 7th, 13th, and 25th percentiles of the region's aggregate market capitalization. (These correspond roughly to the average market caps for the NYSE quintile breakpoints for size used in Fama and French (1993).) The B/M breakpoints in the 5x5 sorts follow the same rules as the 2x3 sorts, except we use the separate quintile B/M breakpoints (rather than 30-40-30 splits) for big (top 90% of market cap) stocks in each region to allocate the region's big and small stocks. The 25 value-weight size-B/M portfolios for the region are the intersections of the independent 5x5 size and B/M sorts.

We do 2x3 and 5x5 sorts on size and momentum using the same breakpoint conventions as the size-B/M sorts, except that the size-momentum portfolios are formed monthly and the lagged momentum return takes the place of B/M. For portfolios formed at the end of month t , the lagged momentum return is a stock's average monthly return for $t-11$ to $t-1$. (Skipping the sort month is standard in momentum tests.) The intersection of the independent 2x3 sorts on size and momentum produces six value-weight portfolios, SL, SN, SW, BL, BN, and BW, where S and B indicate small and big, and L, N, and W indicate losers, neutral, and winners (bottom 30%, middle 40%, and top 30% of lagged momentum). In the 2x3 sorts we construct winner – loser returns for small and big stocks, $WML_S = SW - SL$ and $WML_B = BW - BL$, and WML is the equal-weight average of WML_S and WML_B. The intersections of the independent 5x5 size and momentum sorts for a region produce 25 value-weight portfolios, to be used as LHS assets in asset pricing regressions. The first momentum sort absorbs a year of data, so the sample period for all tests is November 1990 through September 2010 (henceforth 1991-2010).

III. Summary Statistics

We begin by examining summary statistics for the RHS explanatory returns in our asset pricing regressions. We then turn to the 25 portfolios formed on size and B/M, and the 25 size-momentum portfolios that are the LHS assets in the regressions.

A. Explanatory Returns

Equity premiums for 1991-2010 (the average differences between monthly value-weight market returns and the one-month U.S. Treasury bill rate) are large in three of the four regions, ranging from 0.52% per month in Europe to 0.86% in Asia Pacific. Japan is the exception, with a negative premium of -0.15% per month. As usual, the estimates of equity premiums are imprecise. The equity premiums for our sample period of 20+ years are above the traditional two-standard-error bound in only two of the four regions, Asia Pacific and North America. The global premium, a respectable 0.39% per month despite Japan's poor return, is 1.37 standard errors from zero.

There is no size premium in any region during our sample period. Average SMB returns are of random sign and all are close to zero. In contrast, there are value premiums everywhere. Average HML returns for the four basic regions range from 0.35% per month ($t = 1.51$) for North America to 0.76% ($t = 3.51$) for Asia Pacific. Echoing Loughran's (1995) results for the U.S., value premiums are larger for small stocks. The exception is Japan, where the value premium is similar for small and big stocks, 0.43% ($t = 2.13$) and 0.47% per month ($t = 1.90$). The average global HML return is 0.46% per month ($t = 2.83$), but the premium for small stocks 0.68% ($t = 3.71$) is much larger than the premium for big stocks, 0.24% ($t = 1.34$), and the difference, 0.44% per month, is 2.79 standard errors from zero.

The evidence that international value premiums are larger for small stocks seems contrary to the results in Fama and French (2006). The sample of the earlier paper is, however, thin on small stocks. The more complete current sample suggests that larger value premiums for small stocks are typical.

There are similar size patterns in momentum returns that are common to all our regions except Japan. Like Asness, Moskowitz, and Pedersen (2009), we find strong momentum returns everywhere, except Japan. Average WML returns for the other three regions range from 0.67% per month ($t = 1.97$) for North America to 0.91% ($t = 3.29$) for Europe. Echoing previous results for the U.S. (Hong, Stein, and Lim (2000)), average WML returns for all regions except Japan are larger for small stocks. The global results are a good summary. The average global WML return is 0.61% per month ($t = 2.24$), the

result of 0.81% ($t = 3.01$) for small stocks and 0.42% ($t = 1.37$) for big stocks. The differences between average WML returns for small and big stocks exceed two standard errors for all regions, except Japan. For Japan, average WML returns are close to zero for small and big stocks.

B. Excess Returns for the 25 Size-B/M and the 25 Size-Momentum Portfolios

For a sample period preceding that used here, Fama and French (1993) find that the low returns of small U.S. growth stocks are a problem in their asset pricing tests. Part A of Table 2 shows that for our new 1991-2010 sample, low returns for small growth stocks are common to all regions except Japan. Japan aside, for extreme growth stocks (the left column of the 5x5 size-B/M matrices), the small stock portfolios have lower average returns than the big stock portfolios – a reverse size effect.

Japan aside, there is a standard size effect in the right column of the 5x5 size-B/M matrices; small extreme value (high B/M) stocks have higher average returns than big extreme value stocks. For every region including Japan, there are value premiums in all size groups; average returns increase from left to right in every row of the size-B/M matrices. But lower average returns of small stocks in the left column of the matrices for North America, Europe, and Asia Pacific combine with a typical size effect in the right column to produce larger value premiums for small stocks, especially microcaps. This common size pattern in value premiums is a major factor in our later rejections of the three-factor model (1).

Part B of Table 2 shows matrices of average excess returns for the 25 size-momentum portfolios of our four regions. For Japan there is no hint of momentum in any size group. For all other regions there are momentum returns in all size groups; average returns increase from left (last year's losers) to right (winners) in all rows of the 5x5 matrices. There is no consistent relation between average return and size in the first two columns of the matrices; losers lose similarly in all size groups. A typical size effect (higher average returns for small stocks) shows up in the fourth column of the matrices, and it is more evident in the fifth column. Thus, last year's winners show positive momentum returns in all size groups, but the persistence is stronger for small stocks, especially microcaps. The size pattern in momentum returns is a major factor in our eventual rejections of the four-factor model (2).

IV. Regressions for Size-B/M Portfolios

Tables 3 and 4 summarize regressions to explain excess returns on the portfolios from the 5x5 sorts on size and B/M. Table 3 shows the F-test of Gibbons, Ross, and Shanken (GRS, 1989) and other summary statistics for the regression intercepts for the four models we consider. Table 4 shows matrices of the intercepts and their t-statistics for selected models. (Detailed regression results are available on request.) For the global LHS portfolios we use only global explanatory returns. For the four regions, we examine results for local and global explanatory returns.

A. Global Models for Global Size-B/M Portfolio Returns

The regressions in which global portfolios provide both dependent and explanatory returns illustrate many of the asset pricing problems we encounter. Because the global LHS size-B/M portfolios are quite diversified, they identify the problems with precision. Moreover, if we use the correct asset pricing model, the tests to explain global returns with global factors provide evidence on whether asset pricing is integrated across our four developed regions. The tests that use global factors to explain returns for the four regions then give details about sources of success and failure.

The global CAPM fares poorly in our tests. The GRS statistic for the CAPM regressions, 4.54 in Table 3, is in the distant right tail of the relevant F-distribution, and the CAPM intercepts (Table 4) are always negative for extreme growth portfolios and positive for extreme value portfolios. The CAPM fails because market betas for the 25 global size-B/M portfolios (not shown) are, if anything, higher for growth than for value portfolios, the reverse of what is needed to explain the value premium in global returns.

Switching to the three-factor model (1) improves the description of average returns on the global portfolios; the GRS statistic falls to 4.02 and the average absolute intercept falls from 0.21% to 0.14%. Nevertheless, the GRS statistic is far above the 99.9% threshold of 2.26, and we confidently reject the global three-factor model. The rejection is due in part to tight regression fits. Adding the global SMB and HML returns raises the average R^2 from 0.81 for the CAPM to 0.95 for the three-factor model, and the average standard error of the intercepts falls by half, from 0.14% to 0.07%. But there are also three-

factor pricing problems. The global model leaves a value pattern in the intercepts for global microcaps (first row of the intercept matrix in Table 4), and it creates a reverse value pattern (positive intercepts for growth portfolios and negative for value portfolios) among megacaps (the last row). There is a simple story. Global value-growth spreads in average returns are larger for small stocks, especially microcaps (Table 2), but the spreads in three-factor HML slopes (not shown) are not wider for small stocks. Similar three-factor problems are observed for other regions where value premiums are larger for small stocks.

The global version of Carhart's (1997) four-factor model (2), which adds the global momentum return WML to the explanatory returns of the three-factor model (1), lowers the GRS statistic, from 4.02 for the three-factor model to 3.60, and the average absolute intercept falls from 0.14 to 0.12. But the four-factor model is still rejected, and its intercepts (Table 4) are similar to those from the three-factor model.

Like the three-factor model (1), the four-factor model (2) leaves a value pattern in the intercepts for microcaps and it creates a reverse value pattern among megacaps. In our later tests to explain the returns on portfolios formed on size and momentum, the more extreme momentum returns of smaller stocks, especially microcaps, lead to similar problems (a momentum pattern in the intercepts for microcaps and a reverse momentum pattern among megacaps) in the estimates of (2). Our response to these problems is to estimate a six-factor model that uses HML_S, HML_B, WML_S, and WML_B, the small and big components of HML and WML, as separate explanatory returns,

$$(3) \quad R_i(t) - RF(t) = a_i + b_i[RM(t) - RF(t)] + s_iSMB(t) \\ + h_{s_i}HML_S(t) + h_{b_i}HML_B(t) + w_{s_i}WML_S(t) + w_{b_i}WML_B(t) + e_i(t).$$

Regression (3) is overkill for explaining size-B/M returns; splitting WML into its small and big components doesn't add much. Likewise, splitting HML into its small and big components doesn't add much in the later tests on size-momentum returns. We focus on (3) to have a single model that potentially provides a unified story for value and momentum returns.

Data dredging is a concern in empirically motivated models like (1) and (2) that are directed at capturing observed patterns in average returns, and the concern is more serious when we split HML and

WML into small and big components in response to rejections of (1) and (2). We do not want the tests to degenerate into a search for the *ex post* MVE tangency portfolio implied by sample-specific patterns in average returns. Aware of this problem, we offer a justification for (3). Our goal is to capture the *ex ante* MVE tangency portfolio implied by the patterns in expected returns. Larger value and momentum premiums for small stocks are common to all our regions except Japan. If the value and momentum patterns in expected returns are in fact different for small and big stocks, (1) and (2) may have bad model problems that are cured in a parsimonious way by (3). At a minimum, estimates of (3) provide diagnostics that help us understand the shortcomings of (1) and (2).

The six-factor model (3) improves the explanation of returns on the 25 global size-B/M portfolios. The GRS statistic falls from 3.60 for the four-factor model to 2.61, and the average absolute six-factor intercept is a respectable 0.11%. But in part due to the tight fit of the six-factor regressions – the average R^2 is 0.96 and the average standard error of the intercepts is 0.07% – the GRS test rejects with confidence. The matrix of intercepts (Table 4) provides perspective. Microcaps are the global six-factor model's big challenge. Though weaker than the pattern left by the four-factor model, a value pattern remains in the six-factor intercepts for microcaps, with estimates of -0.17% for microcap growth and 0.23% for microcap value. The model has almost no problems with in the three largest size quintiles; the absolute intercepts for all but one of these 15 portfolios are 0.15% or less. The intercepts for four of the five portfolios in the second (small) quintile also fall in this band.

The systematic intercept problems of the six-factor model (3) in the tests on global returns seem limited to microcaps. It is possible that for global size-B/M portfolios, (3) is a passable model for the four largest size quintiles, asset pricing is globally integrated for stocks in the four largest size quintiles, and the formal rejection of (3) is due either to the absence of integrated global pricing for microcaps or other bad model problems exposed by microcaps. As suggestive evidence, Table 3 summarizes tests on the intercepts from (3) for the global size-B/M portfolios when the microcap (first) row of the intercept matrix is deleted. Dropping microcaps causes the GRS statistic to fall from 2.61 to 2.34, which still

rejects – even if we ignore the selection bias created by omitting the quintile with the biggest problems. The tests, however, have substantial power (average R^2 is 0.96), and microcaps aside, the performance of the six-factor model seems acceptable. For example, without microcaps the average absolute intercept in (3) is 0.09, among the lowest in Table 3.

More interesting, without microcaps the global four-factor model performs as well as the six-factor model. The GRS statistic, 2.25, and the average absolute intercept, 0.09, just about match the no-microcap values for the six-factor model, 2.34 and 0.09. These results suggest that, microcaps aside, integrated global pricing and the four-factor model are a passable story for global size-B/M portfolio returns – an attractive conclusion, given the data dredging concerns raised by the six-factor model.

It is possible that global LHS portfolios, which mix assets from our four basic regions, conceal asset pricing problems. For example, the expected returns of the assets of a region (e.g., North America) may not be captured well by global RHS portfolios, but this information may be buried in tests that use global LHS portfolios. To check this possibility, we turn now to regressions that use global RHS returns to explain the returns on LHS portfolios for each of the four basic regions.

B. Global Models for Regional Size-B/M Portfolio Returns

When the tests include microcaps, the GRS statistic (Table 3) cleanly rejects the global versions of the CAPM, the three-factor model (1), and the four-factor model (2) for the size-B/M portfolio returns of North America, Europe, and Asia Pacific. The six-factor model (3) fares better, producing a strong rejection only in the Asia Pacific tests, and marginal rejections for North America and Europe. Again, microcaps are a problem. When microcaps are dropped, the GRS statistics improve and, if we continue to ignore the selection bias, only the Asia Pacific tests clearly reject the global six-factor model. Once again, with microcaps out, the six-factor model is not systematically better than the four-factor model on the GRS test, and without microcaps the average absolute intercepts are smaller for the four-factor model. Thus, the tests on regional LHS size-B/M returns seem roughly consistent with the earlier conclusion that,

microcaps aside, integrated four-factor global pricing is a reasonable approximation for size-B/M portfolio returns.

There are, however, power problems in the tests to explain regional size-B/M returns with global factors. Japan is the extreme case. Judged on the GRS test, the four global models pass easily when asked to explain Japanese size-B/M portfolio returns. The four GRS statistics (Table 3) are safely below 1.41, the 90% percentile of the relevant F-distribution. But the power of the tests is low. Average R^2 ranges from 0.28 for the CAPM regressions to 0.42 for the six-factor model, and the standard error of the intercepts averages 0.38% or higher. Moreover, the intercepts (not shown) in the regressions for all Japanese portfolios and all global models are negative, and the average intercepts (Table 3) are strongly negative, from -0.49% per month to a huge -1.02%. Thus, in economic terms, the global models fail badly for Japan. The problem traces to low average excess returns on the 25 Japanese size-B/M portfolios (Table 2) combined with slopes close to 1.0 (not shown) for the global market excess return, which has a large positive average value. As a result, average returns on the Japanese size-B/M portfolios are far lower than predicted by the global models. We can't reject global CAPM, three-factor, four-factor, or six-factor pricing for Japan, but we can't imagine an application in which it is sensible to apply the global models to Japanese returns.

Global models also have problems in the regressions to explain size-B/M returns for other regions. With global explanatory returns, the average R^2 values are lowest for Japan, but they are also low for Asia Pacific (around 0.55), and for North America and Europe (around 0.75, versus 0.95 in the regressions to explain the global size-B/M portfolio returns). With global explanatory returns, the average standard errors of the intercepts for Asia Pacific size-B/M portfolios (around 0.35) are similar to the averages for Japan. The averages for the size-B/M portfolios of North America and Europe are lower (around 0.20), but still large. Finally, with global explanatory returns, there is an average intercept problem in the regressions for North America like that in the Japan tests, but of opposite sign. The NA intercepts are systematically positive and large (around 0.40), and as in Japan, the extreme NA intercepts

are common to all size groups, not just microcaps. Again, we can't imagine an application in which it is sensible to apply global models to NA returns.

Extreme average intercepts in the estimates of global models on the size-B/M portfolio returns of Japan and North America suggest that differences in the level of average returns in the four regions are a problem for the global models. As a check, we use the global models to explain the market portfolio returns of the regions. Despite poor regression fits (the average R^2 is 0.68) the GRS test (Table 5) rejects the global CAPM for the market returns of the four regions at the 90% level. The GRS test comes close to rejecting the global three-, four-, and six-factor models for regional market returns at the 95% level. Once again, the intercepts for the North America market return are large and positive (0.24% to 0.34%) in the four global models in Table 5, and the intercepts for Japan are large and negative (-0.51% to -0.89%). Solnik (1974), Harvey (1991), and Fama and French (1998) fail to reject the global CAPM as a model for country market returns. Our stronger evidence against global models for regional market portfolio returns may be specific to our sample period, but enhanced power is also a possibility. Previous papers typically use LHS market portfolios for many countries. In multiple comparisons tests like GRS, more LHS portfolios can imply less power. Collapsing countries into four regions, with a presumption of integrated pricing in each region, reduces the power loss.

In short, poor regression fits and large intercepts suggest that global models do not do well when asked to explain the returns on regional size-B/M portfolios. We see next that local (regional) models are better for that task.

C. Local Models for Regional Size-B/M Portfolio Returns

The GRS statistic (Table 3) testing whether the Japanese market, SMB, and HML returns capture the average returns for the 25 Japanese size-B/M portfolios, 0.71, is below the median of the relevant F-distribution, there are no notable patterns in the matrix of three-factor regression intercepts (Table 4), and the intercepts are almost all economically and statistically close to zero.

The GRS test suggests that the local CAPM also works in Japan. This failure to reject, however, is probably due to low power. The average R^2 from the CAPM regressions is only 0.78, the average standard error of the intercepts is 0.22%, the average absolute intercept is 0.17%, and the CAPM leaves a strong value pattern in the (unreported) intercepts for all five size groups. Adding the three-factor model's SMB and HML returns pushes the average R^2 up to 0.93, shrinks the average standard error of the intercepts to 0.12%, and lowers the average absolute intercept to 0.10%. The local four- and six-factor models do not improve the explanation of the Japanese size-B/M average portfolio returns provided by the local three-factor model. This is not surprising since Japan is the only region where there is no momentum and there is no size pattern in value premiums (Table 2).

Judged by GRS statistics, the local six-factor model is the choice for returns on the 25 European size-B/M portfolios. The GRS test (Table 3) says that the European version of the CAPM does not capture the cross-section of average returns for the region's 25 size-B/M portfolios, and there is a value pattern in the (unreported) CAPM intercepts. The European three-factor model does better, but the regressions leave a value pattern in the intercepts for microcaps, and they create a reverse value pattern for megacaps. The added flexibility of the six-factor model allows it to absorb these patterns in the intercepts. There are no apparent patterns in the six-factor intercepts and the average absolute intercept is only 0.10% per month. As a result, the GRS statistic for the European six-factor model is only 1.33.

Despite the six-factor model's GRS victory, one might argue that for applications, the average absolute intercept is a better metric. On this score, the six-factor model is no better than the three-factor model in Europe; the average absolute intercept is 0.09 for both (and for the local four-factor model). The six-factor model absorbs the microcap and megacap patterns in the three-factor intercepts, but it pushes other intercepts away from zero (Table 4). The European six-factor model also does not offer much more explanatory power than the three-factor model. The average R^2 for the 25 European size-B/M portfolios is 0.93 for the three-factor model and 0.94 for the six-factor model, and the average standard error of the

intercepts is actually lower for the three-factor model, 0.09% versus 0.10%. In short, there is little net benefit for the European six-factor model relative to the three-factor model.

The six-factor model also wins the GRS contest in Asia Pacific, but it is a hollow victory. The problem is power. The GRS statistic is a large 2.28 for the Asia Pacific CAPM and it declines as we add factors, from 1.82 and 1.42 for the three- and four-factor models to 1.03 for the six-factor model. Thus, the GRS test easily rejects the CAPM, it struggles to reject the three- and four-factor models, and it provides no evidence against the six-factor model. Like the regressions for the other three local models, however, the six-factor AP regressions are imprecise and the estimated intercepts are economically far from zero; the average R^2 is 0.87, the average standard error of the intercepts is 0.19%, and the average absolute intercept is least 0.18%. Imprecision creates a quandary: the six-factor intercepts may be far from zero because they are imprecise or because the six-factor model does not describe Asia Pacific expected returns.

The local three-, four-, and six-factor models for Japan, Europe, and Asia Pacific share a common feature: dropping microcaps does not produce big improvements in the GRS statistic, and the average absolute intercept falls by at most 0.01. We see next that microcaps are a bigger problem in the tests of local models for North American size-B/M portfolio returns.

Since the three-factor model was developed to explain the returns on U.S. size-B/M portfolios, it is ironic that in the tests of local three-factor models, the GRS statistic most strongly rejects for North America. The rejection is not news (Fama and French (1993)). The patterns in the NA three-factor intercepts are like those that show up in the local three-factor models for all regions except Japan; that is, the three-factor model leaves a value pattern in the intercepts for microcap portfolios and it creates a reverse value pattern in the intercepts for megacaps (Table 4). The local NA six-factor model produces a big improvement in the GRS statistic, but it is still rejected at the 97.5% level. The six-factor model leaves a smaller but noticeable value pattern in microcap intercepts. Dropping microcaps causes the average absolute intercept for the six-factor model to fall from 0.10 to 0.08, and the GRS statistic falls

from 1.79 to 1.17. With microcaps out, however, the GRS statistic for the local NA four-factor model also falls a lot, from 2.42 to 1.29, and the average absolute four-factor intercept, 0.09, is close to the 0.08 of the six-factor model. It seems reasonable to conclude that, except for microcaps, the North American four-factor model does an acceptable job explaining the returns on NA size-B/M portfolios.

In short, local three-factor models are passable stories for average returns on local size-B/M portfolios in Japan and Europe. Subject to a caveat about low precision, the local six-factor model is the choice for Asia Pacific. Microcaps do not have a special role in the local models for Japan, Europe, and Asia Pacific, but microcaps are important in the rejections of all local models for North America. Microcaps aside, the local four-factor model does a reasonable job explaining size-B/M portfolio returns for North America, and it is tempting to conclude that North America is an important contributor to the earlier similar conclusion from the tests of global models on global size-B/M portfolios.

IV. Regressions for Size-Momentum Portfolios

Table 6 summarizes regressions to explain excess returns on size-momentum portfolios. The intercepts for selected models are in Table 7. Preliminary tests on international returns confirmed earlier U.S. results (Fama and French (1996)) that the CAPM and the Fama-French three-factor model (1) fare poorly when the returns to be explained have momentum tilts. To save space, we show results here only for the four-factor model (2) and the six-factor model (3), which include momentum explanatory returns. We begin again with the results for the global region.

A. Global Models for Global Size-Momentum Portfolio Returns

In the regressions to explain returns on the 25 global size-momentum portfolios with global explanatory returns, the GRS test (Table 6) rejects the four-factor model. Table 7 shows that the four-factor model leaves a momentum pattern in the intercepts for microcaps and creates a reverse momentum pattern (positive intercepts for losers and negative for winners) for megacaps. The patterns are due to a combination of (i) stronger momentum returns for microcaps (Table 2) and (ii) WML slopes for losers and winners (not shown) that are at least as extreme for megacaps as for microcaps. The six-factor model

(3), which splits WML into its small and big components, seems suited to absorb the patterns in the four-factor intercepts for microcaps and megacaps. But the model is not a panacea. The GRS statistic (Table 6) fall from 4.40 for the four-factor model to 3.39, but it still cleanly rejects global six-factor pricing.

As with the global size-B/M tests above, the rejections of the global four- and six-factor models in the global size-momentum tests are attributable in part to the tight fit of the regressions. The average R^2 is 0.94 in the four-factor regressions and 0.95 in the six-factor regressions, and the average standard error of the intercepts is 0.08% for both models. As a result, even moderate violations of the models are easily detected. And there are violations. The intercepts for four of the five microcap portfolios (Table 7) are at least 0.20% per month in both the four-factor and the six-factor regressions, and the largest, for microcap extreme winners, are 0.80% ($t = 6.56$) and 0.61% ($t = 5.25$). The models are more successful in the four larger size quintiles. Despite the reverse momentum pattern in the four-factor intercepts for megacaps, the four- and six-factor intercepts for quintiles 2-5 are generally small. When microcaps are dropped, the average absolute intercept falls from 0.14 to 0.09 for the four-factor model and 0.10% for the six-factor model. Note that without microcaps, which are a problem for both models, the four-factor model again performs as well as the six-factor model.

The parallels between the global size-momentum regressions and the regressions for global size-B/M portfolios (Tables 3 and 4) are apparent. There are also parallels between the regressions that use global models to explain regional size-momentum returns and regional size-B/M returns. Again, the GRS test easily rejects the global four- and six-factor models in regressions to explain size-momentum returns in North America, Europe, and Asia Pacific. The GRS statistics for Japan are smaller, but echoing our earlier results, low R^2 (0.36 and 0.43) and high average standard errors for the intercepts (0.38% for both models) suggest lack of power. Again, the Japanese intercepts are far from the predicted value of zero, with average absolute values of 0.56% and 0.98% per month for the four- and six-factor models. The average absolute intercepts for the other regions are smaller, but all are far from zero.

In short, as in the tests on regional size-B/M returns, global models fail to explain average returns on the size-momentum portfolios of our four regions. There is thus little support for integrated global pricing for the size-momentum or size-B/M patterns in international average returns, at least with the empirical asset pricing models we use.

B. Local Models for Regional Size-Momentum Portfolio Returns

The Carhart (1997) four-factor model (2) is commonly used in research on U.S. returns. Table 6 says the GRS test rejects the local four-factor model in tests on the 25 North American size-momentum portfolios. The intercepts in Table 7 suggest that microcaps are again the problem. The four-factor model leaves a momentum pattern in the intercepts for microcaps; the intercepts increase from -0.07% for the prior year's biggest losers to 0.75% ($t = 4.87$) for the biggest winners. The intercepts for the four larger size groups are much smaller. There is a mild reverse momentum pattern in the intercepts for megacaps, but the average absolute intercept for the four larger quintiles is only 0.10%, all intercepts are within 0.19% of zero, and the GRS statistic for these 20 portfolios is only 1.20. The six-factor model eliminates the mild reverse momentum pattern in megacaps and shrinks the momentum pattern in microcaps a bit, but there is no improvement in the average absolute intercept, so there is no overall gain from moving to six factors. Given these results, one might conclude that the local four-factor model (2) is reasonable for North American applications to portfolios that are not tilted toward microcaps.

The local six-factor model is more important for the European size-momentum portfolios. The four-factor model leaves a huge momentum spread of 1.19% per month between winner and loser intercepts for microcaps, the spread is 0.74% in quintile two, and the model creates a reverse momentum spread of -0.73% for megacaps. Switching to the six-factor model shrinks the momentum pattern in the intercepts for European microcaps and eliminates the patterns in the second and fifth quintiles. But the six-factor model creates new problems in the third and fourth size quintiles. Three of the ten intercepts are at least 0.25% from zero, with t -statistics of 2.13 or greater. The net result of switching from the four- to the six-factor model is a reduction in the average absolute intercept from 0.19% to 0.14%; the GRS

statistic also falls, from 3.54 to 2.28, which still rejects. Dropping microcaps causes the average absolute intercept to fall to a moderate 0.12, which, given the rather random distribution of intercepts for the four largest quintiles, perhaps suggests that the local six-factor model can be used to explain the average returns on European portfolios that have momentum tilts but are not dominated by microcaps.

There is no evidence of momentum in Japanese returns (Table 2), so it is not surprising that Japan provides a rare case where the CAPM, with a local market portfolio, is a good model for average returns on size-momentum portfolios. (The GRS statistic, not shown, is only 0.75.) It is also not surprising that the local four- and six-factor models do little to improve the CAPM's explanation of average Japanese returns. Thus, from an asset pricing perspective, there is no reason to prefer the four- or six-factor models over the simpler CAPM as the story for average returns on the Japanese size-momentum portfolios.

In applications, however, model fit is typically important for power, and the local momentum factor does capture variation in monthly Japanese size-momentum portfolio returns. Adding WML increases the average R^2 from 0.87 in the three-factor regressions (unreported) to 0.92 in the four-factor regressions. This is similar to the marginal explanatory power of local WML returns in the other regions, which show strong positive average WML returns. Since there is a large value premium in Japanese average returns, there is a good case for the four-factor model in applications in which there may be value and momentum tilts. The Japanese six-factor model, however, provides no additional benefits.

As in the size-B/M tests, the local Asia Pacific factors lack power in regressions to explain the returns on Asia Pacific size-momentum portfolios. The average R^2 is 0.84 in the four-factor regressions and 0.85 in the six-factor regressions, and the average standard error of the intercepts is 0.21% in both models. Many of the intercepts are far from zero, however, and despite the imprecision of the estimates, the GRS test is able to reject both models with ease.

V. Summary and Conclusions

There are common patterns in average returns in developed markets. Echoing earlier studies, we find value premiums in average returns in all four regions we examine (North America, Europe, Japan,

and Asia Pacific), and there are strong momentum returns in all regions except Japan. Our new evidence centers on how international value and momentum returns vary with firm size. Except for Japan, value premiums are larger for small stocks. The spreads in momentum returns also decrease from smaller to bigger stocks. In Japan there is no hint of momentum returns in any size group.

We test whether the value and momentum patterns in average returns are captured by empirical asset pricing models and whether such models suggest that asset pricing is integrated across regions. For evidence on market integration we examine how well global explanatory returns capture average returns for global portfolios and for portfolios of the four regions.

In the tests of global models on global size-B/M and size-momentum portfolio returns, the GRS test rejects the hypothesis that the true intercepts are zero, but, microcaps aside, the intercepts for the global four-factor model (2) suggest that it is a passable story for average returns on global size-B/M and size-momentum portfolios. We would be comfortable using the global four-factor model in applications to explain the returns on global portfolios – for example, to evaluate the performance of a mutual fund that holds a global portfolio of stocks – as long as the portfolio does not have a strong tilt toward microcaps. This is the good news about global models and integrated asset pricing.

Unfortunately, rejections on the GRS test and large average absolute intercepts suggest that the global models do not do well when we ask them to explain the returns on regional size-B/M or size-momentum portfolios. This is bad news, perhaps damning news, for our global models. It suggests shortcomings of integrated pricing across our four regions – or other bad model problems.

The failure of global models in tests to explain regional returns is one motivation for examining the performance of local models. Local models are also attractive for applications because they provide better fits and thus more precise parameter estimates than global models. The winning models differ some from region to region, but with the possible exception of Asia Pacific, each region has one or two models that are passable, but with some caveats.

Japan is the cleanest case. The local three-factor model is an excellent story for the average returns on the local size-B/M portfolios of Japan. Momentum is not an issue in Japanese average returns, but the local momentum (WML) factor captures lots of variation in monthly returns. Thus, for enhanced power, the local four-factor model may be a better choice for Japanese assets that potentially have momentum and value/growth tilts. We conclude that for Japan the local three- and four-factor models are excellent stories for returns, and asset pricing is integrated within Japan.

The local three-factor model also performs well on European size-B/M portfolios, and the model is quite acceptable for applications in which momentum tilts are absent. European momentum returns are a bigger challenge. The local six-factor model is perhaps an acceptable story for the average returns on the European size-momentum portfolios, but the case is not strong, and applications in which the assets or portfolios to be evaluated have strong momentum tilts can be problematic. One possibility is that there is integrated pricing across the 14 countries of Europe with respect to the value/growth patterns in returns, but whatever underlies momentum is not priced in the same way across countries. It is, of course, also possible that there are other bad model problems exposed by momentum returns.

Microcaps aside, the four-factor model does a passable job explaining size-B/M and size-momentum portfolio returns for North America. North America is surely an important contributor to the similar conclusion from the tests of global models on global size-B/M and size-momentum portfolios. We are comfortable with the local four-factor model for applications to NA returns, as long as there are not strong tilts toward microcaps. Moreover, asset pricing seems to be integrated within North America (US plus Canada), but perhaps with the exclusion of microcaps. Again, however, microcaps may just expose other problems of the local NA models.

The local four- and six-factor models are statistically acceptable on the GRS tests for Asia Pacific size-B/M portfolio returns. Low precision is, however, a serious issue, and large average absolute intercepts suggest that the models are not attractive for applications. Despite low precision, the tests on

Asia Pacific size-momentum portfolios reject four- and six-factor asset pricing. All this raises serious doubt about whether the four Asia Pacific countries are an integrated market.

Finally, we have done lots of unreported robustness checks. Most notably, we have examined 5x5 and 2x3 sorts on size and different value variables, specifically, earnings-price (E/P) ratios and variants of cashflow to price (CF/P) ratios, in lieu of the sorts on size and B/M. Details differ, but the patterns in size-B/M average returns show up with the other value variables. For example, there is a size pattern in average value premiums in the sorts on E/P and CF/P, but it is somewhat weaker than in the sorts on B/M. The SMB, HML, HML_S, and HML_B explanatory returns from each of the 2x3 sorts on the different value variables also lead to similar conclusions when used in tests on the 5x5 size-B/M, size-E/P, size-CF/P, and size-momentum portfolios, except that (not surprisingly) regression fits are a little tighter when the tests use the same value variable in the sorts that produce the LHS and RHS returns.

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Table 1 – Summary statistics for explanatory returns: November 1990 – September 2010, 239 months

We examine regional portfolios for North America, Europe, Japan, and Asia Pacific (excluding Japan) and Global portfolios, which combine the four regions. We form portfolios at the end of June of each year t by sorting stocks in a region into two market cap and three book-to-market equity (B/M) groups. Big stocks are those in the top 90% of market cap for the region, and small stocks are those in the bottom 10%. The B/M breakpoints for the four regions are the 30th and 70th percentiles of B/M for the big stocks of a region. The global portfolios use global size breaks, but we use the B/M breakpoints for the four regions to allocate the stocks of these regions to the global portfolios. The independent 2x3 sorts on size and B/M produce six value-weight portfolios, SG, SN, SV, BG, BN, and BV, where S and B indicate small or big and G, N, and V indicate growth, neutral, and value (bottom 30%, middle 40%, and top 30% of B/M). SMB is the equal-weight average of the returns on the three small stock portfolios for the region minus the average of the returns on the three big stock portfolios. We construct value – growth returns for small and big stocks, $HML_S = SV - SG$ and $HML_B = BV - BG$, and HML is the equal-weight average of HML_S and HML_B. The 2x3 sorts on size and lagged momentum are similar, but the size-momentum portfolios are formed monthly. For portfolios formed at the end of month t , the lagged momentum return is a stock's average monthly return for $t-11$ to $t-1$. The independent 2x3 sorts on size and momentum produce six value-weight portfolios, SL, SN, SW, BL, BN, and BW, where S and B indicate small and big and L, N, and W indicate losers, neutral, and winners (bottom 30%, middle 40%, and top 30% of lagged momentum). We construct winner – loser returns for small and big stocks, $WML_S = SW - SL$ and $WML_B = BW - BL$, and WML is the equal-weight average of WML_S and WML_B. Dif is the difference between HML_S and HML_B or WML_S and WML_B. All returns are in U.S. dollars. Market is the return on a region's value-weight market portfolio minus the U.S. one month T-bill rate. The mean value of the T-bill rate is 0.31%. Mean and Std Dev are the mean and standard deviation of the return, and t-Mean is the ratio of Mean to its standard error.

	Market	SMB	HML	HML_S	HML_B	Dif	WML	WML_S	WML_B	Dif
Global										
Mean	0.39	0.09	0.46	0.68	0.24	0.44	0.61	0.81	0.42	0.39
Std Dev	4.40	2.23	2.50	2.82	2.74	2.44	4.25	4.16	4.72	2.65
t-Mean	1.37	0.66	2.83	3.71	1.34	2.79	2.24	3.01	1.37	2.28
North America										
Mean	0.59	0.21	0.35	0.58	0.12	0.47	0.67	0.87	0.48	0.40
Std Dev	4.44	3.33	3.59	4.46	3.35	3.27	5.30	5.39	5.64	3.03
t-Mean	2.07	0.97	1.51	2.02	0.54	2.21	1.97	2.50	1.31	2.02
Europe										
Mean	0.52	-0.03	0.56	0.71	0.41	0.30	0.91	1.35	0.47	0.88
Std Dev	4.94	2.43	2.47	2.93	2.89	3.08	4.29	4.04	4.99	2.97
t-Mean	1.63	-0.22	3.50	3.74	2.20	1.50	3.29	5.18	1.46	4.58
Japan										
Mean	-0.15	-0.10	0.45	0.43	0.47	-0.04	0.06	-0.01	0.12	-0.13
Std Dev	6.05	3.53	2.96	3.15	3.84	3.76	4.79	4.38	5.93	4.12
t-Mean	-0.38	-0.44	2.36	2.13	1.90	-0.16	0.19	-0.03	0.32	-0.50
Asia Pacific										
Mean	0.86	-0.22	0.76	1.12	0.39	0.73	0.68	0.99	0.36	0.64
Std Dev	6.22	3.17	3.33	3.60	4.32	4.35	4.74	4.34	5.96	4.33
t-Mean	2.14	-1.09	3.51	4.81	1.41	2.58	2.20	3.54	0.93	2.28

Table 2 – Summary statistics for the 25 size-B/M and size-momentum excess returns for November 1990 – September 2010, 239 months.

At the end of June of each year t we construct 25 size-B/M portfolios for each region, to be used as LHS assets in asset pricing regressions. The size breakpoints for a region are the 3rd, 7th, 13th, and 25th percentiles of aggregate market cap for the region. The B/M breakpoints follow the same rules as in the 2x3 sorts, except that the separate quintile B/M breakpoints for big (top 90% of market cap) North American, European, Japanese, and Asia Pacific stocks are used to allocate the stocks of these regions to the global portfolios. The intersections of the 5x5 independent size and B/M sorts for each region produce 25 value-weight size-B/M portfolios. The 5x5 sorts on size and momentum use the same breakpoint conventions as the size-B/M sorts, except that the size-momentum portfolios are formed monthly. For portfolios formed at the end of month t , the lagged momentum return is a stock's average monthly return for $t-11$ to $t-1$. The intersections of the independent 5x5 size and momentum sorts produce 25 value-weight portfolios for each region.

Part A: Monthly Excess Returns for 25 Portfolios Formed on Size and B/M

	Mean					Standard Deviation				
	Low	2	3	4	High	Low	2	3	4	High
Global										
Small	0.01	0.44	0.75	0.78	1.10	6.04	5.63	5.22	4.74	4.45
2	0.01	0.46	0.55	0.59	0.72	5.92	5.40	4.74	4.39	4.56
3	0.14	0.33	0.43	0.49	0.74	5.84	5.27	4.65	4.53	4.69
4	0.32	0.36	0.44	0.55	0.64	5.74	4.68	4.51	4.49	4.86
Big	0.25	0.31	0.44	0.48	0.50	4.63	4.34	4.43	4.46	5.40
North America										
Small	0.41	0.66	1.12	0.96	1.36	8.64	7.24	6.81	5.57	5.50
2	0.21	0.60	0.85	0.83	1.00	7.91	6.90	5.75	4.96	5.28
3	0.77	0.61	0.81	0.75	0.99	7.42	6.17	5.19	4.69	5.06
4	0.79	0.63	0.80	0.79	0.87	7.10	5.41	4.77	4.80	4.95
Big	0.49	0.50	0.55	0.60	0.63	4.91	4.36	4.34	4.40	5.50
Europe										
Small	-0.20	0.31	0.43	0.61	0.86	5.93	5.59	5.21	4.99	4.94
2	0.09	0.47	0.46	0.68	0.82	6.16	5.59	5.00	5.11	5.29
3	0.13	0.48	0.63	0.51	0.96	5.91	5.30	5.32	5.31	5.49
4	0.37	0.52	0.54	0.61	0.83	5.55	4.97	5.07	5.25	5.80
Big	0.30	0.50	0.60	0.67	0.74	4.92	4.87	5.23	5.50	6.35
Japan										
Small	-0.31	-0.08	-0.08	-0.01	0.16	9.40	7.90	7.73	7.33	7.27
2	-0.44	-0.42	-0.20	-0.03	-0.05	8.39	7.84	7.20	7.12	7.26
3	-0.50	-0.33	-0.31	-0.19	0.08	7.93	7.09	6.79	6.49	7.00
4	-0.51	-0.25	-0.23	-0.04	0.00	7.51	6.51	6.09	6.02	6.91
Big	-0.37	-0.14	-0.08	0.11	0.36	7.01	5.98	6.16	6.12	7.26
Asia Pacific										
Small	0.22	0.60	0.78	1.11	1.92	8.62	8.14	7.56	7.66	9.15
2	-0.03	0.40	0.53	0.81	1.07	7.27	8.05	6.98	7.40	8.11
3	0.06	1.01	0.80	0.95	0.90	7.34	9.19	6.86	6.95	8.21
4	0.80	0.95	0.67	1.06	1.08	6.85	6.06	6.45	7.01	8.81
Big	0.67	0.93	0.91	0.91	1.29	6.44	6.36	6.42	7.02	8.54

Table 2, Part B: Monthly Excess Returns for 25 Portfolios Formed on Size and Momentum

	Mean					Standard Deviation				
	Low	2	3	4	High	Low	2	3	4	High
Global										
Small	0.20	0.69	0.77	1.13	1.56	6.46	4.46	3.98	4.11	5.47
2	0.13	0.46	0.51	0.70	1.10	6.74	4.69	4.24	4.19	5.58
3	0.24	0.42	0.51	0.51	0.80	6.67	4.93	4.28	4.24	5.55
4	0.20	0.41	0.49	0.52	0.80	6.64	4.81	4.20	4.23	5.38
Big	0.10	0.25	0.32	0.54	0.56	6.24	4.57	4.13	4.16	5.39
North America										
Small	0.49	0.89	1.17	1.44	1.95	7.76	5.08	4.77	5.26	7.20
2	0.44	0.88	0.94	0.90	1.46	7.96	5.22	4.84	4.90	7.49
3	0.48	0.69	0.81	0.99	1.21	7.49	5.15	4.50	4.75	6.93
4	0.43	0.73	0.80	0.75	1.22	7.34	4.80	4.34	4.43	6.56
Big	0.31	0.46	0.41	0.70	0.93	6.55	4.53	4.01	4.26	6.23
Europe										
Small	-0.26	0.34	0.49	1.05	1.79	6.62	4.88	4.61	4.47	5.62
2	-0.20	0.48	0.56	0.84	1.45	6.94	5.43	4.91	4.66	5.59
3	0.17	0.39	0.68	0.64	1.11	6.90	5.29	4.99	4.82	5.61
4	0.19	0.47	0.64	0.74	1.10	7.20	5.40	4.86	5.05	5.39
Big	0.24	0.43	0.61	0.64	0.70	7.40	5.65	4.78	4.75	5.54
Japan										
Small	0.12	0.18	0.08	0.16	-0.15	8.90	7.22	6.73	6.50	7.92
2	-0.16	-0.10	-0.05	-0.03	-0.15	8.80	7.11	6.61	6.70	7.38
3	-0.18	-0.24	-0.14	-0.07	-0.08	8.12	6.89	6.16	6.27	6.90
4	-0.17	-0.16	-0.16	-0.20	-0.07	8.04	6.58	6.13	5.96	6.70
Big	-0.11	-0.30	-0.40	-0.09	-0.09	8.24	6.61	6.18	5.90	6.86
Asia Pacific										
Small	0.74	1.15	1.35	1.93	1.83	8.65	7.09	6.51	6.92	8.19
2	-0.13	0.73	0.88	1.48	1.31	9.11	7.09	6.37	8.13	7.89
3	0.16	1.50	0.71	1.13	1.13	8.69	15.03	6.28	6.61	7.89
4	0.45	0.94	0.80	1.05	1.10	8.50	7.17	5.89	6.03	8.00
Big	1.05	0.70	1.00	1.14	1.08	8.48	7.19	6.51	6.44	6.93

Table 3 – Summary statistics for regressions to explain monthly excess returns on portfolios from sorts on size and B/M, with (5x5) and without (4x5) microcaps, November 1990 to September 2010

The regressions use the CAPM, Three-Factor (1), Four-Factor (2), and Six-Factor (3) models with Global and Local Factors to explain the returns on Global, North American, European, Japanese, and Asia Pacific portfolios formed on size and B/M. The 5x5 results include all five size quintiles, the 4x5 results exclude microcap portfolios. The GRS statistic tests whether all intercepts in a set of 25 (5x5) or 20 (4x5) regressions are zero; a is the average intercept; $|a|$ is the average absolute intercept; R^2 is the average adjusted R^2 ; and $s(a)$ is the average standard error of the intercepts. With 25 portfolios and 239 monthly returns, critical values of the GRS statistic for all four models are: 90%: 1.41; 95%: 1.56; 97.5%: 1.69; 99%: 1.86; and 99.9%: 2.26.

	Global Factors					Local Factors								
	5x5					4x5		5x5					4x5	
	GRS	a	a	R ²	s(a)	GRS	a	GRS	a	a	R ²	s(a)	GRS	a
CAPM														
Global	4.54	0.08	0.21	0.81	0.14	2.11	0.16							
North America	2.99	0.35	0.38	0.62	0.23	1.56	0.34	2.79	0.10	0.23	0.73	0.20	1.29	0.18
Europe	2.08	0.13	0.24	0.66	0.20	1.40	0.23	2.05	0.01	0.19	0.80	0.15	1.39	0.16
Japan	1.27	-0.48	0.49	0.28	0.39	1.36	0.51	0.93	0.00	0.17	0.78	0.22	0.96	0.18
Asia Pacific	2.42	0.36	0.46	0.48	0.35	1.90	0.44	2.28	-0.08	0.27	0.75	0.24	1.77	0.22
Three-Factor (1)														
Global	4.02	-0.04	0.14	0.95	0.07	2.69	0.11							
North America	2.68	0.35	0.35	0.75	0.19	1.94	0.32	2.72	-0.03	0.14	0.92	0.11	1.59	0.11
Europe	1.87	-0.07	0.12	0.75	0.18	1.23	0.11	1.67	-0.03	0.09	0.93	0.09	1.51	0.08
Japan	1.07	-0.68	0.68	0.35	0.38	1.13	0.69	0.71	-0.02	0.10	0.93	0.12	0.85	0.09
Asia Pacific	2.17	0.15	0.32	0.54	0.34	1.66	0.28	1.82	-0.02	0.26	0.86	0.19	1.81	0.25
Four-Factor (2)														
Global	3.60	-0.02	0.12	0.95	0.07	2.25	0.09							
North America	2.16	0.37	0.37	0.75	0.20	1.56	0.35	2.42	-0.00	0.12	0.92	0.11	1.29	0.09
Europe	1.84	-0.04	0.10	0.76	0.18	0.99	0.08	1.77	-0.01	0.09	0.93	0.10	1.50	0.08
Japan	1.04	-0.62	0.62	0.35	0.39	1.07	0.64	0.69	-0.02	0.09	0.93	0.12	0.83	0.09
Asia Pacific	1.78	0.13	0.29	0.54	0.35	1.33	0.25	1.42	0.03	0.22	0.86	0.19	1.32	0.21
Six-Factor (3)														
Global	2.61	0.01	0.11	0.96	0.07	2.34	0.09							
North America	1.49	0.44	0.44	0.75	0.21	1.04	0.39	1.79	0.04	0.10	0.93	0.11	1.07	0.08
Europe	1.56	0.16	0.17	0.77	0.19	1.05	0.16	1.33	0.01	0.09	0.94	0.10	1.22	0.08
Japan	1.00	-1.02	1.02	0.42	0.39	1.08	1.02	0.70	-0.01	0.10	0.94	0.11	0.84	0.09
Asia Pacific	1.83	-0.06	0.33	0.55	0.36	1.58	0.30	1.03	0.06	0.18	0.87	0.19	0.96	0.20

Table 4 Intercepts from CAPM, three-factor (1), four-factor (2), and six-factor (3) regressions to explain monthly excess returns on portfolios from 5x5 sorts on size and B/M, November 1990 to September 2010

The regressions use the CAPM, Three-Factor (1), Four-Factor (2), and Six-Factor (3) models with Global and Local Factors to explain the excess returns on Global, North American, European, Japanese, and Asia Pacific portfolios formed from independent size and B/M sorts. The table reports intercepts, a, and t-statistics, t(a), for the intercepts.

	a					t(a)				
	Low	2	3	4	High	Low	2	3	4	High
Global Size-B/M Returns Regressed on Global Factors										
CAPM										
Small	-0.42	0.03	0.37	0.42	0.77	-1.82	0.14	1.96	2.56	4.71
2	-0.44	0.03	0.18	0.24	0.37	-2.19	0.17	1.24	1.96	2.46
3	-0.32	-0.09	0.05	0.12	0.37	-1.93	-0.63	0.42	1.00	2.69
4	-0.15	-0.03	0.06	0.18	0.25	-0.96	-0.37	0.64	1.64	1.84
Big	-0.13	-0.06	0.06	0.10	0.06	-1.11	-0.93	0.83	1.10	0.42
Three-Factor (1)										
Small	-0.34	0.02	0.26	0.20	0.45	-3.36	0.18	2.66	2.79	6.00
2	-0.32	0.02	0.03	-0.05	-0.03	-3.98	0.35	0.52	-0.88	-0.54
3	-0.13	-0.10	-0.14	-0.19	-0.02	-1.77	-1.47	-1.89	-2.72	-0.30
4	0.07	-0.11	-0.13	-0.10	-0.13	0.90	-1.44	-1.97	-1.26	-1.84
Big	0.20	-0.00	-0.05	-0.08	-0.23	3.24	-0.04	-0.79	-1.36	-2.64
Four-Factor (2)										
Small	-0.35	0.03	0.26	0.19	0.41	-3.39	0.33	2.56	2.59	5.43
2	-0.25	0.07	0.04	-0.02	-0.02	-3.14	0.93	0.63	-0.44	-0.28
3	-0.09	-0.11	-0.09	-0.14	-0.01	-1.16	-1.46	-1.20	-2.05	-0.15
4	0.07	-0.07	-0.12	-0.05	-0.08	0.80	-0.92	-1.73	-0.64	-1.03
Big	0.22	-0.02	-0.03	-0.08	-0.14	3.53	-0.39	-0.48	-1.29	-1.63
Six-Factor (3)										
Small	-0.17	0.18	0.29	0.14	0.23	-1.70	1.81	2.75	1.89	3.25
2	-0.12	0.22	0.07	-0.07	-0.15	-1.66	3.33	0.94	-1.30	-3.27
3	0.01	-0.04	-0.08	-0.18	-0.09	0.12	-0.48	-1.07	-2.40	-1.27
4	0.15	-0.10	-0.14	-0.08	-0.02	1.76	-1.24	-1.99	-1.05	-0.24
Big	0.04	-0.07	0.04	0.01	0.09	0.82	-1.07	0.63	0.09	1.40

Table 4 (continued)

	a					t(a)				
	Low	2	3	4	High	Low	2	3	4	High
North American Size-B/M Returns Regressed on North American Factors										
Three-Factor (1)										
Small	-0.43	-0.14	0.27	0.12	0.40	-2.51	-1.00	1.59	1.33	4.54
2	-0.46	-0.15	0.02	-0.03	-0.01	-3.77	-1.50	0.19	-0.41	-0.15
3	0.11	-0.18	0.03	-0.08	0.05	0.89	-1.58	0.30	-0.77	0.58
4	0.23	-0.07	0.04	-0.02	-0.04	1.76	-0.62	0.41	-0.16	-0.40
Big	0.16	-0.00	-0.09	-0.08	-0.29	2.17	-0.00	-1.10	-0.89	-2.65
Four-Factor (2)										
Small	-0.42	-0.11	0.26	0.13	0.37	-2.41	-0.81	1.53	1.49	4.13
2	-0.34	-0.12	0.03	0.00	0.01	-2.95	-1.13	0.35	0.06	0.16
3	0.05	-0.14	0.09	-0.02	0.07	0.40	-1.23	0.86	-0.19	0.73
4	0.20	-0.03	0.05	0.02	0.02	1.51	-0.28	0.45	0.22	0.27
Big	0.18	-0.00	-0.05	-0.04	-0.24	2.32	-0.01	-0.60	-0.47	-2.21
Six-Factor (3)										
Small	-0.26	0.06	0.27	0.08	0.24	-1.53	0.44	1.48	0.91	2.68
2	-0.16	0.03	0.04	-0.02	-0.11	-1.45	0.30	0.35	-0.20	-1.48
3	0.27	-0.08	0.09	0.01	0.00	2.23	-0.69	0.76	0.08	0.02
4	0.27	0.05	0.05	0.07	0.09	2.04	0.48	0.47	0.55	1.02
Big	0.02	-0.01	-0.01	0.12	-0.02	0.27	-0.18	-0.15	1.33	-0.24
European Size-B/M Returns Regressed on European Factors										
Three-Factor (1)										
Small	-0.38	-0.00	0.03	0.07	0.18	-3.03	-0.01	0.34	0.91	2.26
2	-0.13	0.03	-0.08	-0.00	-0.02	-0.98	0.39	-1.07	-0.05	-0.25
3	-0.10	-0.02	0.00	-0.25	0.10	-0.87	-0.23	0.03	-2.91	0.94
4	0.09	-0.01	-0.11	-0.16	-0.11	0.81	-0.06	-1.34	-1.60	-1.13
Big	0.13	0.09	0.04	-0.03	-0.19	1.59	1.01	0.50	-0.34	-1.60
Six-Factor (3)										
Small	-0.18	0.14	0.13	0.05	0.08	-1.48	1.26	1.31	0.59	1.00
2	0.01	0.16	-0.12	-0.08	-0.14	0.04	1.74	-1.54	-0.95	-2.07
3	0.09	-0.05	0.04	-0.21	0.19	0.76	-0.50	0.28	-2.26	1.59
4	0.20	-0.08	-0.05	-0.10	0.02	1.64	-0.79	-0.54	-0.91	0.19
Big	0.03	-0.02	0.06	0.05	-0.02	0.39	-0.23	0.65	0.48	-0.19
Japanese Size-B/M Returns Regressed on Japanese Factors										
Three-Factor (1)										
Small	0.03	0.14	0.11	0.13	0.17	0.16	0.95	0.76	1.34	1.68
2	-0.06	-0.18	-0.05	0.07	-0.10	-0.37	-1.45	-0.49	0.76	-1.48
3	-0.11	-0.03	-0.20	-0.15	0.02	-0.74	-0.23	-2.01	-1.55	0.29
4	-0.13	-0.04	-0.15	-0.09	-0.10	-0.87	-0.33	-1.24	-0.83	-0.93
Big	0.06	-0.03	-0.06	0.03	0.19	0.52	-0.28	-0.56	0.25	1.10

Table 4 (continued)

	a					t(a)				
	Low	2	3	4	High	Low	2	3	4	High
Asia Pacific Size-B/M Returns Regressed on Asia Pacific Factors										
Three-Factor (1)										
Small	-0.21	0.05	0.17	0.36	0.83	-0.79	0.26	1.11	2.33	2.54
2	-0.51	-0.30	-0.18	-0.05	-0.11	-2.64	-1.84	-1.24	-0.32	-0.67
3	-0.46	0.37	0.15	0.09	-0.40	-2.41	0.92	0.84	0.54	-1.83
4	0.22	0.32	0.02	0.13	-0.41	1.27	2.06	0.11	0.73	-1.91
Big	0.12	0.19	-0.01	-0.41	-0.46	0.87	1.63	-0.05	-2.94	-2.18
Six-Factor (3)										
Small	0.05	0.11	0.07	0.37	-0.01	0.19	0.56	0.44	2.24	-0.02
2	-0.16	0.05	-0.12	0.03	-0.15	-0.86	0.29	-0.78	0.19	-0.85
3	-0.19	0.39	0.22	0.21	-0.38	-0.98	0.93	1.16	1.13	-1.69
4	0.39	0.37	0.26	0.28	-0.08	2.15	2.19	1.46	1.46	-0.34
Big	-0.24	0.12	0.10	-0.12	-0.04	-1.97	0.93	0.76	-0.88	-0.21

Table 5 Summary statistics and intercepts for CAPM, three-factor (1), four-factor (2), and six-factor (3) regressions to explain monthly excess returns on value-weight market portfolios for North America, Europe, Japan, and Asia Pacific with global factors, November 1990 to September 2010

The GRS statistic, in Part A, tests whether all intercepts in a set of four regressions are zero; a is the average intercept; $|a|$ is the average absolute intercept; R^2 is the average adjusted R^2 ; and $s(a)$ is the average standard error of the intercepts. With four portfolios and 239 monthly returns, critical values of the GRS statistic for all four models are: 90%: 1.97; 95%: 2.41; 97.5%: 2.84; and 99%: 3.40. In Part B, a is the intercept for a region and $t(a)$ is its t-statistic.

Part A: Summary statistics

	GRS	a	$ a $	R^2	$s(a)$
CAPM	2.16	0.07	0.32	0.68	0.20
Three-Factor (1)	2.30	0.02	0.30	0.70	0.20
Four-Factor (2)	2.35	0.02	0.30	0.70	0.20
Six-Factor (3)	2.35	-0.06	0.38	0.71	0.21

Part B: Intercepts

	a				$t(a)$			
	NA	Europe	Japan	AP	NA	Europe	Japan	AP
CAPM	0.24	0.12	-0.51	0.43	1.98	0.92	-1.76	1.72
Three-Factor (1)	0.33	0.02	-0.55	0.30	2.75	0.18	-1.89	1.22
Four-Factor (2)	0.34	0.01	-0.57	0.29	2.83	0.11	-1.91	1.12
Six-Factor (3)	0.32	0.16	-0.89	0.15	2.52	1.19	-2.95	0.57

Table 6 Summary statistics for regressions to explain monthly excess returns on portfolios from sorts on size and momentum, with (5x5) and without (4x5) microcaps, November 1990 to September 2010

The regressions use the Four-Factor (2) and Six-Factor (3) models with Global and Local Factors to explain the returns on Global, North American, European, Japanese, and Asian Pacific portfolios formed on size and momentum. The 5x5 results include all five size quintiles, the 4x5 results exclude microcaps. The GRS statistic tests whether all intercepts in a set of 25 or 20 regressions are zero; a is the average intercept; $|a|$ is the average absolute intercept; R^2 is the average adjusted R^2 ; and $s(a)$ is the average standard error of the intercepts. With 25 portfolios and 239 monthly returns, critical values of the GRS statistic for all four models are: 90%: 1.41; 95%: 1.56; 97.5%: 1.69; 99%: 1.86; and 99.9%: 2.26.

	Global Factors					Local Factors								
	5x5					4x5		5x5					4x5	
	GRS	a	a	R^2	s(a)	GRS	a	GRS	a	a	R^2	s(a)	GRS	a
Four-Factor (2)														
Global	4.40	0.07	0.14	0.94	0.08	2.56	0.09							
NorthAmerica	2.40	0.46	0.46	0.75	0.19	1.22	0.41	2.80	0.12	0.15	0.91	0.11	1.20	0.10
Europe	3.85	0.05	0.21	0.75	0.19	3.04	0.15	3.54	0.07	0.19	0.92	0.10	2.82	0.16
Japan	1.37	-0.56	0.56	0.36	0.38	1.16	0.60	0.82	-0.01	0.10	0.92	0.13	0.68	0.07
AsiaPacific	2.78	0.33	0.43	0.52	0.37	2.33	0.37	3.51	0.27	0.38	0.84	0.21	2.37	0.29
Six-Factor (3)														
Global	3.39	0.05	0.14	0.95	0.08	2.33	0.10							
NorthAmerica	2.11	0.50	0.50	0.75	0.20	1.32	0.43	2.16	0.13	0.15	0.92	0.11	1.12	0.10
Europe	3.24	0.22	0.24	0.76	0.19	2.54	0.21	2.28	0.06	0.14	0.93	0.10	1.89	0.12
Japan	1.60	-0.98	0.98	0.43	0.38	1.56	1.00	0.83	-0.01	0.09	0.93	0.12	0.79	0.08
AsiaPacific	2.74	0.13	0.35	0.52	0.39	1.99	0.31	2.98	0.29	0.38	0.85	0.21	1.81	0.29

Table 7 Intercepts from four-factor (2), and six-factor (3) regressions to explain monthly excess returns on portfolios from 5x5 sorts on size and momentum, November 1990 to September 2010

The regressions use the Four-Factor (2) and Six-Factor (3) models with Global and Local Factors to explain the excess returns on Global, North American, European, Japanese, and Asian Pacific portfolios formed from independent size and momentum sorts. The table reports intercepts, a, and t-statistics, t(a).

	a					t(a)				
	Losers	2	3	4	Winners	Losers	2	3	4	Winners
Global Size-Momentum Returns Regressed on Global Factors										
Four-Factor (2)										
Small	0.03	0.22	0.21	0.53	0.80	0.28	1.94	2.63	6.43	6.56
2	-0.01	0.01	-0.08	0.07	0.31	-0.15	0.12	-1.06	1.07	3.98
3	0.10	-0.05	-0.06	-0.16	-0.03	1.15	-0.69	-0.80	-2.03	-0.40
4	0.12	0.01	-0.03	-0.13	0.01	1.17	0.11	-0.37	-1.73	0.12
Big	0.23	0.02	-0.13	-0.07	-0.17	2.38	0.29	-1.74	-1.16	-1.90
Six-Factor (3)										
Small	0.22	0.20	0.10	0.38	0.61	2.21	1.72	1.23	4.67	5.25
2	0.19	-0.00	-0.14	-0.02	0.18	3.01	-0.01	-1.84	-0.35	2.78
3	0.22	-0.06	-0.07	-0.23	-0.10	2.61	-0.77	-0.86	-2.83	-1.21
4	0.18	-0.01	-0.07	-0.14	0.02	1.73	-0.10	-0.86	-1.77	0.23
Big	0.08	-0.08	-0.18	-0.03	0.06	0.96	-1.29	-2.41	-0.54	0.88
North American Size-Momentum Returns Regressed on North American Factors										
Four-Factor (2)										
Small	-0.07	0.17	0.37	0.54	0.75	-0.46	1.74	3.88	4.91	4.87
2	-0.05	0.19	0.15	0.03	0.15	-0.44	2.03	1.43	0.26	1.47
3	0.09	0.10	0.08	0.09	0.03	0.65	0.92	0.82	0.81	0.25
4	0.07	0.18	0.13	-0.04	0.05	0.50	1.87	1.26	-0.44	0.40
Big	0.14	0.09	-0.12	-0.03	-0.16	1.16	0.95	-1.19	-0.31	-1.45
Six-Factor (3)										
Small	0.16	0.18	0.35	0.45	0.67	1.29	1.84	3.59	3.91	4.30
2	0.14	0.18	0.13	-0.02	0.05	1.53	1.95	1.20	-0.17	0.58
3	0.26	0.13	0.11	0.02	-0.04	2.05	1.19	1.11	0.21	-0.38
4	0.12	0.18	0.19	-0.02	0.12	0.89	1.76	1.83	-0.19	0.94
Big	0.03	-0.02	-0.15	0.02	0.08	0.26	-0.29	-1.47	0.19	0.89

Table 7 (continued)

	a					t(a)				
	Losers	2	3	4	Winners	Losers	2	3	4	Winners
European Size-Momentum Returns Regressed on European Factors										
Four-Factor (2)										
Small	-0.22	-0.06	-0.10	0.37	0.97	-1.93	-0.63	-0.98	3.98	5.97
2	-0.18	0.09	-0.09	0.10	0.56	-1.92	0.77	-1.05	1.15	4.78
3	0.16	-0.03	0.06	-0.19	0.11	1.45	-0.32	0.60	-2.31	1.03
4	0.22	0.08	0.01	-0.13	0.06	1.58	0.83	0.14	-1.33	0.51
Big	0.43	0.09	-0.00	-0.22	-0.30	3.53	0.88	-0.04	-2.57	-2.63
Six-Factor (3)										
Small	0.07	0.02	-0.12	0.28	0.52	0.66	0.25	-1.21	2.94	3.57
2	0.06	0.15	-0.10	-0.00	0.19	0.64	1.20	-1.06	-0.05	1.96
3	0.36	0.06	0.09	-0.25	-0.14	3.40	0.66	0.84	-2.85	-1.39
4	0.31	0.12	0.05	-0.11	0.05	2.13	1.26	0.50	-1.06	0.45
Big	0.05	-0.14	-0.03	-0.10	0.07	0.47	-1.35	-0.37	-1.10	0.67
Japanese Size-Momentum Returns Regressed on Japanese Factors										
Four-Factor (2)										
Small	0.31	0.25	0.13	0.18	-0.04	2.10	1.90	1.15	1.44	-0.22
2	0.05	-0.03	-0.02	0.00	-0.01	0.42	-0.32	-0.14	0.01	-0.09
3	-0.00	-0.19	-0.10	-0.02	0.04	-0.03	-1.82	-0.83	-0.13	0.30
4	-0.00	-0.10	-0.12	-0.13	0.04	-0.00	-0.84	-0.99	-1.02	0.30
Big	0.08	-0.15	-0.32	-0.06	0.04	0.50	-1.17	-2.51	-0.57	0.38
Six-Factor (3)										
Small	0.26	0.22	0.12	0.19	0.00	2.21	1.84	1.11	1.60	0.03
2	0.02	-0.05	-0.02	0.02	0.03	0.19	-0.56	-0.21	0.17	0.22
3	-0.02	-0.20	-0.10	-0.01	0.06	-0.19	-1.94	-0.84	-0.06	0.45
4	-0.00	-0.10	-0.12	-0.13	0.05	-0.01	-0.84	-0.98	-1.02	0.34
Big	0.13	-0.12	-0.32	-0.08	0.01	1.11	-1.05	-2.50	-0.74	0.14
Asian Pacific Size-Momentum Returns Regressed on Asia Pacific Factors										
Four-Factor (2)										
Small	0.30	0.77	0.77	1.16	0.76	1.69	4.38	4.86	5.55	3.84
2	-0.56	0.18	0.20	0.78	0.15	-3.67	1.08	1.15	2.07	0.81
3	-0.23	1.02	0.05	0.34	-0.06	-1.27	1.09	0.30	2.08	-0.31
4	-0.15	0.29	0.23	0.23	-0.08	-0.86	1.64	1.44	1.43	-0.41
Big	0.56	0.11	0.17	0.03	-0.31	2.86	0.82	1.10	0.22	-1.76
Six-Factor (3)										
Small	0.54	0.80	0.80	1.16	0.55	3.39	4.34	4.84	5.36	2.94
2	-0.27	0.29	0.30	0.83	-0.10	-1.95	1.69	1.69	2.11	-0.61
3	-0.09	1.17	0.08	0.42	-0.17	-0.47	1.20	0.52	2.44	-1.00
4	-0.12	0.32	0.30	0.28	-0.17	-0.67	1.77	1.82	1.64	-0.81
Big	0.23	-0.05	0.13	0.26	-0.18	1.35	-0.40	0.80	1.86	-1.01