The Journal of Portfolio Management

VOLUME 39 NUMBER 4 www.iijpm.com SUMMER 2013

The Devil in HML's Details

CLIFFORD ASNESS AND ANDREA FRAZZINI

Institutional Investor Journals

The Voices *of* Influence | iijournals.com

The Devil in HML's Details

Clifford Asness and Andrea Frazzini

Clifford Asness
is a founding and managing principal at AQR Capital Management in Greenwich, CT.
cliff.asness@aqr.com

Andrea Frazzini
is a vice president at AQR Capital Management in Greenwich, CT.
andrea.frazzini@aqr.com

Few papers focus solely on subjects as seemingly innocuous as timely, frequent updates of price (P) in calculations of book-to-price ratio (B/P). But rarely is so innocuous a choice worth between 305 and 378 basis points annually of statistically significant alpha, plus an ability to illuminate important aspects of the dynamics between value and momentum strategies.[1]

This article focuses on a seemingly small detail in the construction of portfolios that are long value stocks and short growth stocks, often referred to as HML (high minus low).[2] The most common construction, as pioneered by Fama and French [1992], uses book-to-price (B/P) as the proxy for value, and forms a portfolio that is long high-B/P firms and short low-B/P firms. A high B/P means a stock is cheap (or high risk, to efficient market fans) and has a high expected return. A low B/P means the opposite.

In calculating B/P for each stock and forming a value strategy, this method updates value once a year on June 30, using book and price as of the prior December 31. It then holds those values (and portfolio holdings) constant until rebalancing the portfolio the following June 30. In other words, both the book and price data used to form B/P and value portfolios are always between six and 18 months old.

Fama and French [1992] made these conservative construction choices to make sure that book value would actually be available at the time of portfolio construction and/or rebalancing. They then presumably chose to use price from the same date as book, based on common sense. To measure B/P, using book and price from the same date might be the obvious choice.

We believe that this was entirely reasonable, particularly in the early days of the literature, when momentum was not a literal or figurative factor. Now, however, it is suboptimal.

Most of this article focuses on the question of whether we should lag price in constructing valuation ratios. Unlike book value, we know with certainty that the June 30 price is available on the June 30 rebalance date, giving us a choice of computing valuation ratios based on lagged fiscal year-end prices or on current prices. We show that using a more-current price is superior to the standard method of using prices at fiscal year-end as a proxy for the true B/P ratio, and superior in five-factor model regressions. This improvement can lead to a significantly better portfolio combined strategy, and also sheds light on the dynamic relationship between value and momentum. When we use factor models to judge other strategies or for performance attribution, this strategy implicitly raises the bar.

Consider a stock with a December fiscal year-end date and a price that fell 75 percent between December 31 and the June 30 rebalance date, when you must decide if this is a value stock. Does the fallen price make this more likely, less likely, or have no effect on whether this should be considered a value stock?

The answer depends on how much variation in B/P ratios is due to expected returns and how much is due to changes in future book values. Our findings show that true value stocks often show such price drops, and a measure that takes this fall into consideration, as our proposed method does, is superior to one that ignores it, as the standard method does. It is superior not because we create a better stand-alone value strategy—one might naively think that more timely updating improves any stand-alone strategy[3]—but because it better handles the complex relationship between value and momentum strategies.

DATA, METHODOLOGY, AND TERMINOLOGY

Data Sources

Our U.S. equity data includes all available common stocks on the merged CRSP/XpressFeed data between July 1950 and March 2011. Our global equity data includes all available common stocks on the XpressFeed Global database for 19 developed markets. The international data runs from January 1983 to March 2011.[4] We report our sample's summary statistics in the appendix.

To compute total book value of equity (BE), we prefer stockholders' equity (SEQ). If that is unavailable, we use the sum of common equity (CEQ) and preferred stock (PSTK). If both SEQ and CEQ are unavailable, we proxy book equity by total assets (AT), minus the sum of total liability (LT), minority interest (MIB), and preferred stocks (PSTKRV, PSTKL, or PSTK, depending on availability). To compute book value per share (B), we divide by common shares outstanding (CSHPRI). If CSHPRI is missing, we use compute company-level total shares outstanding by summing issue-level shares (CSHOI) at fiscal year-end for securities with an earnings participation flag in the security-pricing file. Following Fama and French [1992], we assume that accounting variables are known with a minimum six-month gap, and align the firm's book price at fiscal year-end, which is anywhere in year $t-1$ to June of calendar year t. To be included in any of our tests, a firm must have a non-negative book price and non-missing price at fiscal year-end, as well as in June of calendar year t.

Constructing Value Measures

We focus on a seemingly small modification to standard practice—one that we think is not so small in its impact. We compute three measures of B/P. The first is Fama and French's [1992] standard approach, with B/P equal to the book value per share (B) divided by price at fiscal yearend (P_{fye}), both in local currency:[5]

$$bp_t^{annual,lagged} \equiv bp_t^{a,l} = \log(B/P_{fye})$$

We label this measure *annual* (indicated by the superscript *a*), as it is updated once a year, and *lagged* (indicated by the superscript *l*), as at the update, it uses prices from six to 18 months ago, not current prices.[6]

The second measure is equal to book value per share (adjusted for splits, dividends, and other corporate actions between fiscal year-end and portfolio formation dates), divided by current price P_t, both in local currency:

$$bp_t^{annual,current} \equiv bp_t^{a,c} = \log(B^*/P_t)$$

where $B^* = B \times Adj_t / Adj_{fye}$ and Adj is the cumulative adjustment factor. This alternative measure holds Fama and French's method [1992] constant, save for choosing date to use for price.[7] We call this measure *annual*, as it is updated once a year (indicated by the superscript *a*) and *current,* as it uses the most recent available price as of the June 30 rebalance date (indicated by the superscript *l*). "Current" refers only to price at time of portfolio formation, not to book value, which our measures always lag.

Our last measure is equal to book value per share, divided by current price and updated monthly:

$$bp_t^{monthly,current} \equiv bp_t^{m,c} = \log(B^*/P_t)$$

In our naming convention (indicated by the superscript *m*), *monthly* applies only to price. Our convention for book value remains the same as the standard for all three measures. This measure is equal to $bp_t^{a,c}$ in June of each year, but is updated every month using current prices, as opposed to staying constant through the year. Through the paper we will maintain this notation convention: The first superscript indicates the refreshing frequency (annual *a* or monthly *m*); the second superscript indicates the lag used to update price (lagged *l* or current *c*).

Exhibit 1 illustrates the three approaches for a firm with a fiscal year ending in December 2000. To summarize each of the three measures, use the same measure of book value (lagged at least six months at portfolio formation date), but vary the lag used to update price. Note that $bp_t^{a,l}$ is the widely used method in academic finance; we refer to it as the *standard method*. $bp_t^{a,c}$ is the same measure using price as of June 30, not as of the prior December 31, then leaving both book and price unchanged for the next 12 months. $bp_t^{m,c}$ is the same ratio with price updated monthly.

The three measures are mechanically related:

$$bp_t^{a,c} = bp_t^{a,l} - r_{fye \to t}$$

$$bp_t^{m,c} = bp_t^{a,c} - r_{t \to t+k}$$

where $r_{t \to s} = \log(1 + R_{t \to s})$ is equal to the total log return between date t and $s > t$. Hence the choice between the different measures is equivalent to choosing whether we should ignore or include recent returns when building value portfolios.

This choice matters most when we combine these portfolios with momentum or short-term reversal portfolios, which are themselves direct bets on recent returns. We'll form value strategies using all three methods for estimating B/P. We describe the details of portfolio construction in the next subsection.

Portfolios

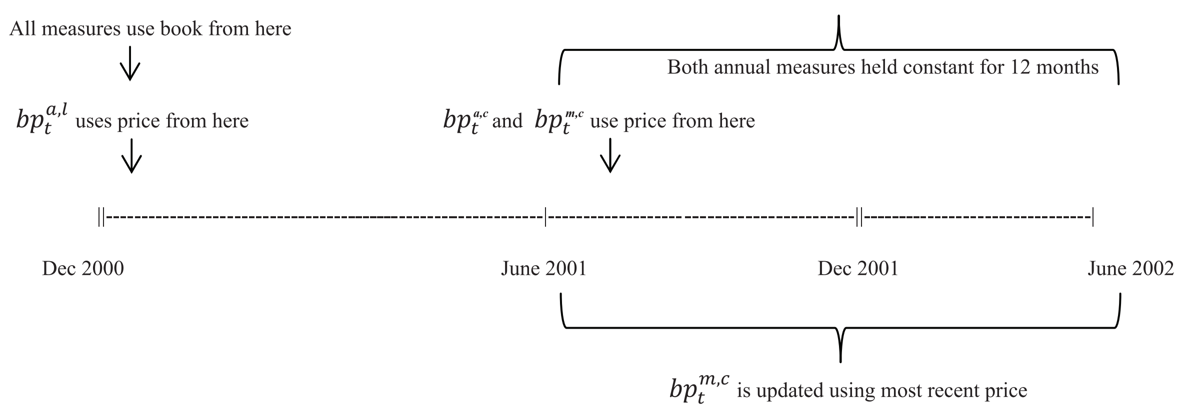
Our portfolio construction closely follows Fama and French [1992, 1993, 1996]. Our global factors are country neutral. That is, we form one set of portfolios in each country and compute a global factor by weighting each country's portfolio by the country's total (lagged) market capitalization.

The market factor MKT is the value-weighted return on all available stocks, minus the one-month Treasury bill rate.

Exhibit 1

Example: B/P Calculation for a Firm with Fiscal Year Ending in December 2000

This exhibit illustrates the three approaches used to compute B/P for a firm with a fiscal year ending in December 2000. $bp_t^{a,l}$ B/P is equal to the book value per share (B) divided by price at fiscal year-end (P_{fye}) both in local currency, $bp_t^{a,c}$ is equal to book value per share (adjusted for splits, dividends, and other corporate actions between fiscal year-end and portfolio formation dates). $bp_t^{m,c}$ is equal to book value per share divided by current price, updated monthly. In the name convention, the first superscript indicates the refreshing frequency (annual *a* or monthly *m*), and the second superscript indicates the lag used to update price (lagged *l* or current *c*).



$BP^{a,l}_{June\ 30th\ 2001}$ = Book (December 31, 2000)/Price (December 31, 2000)

$BP^{a,c}_{June\ 30th\ 2001}$ = Book (December 31, 2000)/Price (June 30, 2001)

$BP^{m,c}_{June\ 30th\ 2001}$ = Book (December 31, 2000)/Price (June 30, 2001, updated monthly thereafter)

We construct the size and value factors using six value-weighted portfolios formed on size and B/P. At the end of June of year *t*, stocks are assigned to two size-sorted portfolios, based on their market capitalization. For the U.S., the size breakpoint is median NYSE market equity. For the international sample, the size breakpoint is the 80th percentile by country.[8] Portfolios are value-weighted, refreshed every June, and rebalanced every calendar month to maintain value weights. The size factor SMB (small minus big) is the average return on the three small portfolios, minus the average return on the three big portfolios:[9]

$$\text{SMB} = 1/3\ (\text{Small Value} + \text{Small Neutral} + \text{Small Growth}) - 1/3\ (\text{Big Value} + \text{Big Neutral} + \text{Big Growth})$$

The value factor's HML is the average return on the two value portfolios, minus the average return on the two growth portfolios:

$$\text{HML} = \tfrac{1}{2}\ (\text{Small Value} + \text{Big Value}) - \tfrac{1}{2}\ (\text{Small Growth} + \text{Big Growth})$$

We construct a version of HML for each annual measure: $HML^{annual,lagged} \equiv HML^{a,l}$ and $HML^{annual,current} \equiv HML^{a,c}$. Finally we construct a version of HML for our monthly B/P measure, $HML^{monthly,current} \equiv HML^{m,c}$, in the same manner, but this portfolio is refreshed monthly. All our portfolios are rebalanced monthly, to keep value weights. *Refreshed* refers to the date that we update value and size breakpoints—once a year in for the annual measures, every month for the monthly measure—not to the rebalancing frequency for value weighting, which is the same for all three.[10]

We construct the momentum and short-term reversal portfolios in a similar way. We use six value-weighted portfolios, formed on size and prior returns. The portfolios are the intersections of two portfolios formed on size and three portfolios formed on prior returns. We use one-year return (in local currency), skipping the most recent month for momentum (UMD) and (minus) the local currency return in the most recent month for short-term reversal (STR):

$$\text{UMD} = \tfrac{1}{2}\ (\text{Small High} + \text{Big High}) - \tfrac{1}{2}\ (\text{Small Low} + \text{Big Low})$$

$$\text{STR} = \tfrac{1}{2}\ (\text{Small Low} + \text{Big Low}) - \tfrac{1}{2}\ (\text{Small High} + \text{Big High})$$

We refresh both portfolios every calendar month, and rebalanced monthly to maintain value weights.

All portfolio returns are in U.S. dollars; excess returns are above the U.S. Treasury bill rate.[11] Because some of our variables are computed from closing prices, we skip one trading day between portfolio formation and investment in all portfolios, both when refreshing the breakpoints and when rebalancing stocks in the portfolio.[12]

What Proxies Best for the True Unobservable B/P?

In this section, we run a horse race using cross-sectional regressions of current B/P on lagged B/P and highlight the relative forecasting power of the different measures. Imagine you're standing at Dec 31, 2000, and you want to form a value portfolio based on B/P. The measure you want is:

$$BP^{Unobservable}_{as\ of\ Dec\ 2000} \equiv BP^{a,l}_{t} = \text{Book (December 31, 2000)}/\text{Price (December 31, 2000)}$$

But that measure isn't available, because book value as of December 31, 2000 is not known until sometime after that date. (Hence the standard six-month lag and our "Unobservable" superscript). But as of December 31, 2000, you have two available measures:

$$BP^{a,l}_{t-1} = \text{Book (December 31, 1999)}/\text{Price (December 31, 1999)}$$

$$BP^{a,c}_{t-1} = \text{Book (December 31, 1999)}/\text{Price (June 30, 2000)}$$

Use either or any combination of both to form a forecast of $BP^{Unobservable}$.

We directly test this question: Does the standard method, $BP^{a,l}_{t-1}$, which aligns price and book, or our proposed method, $BP^{a,c}_{t-1}$, which uses more current prices (thus incorporating more recent returns), make a better proxy for unobservable B/P? As we are not yet testing our monthly refreshed method, both of these use a lagged price here, as both portfolios are only refreshed annually at the end of June, and we're examining the end of December. Our proposed $BP^{a,c}_{t-1}$ is simply less lagged than the standard $BP^{a,l}_{t-1}$.

We run Fama and MacBeth [1973] regressions of the unobservable B/P on competing versions of past B/P, plus an error-correction term:

$$bp_t^{a,l} = \gamma_0 + \gamma_1 bp_{t-1}^{a,l} + \gamma_2\left(bp_{t-1}^{a,c} - bp_{t-1}^{a,l}\right) + \in_t$$

We test which of two observable proxies does a better job of explaining the unobservable, as of December 31.[13]

We run cross-sectional regressions each year for all firms in our universe. The left side is the unobservable, true B/P, for which we'd like to get the closest proxy. We can interpret coefficient γ_1 as the weight we would put on the standard B/P version in the literature. We can also interpret coefficient γ_2 as the amount by which we would move away from this standard version towards our new version, which differs by its more-timely, less-lagged use of price. With some rearranging, we can interpret γ_2 and $\gamma_1 - \gamma_2$ as the linear weights we would put on the different measures in a linear forecast. (The measure we cast as the starting point is, of course, irrelevant.):

$$\widehat{bp_{t+1}^{a,l}} = \gamma_0 + (\gamma_1 - \gamma_2)bp_t^{a,l} + \gamma_2 bp_t^{a,c}$$

EXHIBIT 2
HML: Global Sample, Cumulative Five-Factor Alphas, 1950–2011

This exhibit plots cumulative portfolio alphas. We run time-series regressions on monthly excess returns of value portfolios (HML) and on monthly excess returns of a set of explanatory portfolios, then plot cumulative alphas.

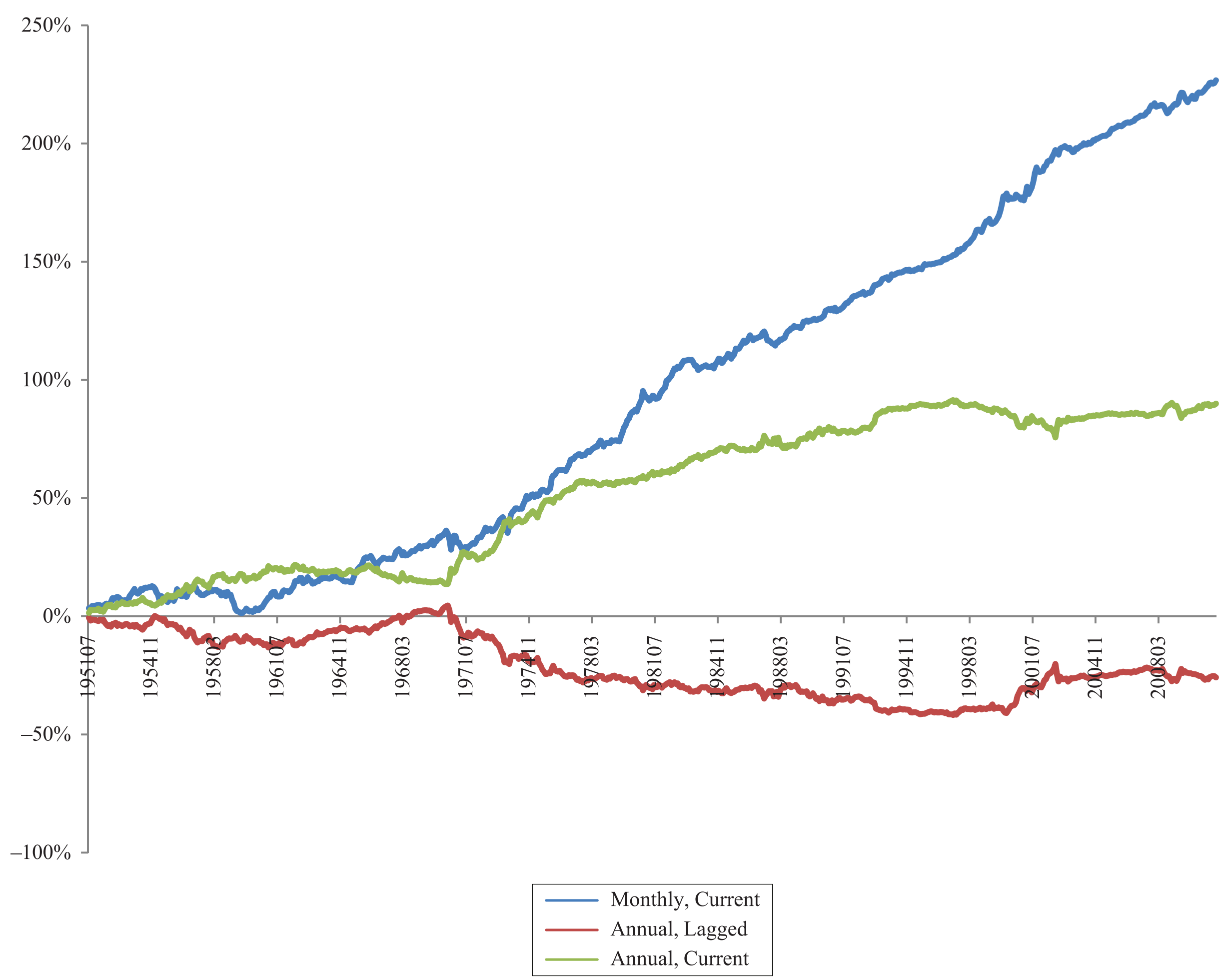


Exhibit 3

Case Study: HML and UMD in 2009, Global Sample, Total Returns

This exhibit plots total returns. We plot cumulative returns of value (HML) and momentum (UMD) portfolios (HML) between February 2009 and July 2010.

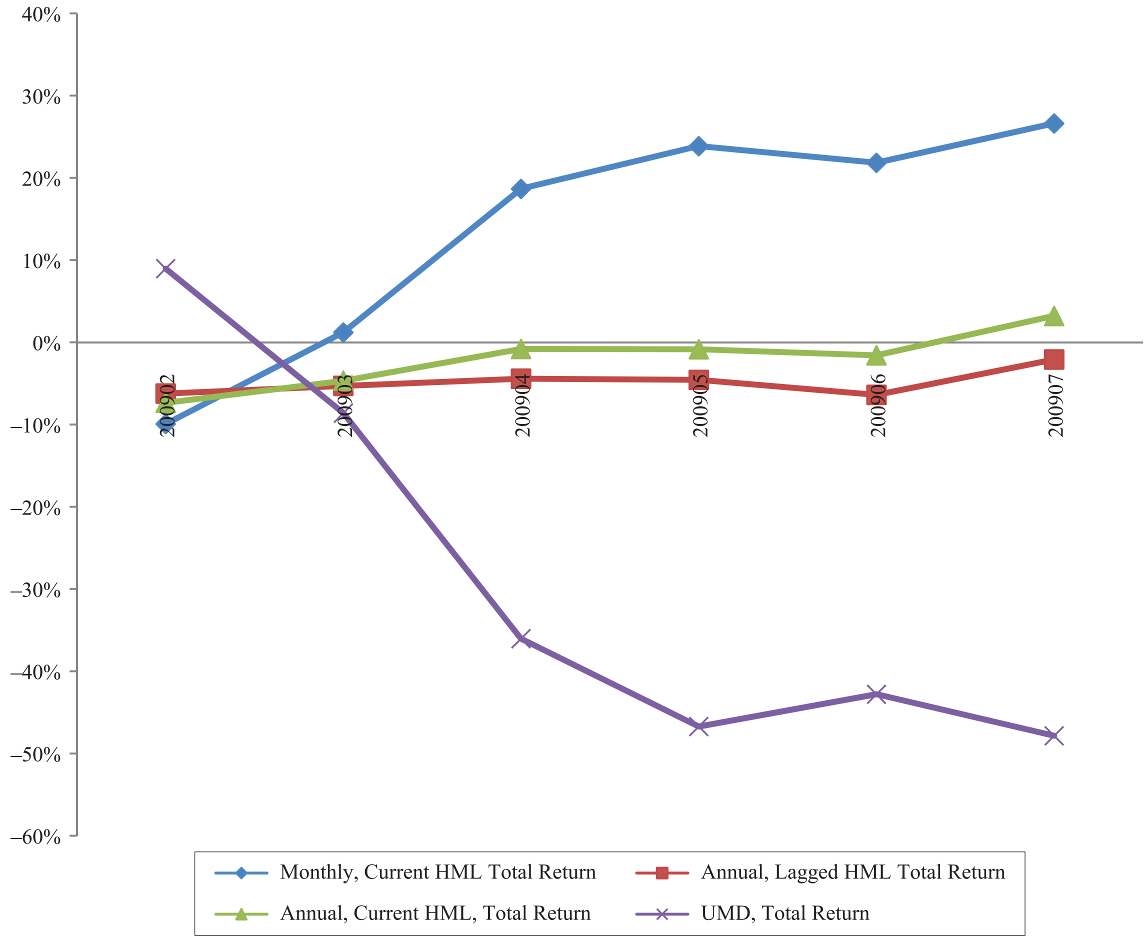


Exhibit 4 reports the time-series averages of the cross-sectional estimates of γ_1, γ_2, and $\gamma_1 - \gamma_2$ and the corresponding *t*-statistics of the time-series of point estimates. We also report γ_2/γ_1, interpreted as the fraction of linear forecast attributed to our more timely $bp^{a,c}$. (We attribute the remainder to the standard method $bp^{a,l}$).

We focus on the all-sample U.S. results in the first row of Exhibit 4, panel A. In the appendix we report robustness checks across fiscal year, industry, size deciles, and time. The point estimate for γ_2 is 0.86, meaning that we would move 86 percent of the distance from the standard lagged B/P towards our proposed current B/P. The *t*-statistic for this move is 38.9. Alternatively, had we switched the order, started with our new measure, and reported how far to move towards the standard, we could still reject the null hypothesis of no incremental value of the standard lagged B/P versus our proposed current B/P, as measured by $\gamma_1 - \gamma_2$, but the effect is negligible (0.05 with a *t*-statistics or 3.14). The right-most column gives a more intuitive way of looking at the results. Scaled to 100 percent, we would base 94 percent of our linear forecast of the unobservable goal on our proposed current B/P, and only 6 percent on the standard method. All robustness checks are reasonably close to the all-sample results. Essentially, in a simple evaluation of what measure best proxies for the clear but unobtainable goal—true, timely B/P)—our proposed change is a clear winner.

Exhibit 4

Cross Sectional Regressions: Forecasting B/P Ratios

This exhibit reports Fama–MacBeth regression of B/P ratios on past ratios and an error correction adjustment. The left side is equal to book value per share, divided by price at fiscal year-end. The right side is lagged book value divided by price at fiscal year-end and lagged book value divided by current price as of the previous June: $bp_t^{al} = \gamma_0 + \gamma_1 bp_{t-1}^{a,l} + \gamma_2 \left(bp_{t-1}^{a,c} - bp_{t-1}^{a,l}\right) + \in_t$. The rightmost column reports γ_2/γ_1, the fraction of the linear forecast attributed to $bp^{a,c}$.

	γ_1		γ_2		$\gamma_1 - \gamma_2$			
	Coeff	***t*-stat**	**Coeff**	***t*-stat**	**Coeff**	***t*-stat**	**R2**	γ_2/γ_1
Panel A: U.S. Sample								
All sample	**0.91**	101.3	**0.86**	38.9	**0.05**	3.14	0.73	0.94
Large Cap (above NYE median)	**0.93**	101.5	**0.98**	43.1	**–0.04**	–2.40	0.78	1.05
Small Cap (below NYE median)	**0.88**	110.1	**0.80**	42.4	**0.08**	4.70	0.70	0.91
Panel B: International Sample								
All sample	**0.88**	68.9	**0.75**	37.3	**0.12**	5.92	0.67	0.86
Large Cap (above 80th percentile)	**0.91**	66.4	**0.87**	33.3	0.04	1.66	0.72	0.96
Small Cap (below 80th percentile)	**0.86**	61.1	**0.73**	31.8	**0.14**	6.14	0.65	0.84

The international results in panel B are strikingly consistent with our U.S. results and highly support our proposed method of computing B/P over the standard specification (although, of course, based on a shorter sample). In our international sample, we would base between 84 percent and 96 percent of our forecast of the unobservable goal on our current method.

We report a series of robustness checks in the Appendix. All the results tell a consistent story: recent returns matters, i.e., to proxy for the unobservable, true B/P, our new, more-timely measure is superior to the standard measure that unnecessarily lags price to match the necessary lag in book.

Exhibit 5 and Exhibit A3 in the appendix provide some information about the reasons that standard B/P is a worse proxy for the true, unobservable B/P. We run Fama and MacBeth's [1973] regression of log changes in book price per share on log returns over the past three years: [14]

$$\Delta b^*_{t-12\to t} = \theta_0 + \theta_1 r_{t-12\to t} + \theta_2 r_{t-24\to t-12} + \theta_3 r_{t-36\to t-12} + \in_t$$

In other words, we study how much a given price change translates into a change in book value. The all-sample results show that, in a given year, somewhere around 22 percent of a price move in the prior 12 months is reflected in a contemporaneous change in book price. Eventually, including all three lags, this total rises to a percentage in the mid-40s. Looking at the international sample, we find similar results, with the three-year totals almost hitting 50 percent.[15] To summarize, current and prior returns predict future changes in book value, but in an attenuated fashion, with coefficients of well below 100 percent.

How does this provide intuition for our Exhibit 5 results? For impacts of one or three-plus years, between 20 percent and 40 percent of price movements seem to be currently or eventually reflected in book value. Therefore, if someone told us about a strong price move, our first guess would not be that true B/P was unaffected. Rather, we would guess that, if price fell sharply, true B/P would rise sharply, though not quite to the full extent of the price move.

Thus, the standard method of measuring B/P, which unnecessarily lags price to match the necessary lag in book, is not our best guess of true B/P. Our best guess of true B/P would use most of any observed price move, even if that move was not aligned with the latest observable book value.

Had these coefficients summed to near 100 percent, our best guess of true B/P would indeed be approximately the standard method. Our more timely method did not have to create the large improvement we observe. But price moves much more than book, causing the standard method to miss important information.[16]

Does the Standard or New, More Timely B/P form a Better Value Portfolio?

We have shown that our proposed more timely measure is a better proxy for true value than is the traditional measure. If the goal is value investing, one could

EXHIBIT 5

Cross Sectional Regressions: Forecasting Changes in Book per Share

This exhibit reports Fama-MacBeth regression of changes in the log of book price per share on log returns over the prior three years. $\Delta b^*_{t-12\to t} = \theta_0 + \theta_1 r_{t-12\to t} + \theta_2 r_{t-24\to t-12} + \theta_3 r_{t-36\to t-12} + \in_t$ The left side is equal changes in book value per share. Lowercase indicates logs = log(*B*), the asterisk * indicates that the quantity is adjusted for splits between the two dates, and $r_{t\to s} = \log(1 + R_{t\to s})$ is equal to the total log return between date *t* and *s* > *t*. The lags are in months. Cross sectional regressions are run every fiscal year.

	Coefficient			*t*-statistics			
	θ_1	θ_2	θ_3	θ_1	θ_2	θ_3	R2
Panel A: U.S. Sample							
All sample	**0.22**	**0.15**	**0.08**	17.42	19.38	15.24	0.15
Large Cap (above NYE median)	**0.17**	**0.13**	**0.08**	14.13	14.93	11.46	0.14
Small Cap (below NYE median)	**0.23**	**0.15**	**0.07**	18.89	17.81	12.77	0.16
Panel B: International Sample							
All sample	**0.26**	**0.15**	**0.09**	13.25	9.29	3.79	0.11
Large Cap (above 80th percentile)	**0.17**	**0.12**	**0.10**	8.61	6.34	7.40	0.11
Small Cap (below 80th percentile)	**0.28**	**0.16**	**0.09**	**12.91**	9.29	3.18	0.12

advocate using our more timely proxy on first principles. The rest of this article is an attempt to discover how much this first principle really matters.

In Exhibit 6, we examine portfolio returns. We run time-series regressions and test whether each version of HML adds value in the presence of the other competing HML, the market (MKT), a size factor (SMB), and a short-term reversal factor (STR). We discuss results for the U.S. but also report tests for our international sample, as well for the full set of countries aggregated in a global portfolio.[17]

Columns 1 and 2 report results for our two annual value measures. They are run against five-factor models, including the other competing value measure. When fully controlling for factor exposure, the standard $HML^{a,l}$ approach subtracts −58 basis points (bps) annually (which is statistically insignificant). Our more timely $HML^{a,c}$ factor adds 143 bps (which is statistically significant) over the traditional four-factor model, augmented with short-term reversal.[18] In other words, in the presence of the other factors, our newer, more timely approach is clearly better than the standard lagged approach.

In section 2 we showed that, in ignoring returns and focusing only on proxies for true ex post B/P, our more timely measure is superior. In this section we add that, in the presence of momentum, and for logical reasons having to do with the overlap of our value measure and the period used to form momentum, our more timely value measure also outperforms the more standard lagged measure.

Columns 3 and 4 show results for our monthly updated measure. Again we compete with the standard measure (annual lagged), but unlike in columns 1 and 2, in columns 3 and 4 we now also compete with our monthly updated measure. In column 3 we see a strong positive loading on UMD and a negative intercept of −161 bps a year, with a *t*-statistic of −2.92. In other words, the standard measure economically and statistically subtracts return, given five-factor exposure and including our monthly value measurement. The results are more dramatic in the other direction. In column 4, regressing our timely $HML^{m,l}$ on MKT, SMB, UMD, and standard $HML^{a,l}$, we see a large negative loading on UMD, as our timely measure is far more negatively correlated with momentum than is the standard measure, and a very significant intercept of 305 bps a year with a +5.92 *t*-statistic. Essentially, in the presence of MKT, SMB, standard value, and UMD, our most timely value measure is clearly superior.

The international and global results are consistent with the U.S., in particular. Using a monthly updated version of value with current prices adds between 305 and 378 bps of alpha, even after controlling for other value measures. The only exception are the international portfolio results with annual updated measure (column 6), where we are unable to reject the null hypothesis of no value added. (Column 8 still shows very significant results, and our largest intercept in basis points, for the international sample when the monthly HML is employed).

EXHIBIT 6

HML: Time Series Regressions, 1950–2011

This article reports portfolio returns and multivariate loadings. We run time-series regressions on monthly excess returns of value portfolios (HML) and on monthly excess returns of a set of explanatory portfolios. This article includes all available stocks in our U.S. and international samples. The sample period runs from 1950 to 2011. Country portfolios are aggregated into international and global portfolios using the country's total market capitalization as of the prior month. Alpha is the intercept in a regression of monthly excess return. Alphas are annualized, *t*-statistics are reported below the coefficient estimates, and a five percent statistical significant is indicated in bold.

	U.S.				International				Global			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Refreshing frequency	Annual	Annual	Annual	Monthly	Annual	Annual	Annual	Monthly	Annual	Annual	Annual	Monthly
Method to lag price	Lagged	Current	Lagged	Current	Lagged	Current	Lagged	Current	Lagged	Current	Lagged	Current
Alpha	−0.58	**1.43**	**−1.61**	**3.05**	1.05	0.56	−1.24	**3.78**	−0.43	**1.51**	**−1.72**	**3.36**
	(−1.35)	(3.42)	(−2.92)	(5.92)	(1.52)	(0.71)	(−1.59)	(4.58)	(−1.07)	(3.69)	(−3.48)	(7.14)
MKT	0.01	**−0.03**	**−0.02**	−0.01	−0.02	0.00	**−0.03**	0.01	0.00	**−0.03**	−0.02	−0.01
	(0.93)	(−3.38)	(−2.09)	(−0.82)	(−1.38)	(−0.30)	(−2.36)	(0.63)	(0.26)	(−3.20)	(−1.87)	(−1.53)
SMB	**−0.04**	0.02	**−0.04**	0.01	−0.02	0.03	−0.01	0.03	**−0.03**	0.02	−0.02	0.00
	(−3.32)	(1.78)	(−2.50)	(0.46)	(−0.67)	(1.22)	(−0.33)	(0.91)	(−2.48)	(1.77)	(−1.28)	(0.31)
STR	−0.01	0.02	**−0.07**	**0.08**	−0.02	0.01	**−0.07**	**0.07**	−0.02	0.03	**−0.08**	**0.10**
	(−1.13)	(1.85)	(−4.19)	(5.58)	(−0.88)	(0.61)	(−3.22)	(3.28)	(−1.25)	(1.92)	(−5.13)	(6.52)
UMD	**0.17**	**−0.19**	**0.38**	**−0.43**	**0.14**	**−0.18**	**0.35**	**−0.45**	**0.17**	**−0.20**	**0.37**	**−0.42**
	(17.24)	(−21.46)	(26.12)	(−39.28)	(8.68)	(−10.68)	(17.33)	(−25.38)	(16.42)	(−20.37)	(25.99)	(−38.00)
$HML^{annual,lagged}$		**0.92**		**0.85**		**1.02**		**0.95**		**0.94**		**0.87**
		(70.41)		(53.14)		(35.17)		(31.50)		(65.58)		(52.83)
$HML^{annual,current}$	**0.95**				**0.78**				**0.91**			
	(70.41)				(35.17)				(65.58)			
$HML^{monthly,current}$			**0.94**				**0.80**				**0.91**	
			(53.14)				(31.50)				(52.83)	
R2	0.89	0.90	0.82	0.89	0.80	0.81	0.76	0.85	0.87	0.89	0.82	0.89

Exhibit 2 summarizes the results, plotting the cumulative alphas from Exhibit 6, columns 10, 11, and 12. Cumulative alphas are the monthly alpha, plus the error term from the regression. The exhibit shows the large advantage from updating price when constructing value portfolios and combining with other known factors. The exhibit also shows that, though gains to our new factors were small (but the right sign) before 1970, they have been steady and not period specific after 1970.[19]

The appendix reports a battery of robustness checks. We run time-series regression of each value measure on the full set of factors, including the other value measure. For each sample (U.S., international, and global), we report results separately for firms with fiscal years ending and not ending in December. We split the sample into large and small firms, based on the NYSE median market cap for the U.S. sample or the top 80th percentile by country for the international sample, and we report results for different time periods. The robustness checks are consistent with our main results: Value portfolios constructed using more current prices earn higher abnormal returns, even after controlling for the other lagged standard value measure, on average between 121 and 378 bps of alpha.

We asked ourselves why a value portfolio based on more current prices does so much better when combined with momentum and other factors. The short answer is that failing to update prices when computing B/P ratios is not only an inferior measure of true unobservable B/P, but is also an inefficient way to load momentum into a portfolio (or, for stand-alone value, to load less negatively). If price has fallen sharply in the last six months, it is natural and empirically clear from our earlier results that the stock usually has also cheapened, or gotten more attractive on value measures. Also, if the price has fallen sharply in the last six months, then monthly momentum has almost always gotten worse. In other words, skipping six months, as done in the standard $HML^{a,l}$, reduces the natural negative correlation of value and momentum. On the other hand, as of June 30, our more timely value measure $HML^{a,c}$ fully accounts for the negative correlation with momentum, including the impact of the prior six months.

We originally lagged the standard value factor $HML^{a,l}$ to make sure book was available, with price lagged more matter-of-factly to match book. Correlation or overlap with UMD was not a decision factor at that point, as the research on momentum was still in the future. We argue the lag in price was unjustified on first principles (again, when price falls, book does not fall as much, and our best guess is the stock has cheapened), without considering momentum. But if momentum were never discovered, the choice would have been fairly innocuous. As it is, the choice is anything but innocuous.

Effectively, the standard $HML^{a,l}$ looks like a portfolio of the more timely HML, plus UMD, plus noise. In fact, running this regression directly, i.e., without the other factors, results in:

$$\begin{aligned} HML^{a,l} &\\ &= -0.77 + 0.96 \times HML^{a,c} + 0.18 \times UMD \quad R2 = 89\% \\ &\quad\ (-1.86) \qquad (74.64) \qquad\qquad (19.18) \\ HML^{a,l} &\\ &= -2.51 + 0.95 \times HML^{m,c} + 042 \times UMD \quad R2 = 89\% \\ &\quad\ (-4.59) \qquad (55.20) \qquad\qquad (29.30) \end{aligned}$$

Effectively, the regression loads very positively on the highly correlated (but more timely) $HML^{a,c}$ and also very positively on UMD. If we accept, as our earlier evidence showed, that $HML^{a,c}$ is a better, purer proxy for true value, than we can view the standard $HML^{a,l}$ as a portfolio of more accurate value, momentum, and noise. Furthermore, examining the intercept shows a somewhat inferior portfolio—a little or a lot, depending on the annual or monthly method employed. We can only suppose this comes from the fact that ignoring six to 18 months of return is not the best way to account for momentum. It is not the same as the clean addition of a momentum factor, but rather a noisy proxy for it.

Although the general intuition is useful, and we have already shown that the result is strong and robust over time and geography, it is still useful to examine some specific examples.

EXAMPLE 1: THE 2009 MOMENTUM CRASH

After being battered by the financial crisis, markets sharply reversed in March 2009 and the momentum strategy suffered greatly. The three-month additive spread return on UMD from March to May, a 14 percent annual volatility series since 1950, was −56 percent. Although this was very painful, it did little to change the momentum strategy's record of long-term efficacy. Still, it's instructive to look at how much of that pain actually had to be borne by a value-plus-momentum investor.

Looking at the standard value portfolio $HML^{a,l}$, our more timely but still annual $HML^{a,c}$, and our very timely $HML^{m,c}$, we see spread returns of +2 percent, +7 percent, and +34 percent, respectively, over the same three months. The standard value portfolio didn't help at all, while our $HML^{m,c}$ offset much of the momentum pain (if indeed one were balanced 50/50 between value and momentum).

This can be seen in Exhibit 3, where we plot total returns for the different HML measures and UMD for our global sample. This is not an accident. March to May 2009 saw a momentum debacle, as momentum tends to severely underperform when the world reverses its actions of the last year—see Daniel [2011]—and this reversal was epic in size. A negatively correlated factor, such as value, could be there at such times to offset such a crash. The standard method could not. But with the simple and intuitive act of updating price in a timely way, our $HML^{m,c}$, value was there to save the day.

EXAMPLE 2—VALUE AND MOMENTUM IN JAPAN

Japan is a particularly constructive place to examine, as it is widely known as a country where the momentum strategy has failed (Asness [2011]).

Consider Exhibit 7. In columns 1 and 2, we see Japanese UMD adjusted for the market model and the traditional four-factor model, using the standard lagged and annual definition of HML, augmented with the short-term reversal factor. The result is 23 years of economically small and statistically insignificant alpha.

Many observe that momentum has failed in Japan, and they are correct when we view momentum through the standard lens. Furthermore, in column 2 we see that momentum is only marginally correlated with standard HML (and the wrong sign!). That is not intuitive. Recall that one of the problems with standard HML is that it radically reduces the natural negative correlation of a true value and true momentum strategy.

Column 3 replaces standard HML with our annual but unlagged HML, and column 4 replaces standard HML with our monthly unlagged HML. We focus on column 4, as the story it tells is stronger and clearer, but column 3 shows an attenuated version of the same effect.

In column 4, we see an economically and statistically large intercept for UMD in Japan, driven by a economically and statistically large, negative coefficient on monthly unlagged HML. When we adjust for the very strong negative correlation of UMD with monthly unlagged HML, we see tremendous value added, even in Japan.

This is all quite intuitive. In Japan, from 1988 to 2011, univariate value was quite strong, and univariate momentum was a complete dud (around zero univariate return). When we use the standard measure of HML, which downplays the negative correlation of momentum and true value, UMD remains a dud. But, when we use monthly unlagged value, itself a very strong strategy in Japan over this period, UMD is resurrected. Being very negatively correlated with a strong strategy, such as monthly HML in Japan, but not losing, is indeed value added, as risk can be reduced at a low cost to expected return. This reality in Japan is masked by the standard measure of value, but shown remarkably clearly by our much more timely measure of true value: $HML^{m,c}$.

EXHIBIT 7
Case Study: Momentum in Japan, 1988–2011

This exhibit reports portfolio returns and multivariate loadings. We run time-series regressions on monthly excess returns of momentum portfolios (UMD) and on monthly excess returns of a set of explanatory portfolios. This exhibit includes all available stocks in our Japanese sample. The sample period runs from 1988 to 2011. Alpha is the intercept in a regression of monthly excess return. The left side is momentum (UMD) returns. The explanatory variables are market excess returns (MKT), a size portfolio (SMB), a value portfolio (HML) and a short-term reversal (STR) portfolio. Alphas are annualized, *t*-statistics are reported below the coefficient estimates, and a five percent statistical significant is indicated in bold.

Panel A: UMD, Japan, 1988–2011

	(1)	(2)	(3)	(4)
Alpha	1.15	2.26	**7.34**	**12.04**
	(0.34)	(0.68)	(2.37)	(4.49)
MKT	**−0.23**	**−0.16**	**−0.27**	**−0.24**
	(−5.34)	(−3.38)	(−6.41)	(−7.13)
SMB		**−0.19**	−0.05	0.03
		(−2.54)	(−0.63)	(0.42)
STR		**−0.32**	**−0.31**	**−0.18**
		(−4.73)	(−4.95)	(−3.34)
$HML^{annual,Lagged}$		0.14		
		(1.21)		
$HML^{annual,current}$			**−0.58**	
			(−6.60)	
$HML^{monthly,current}$				**−0.80**
				(−12.66)
R2	0.09	0.19	0.30	0.49

CONCLUSION

The standard approach to calculating HML, itself the standard value strategy, updates portfolios once a year, using prices lagged six months from the update. Thus, by the next update, the price used to determine value is 18 months old.

We show on first principles that, if the goal is approximating the true, unobservable B/P, a technique that uses an unlagged price comes much closer. We recommend a change to the standard approach, based only on this idea and before examining returns. We show that, in the context of a five-factor model that includes momentum, this logically superior value measure is actually far superior in terms of returns. We further extend this to a monthly updated value strategy and find that, for precisely analogous reasons, the return advantage grows far stronger.

The bottom line is that the standard approach to value was a reasonable, conservative choice that has served the field well. But it is not the best possible choice. Moving in very simple ways, based on first principles, to the choices we study here can make a big difference in the efficacy of combined portfolio strategies, helping us set a higher bar by using value and momentum for risk-adjustment and performance attribution.

APPENDIX

ADDITIONAL EMPIRICAL RESULTS AND ROBUSTNESS TESTS

This appendix contains additional empirical results and robustness tests.

– Exhibit A1 reports summary statistics.
– Exhibit A2 reports results of Fama–MacBeth regression of book-to-price ratios on past ratios.
– Exhibit A3 reports results of Fama–MacBeth regression of changes in log of book price per share on log returns over the prior three years.
– Exhibit A4 reports returns of HML portfolios.
– Exhibit A5 reports five-factor alphas of HML portfolios across different subsamples.
– Exhibit A6 reports *t*-statistics of five-factor alphas of HML portfolios by country.

EXHIBIT A1

Summary Statistics

This exhibit shows summary statistics as of June of each year. The sample includes all commons stocks on the CRSP/XpressFeed data between 1950 and 2011 and all common stocks on the XpressFeed Global data between 1983 and 2011. "Number of stocks—mean" is the average number of stocks per year. "Mean ME" is the average firm's market value of equity, in billion USD. Means are pooled averages (firm-year) as of June of each year.

Country	Number of Stocks—Total	Number of Stocks—Mean	Mean ME (firm, Billion USD)	Average Weight in International Portfolio	Average Weight in Global Portfolio	Start Year	End Year
Australia	2,951	808	0.56	0.031	0.018	1989	2011
Austria	207	76	0.72	0.004	0.002	1990	2011
Belgium	421	132	1.88	0.017	0.010	1989	2011
Canada	5,560	709	0.71	0.039	0.023	1983	2011
Switzerland	541	200	2.90	0.043	0.025	1989	2011
Germany	2,048	662	2.43	0.109	0.065	1989	2011
Denmark	412	137	0.79	0.008	0.005	1989	2011
Spain	415	141	2.66	0.026	0.016	1991	2011
Finland	288	105	1.38	0.010	0.006	1989	2011
France	1,765	555	2.09	0.084	0.049	1989	2011
United Kingdom	6,006	1,811	1.19	0.167	0.099	1988	2011
Hong Kong	1,670	602	1.13	0.046	0.027	1989	2011
Italy	600	219	2.09	0.034	0.020	1990	2011
Japan	4,952	2,847	1.21	0.291	0.172	1987	2011
Netherlands	407	167	3.25	0.040	0.024	1989	2011
Norway	648	148	0.74	0.007	0.004	1989	2011
New Zealand	312	94	0.79	0.005	0.003	1993	2011
Singapore	1,026	342	0.60	0.016	0.009	1989	2011
Sweden	997	243	1.28	0.022	0.013	1989	2011
United States	23,320	3,087	0.95		0.409	1950	2011

Exhibit A2

Cross Sectional Regressions: Forecasting Book-to-Price Ratios

This exhibit reports Fama-MacBeth regression of book-to-price ratios on past ratios and an error correction adjustment. The left-hand side is equal to book value per share divided by price at fiscal year-end. The right-hand side is lagged book value divided by price at fiscal year-end and lagged book value divided by current price as of the previous June:

$$bp_t^{a,l} = \gamma_0 + \gamma_1 bp_{t-1}^{a,l} + \gamma_2 \left(bp_{t-1}^{a,c} - bp_{t-1}^{a,l}\right) + \in_t$$

The first superscript indicated the refreshing frequency (annual *a* or monthly *m*), the second superscript indicated the lag used to update price (lagged *l* or current *c*). The right-hand side variables are windsorized at 1% level and cross sectional regressions are run every fiscal year. The rightmost column reports γ_2/γ_1, the fraction of the linear forecast attributed to $bp^{a,c}$. Panel A reports results for our U.S. sample. "All sample" reports results for the full sample. "(Non) December FYE" report results for firms with fiscal year (not) ending in December. "Industry Fixed Effect" reports results for regression including industry fixed effects based on 49-industry classification from Ken French's website. "ME-1" to "ME-10" reports results for each NYSE-based size percentiles. The last rows report results by sample period. The sample period for the U.S. sample runs from 1950 to 2011. Panel B reports results for our International sample. "All sample" reports results for the full sample. "Large (Small) Cap" report results for firms above (below) the 80th percentiles (by country). The remaining rows report results by sample period and by country. The sample period for the International sample runs from 1983 to 2011. T-statistics are reported next to the coefficient estimates and five percent statistical significance is indicated in bold.

Panel A: U.S. results

	γ_1		γ_2		γ_1 - γ_2			
	Coeff	***t*-stat**	**Coeff**	***t*-stat**	**Coeff**	***t*-stat**	**R2**	γ_2/γ_1
All sample	**0.91**	101.3	**0.86**	38.9	**0.05**	3.14	0.73	0.94
December FYE only	**0.91**	86.2	**0.89**	35.7	0.02	1.14	0.72	0.98
Non-December FYE only	**0.92**	115.6	**0.83**	41.2	**0.09**	5.97	0.76	0.90
Industry Fixed Effects	**0.90**	97.9	**0.84**	41.3	**0.06**	3.87	0.69	0.93
ME-1 (small)	**0.89**	92.1	**0.79**	29.4	**0.10**	3.86	0.67	0.89
ME-2	**0.86**	78.2	**0.81**	34.8	**0.05**	2.48	0.71	0.94
ME-3	**0.87**	74.2	**0.85**	36.3	0.02	0.94	0.72	0.98
ME-4	**0.88**	75.2	**0.90**	29.6	–0.02	–0.64	0.74	1.02
ME-5	**0.90**	69.6	**0.91**	28.3	–0.01	–0.23	0.75	1.01
ME-6	**0.92**	69.5	**0.97**	33.6	**–0.05**	–1.99	0.77	1.05
ME-7	**0.91**	85.5	**0.97**	32.8	**–0.06**	–1.97	0.77	1.06
ME-8	**0.94**	75.0	**1.03**	33.8	**–0.09**	–3.16	0.76	1.10
ME-9	**0.94**	93.6	**1.03**	31.2	**–0.08**	–2.86	0.79	1.09
ME-10 (large)	**0.95**	86.4	**1.06**	31.4	**–0.11**	–3.63	0.80	1.12
1950–1970	**0.98**	87.1	**1.06**	45.6	**–0.09**	–4.08	0.81	1.09
1971–1990	**0.91**	78.7	**0.78**	38.8	**0.13**	7.99	0.75	0.86
1991–2000	**0.88**	61.5	**0.75**	37.8	**0.13**	7.85	0.64	0.86
2001–2011	**0.84**	47.2	**0.74**	21.0	**0.11**	2.48	0.65	0.87

Panel B: International Results

	γ_1 Coeff	γ_1 *t*-stat	γ_2 Coeff	γ_2 *t*-stat	γ_1 - γ_2 Coeff	γ_1 - γ_2 *t*-stat	R2	γ_2/γ_1
All sample	**0.88**	68.9	**0.75**	37.3	**0.12**	5.92	0.67	0.86
Large Cap	**0.90**	66.4	**0.87**	33.3	0.04	1.66	0.72	0.96
Small Cap	**0.86**	61.1	**0.73**	31.8	**0.14**	6.14	0.65	0.84
1983–1990	**0.82**	26.8	**0.79**	14.1	0.03	0.66	0.64	0.96
1991–2000	**0.93**	73.8	**0.78**	31.4	**0.15**	6.58	0.73	0.84
2001–2011	**0.87**	80.8	**0.71**	25.3	**0.16**	5.52	0.65	0.82
Australia	**0.82**	61.7	**0.69**	31.4	**0.13**	8.30	0.64	0.84
Austria	**0.83**	17.8	**0.75**	8.2	0.08	1.14	0.59	0.90
Belgium	**0.91**	2.0	**0.89**	3.2	0.02	0.06	0.68	0.98
Canada	**0.82**	65.1	**0.71**	31.3	**0.12**	4.68	0.59	0.86
Switzerland	**0.96**	43.5	**0.93**	20.5	0.03	0.66	0.67	0.97
Germany	**0.85**	39.6	**0.80**	21.1	0.04	1.08	0.61	0.95
Denmark	**0.98**	25.0	**1.02**	12.2	–0.04	–0.52	0.62	1.04
Spain	**0.84**	33.7	**0.92**	11.1	–0.08	–0.85	0.70	1.10

Exhibit A2 (*Continued*)

Panel B: International Results

	γ_1		γ_2		$\gamma_1 - \gamma_2$			
	Coeff	***t*-stat**	**Coeff**	***t*-stat**	**Coeff**	***t*-stat**	**R2**	γ_2 / γ_1
Finland	**0.93**	21.3	**0.81**	11.5	0.12	1.76	0.67	0.87
France	**0.88**	44.2	**0.87**	20.4	0.01	0.30	0.67	0.99
U.K.	**0.88**	54.9	**0.74**	17.7	**0.14**	4.16	0.66	0.84
Honk Hong	**0.92**	64.5	**0.80**	19.8	**0.12**	2.46	0.69	0.87
Italy	**0.90**	44.9	**0.73**	10.0	**0.17**	2.44	0.69	0.81
Japan	**0.95**	108.9	**0.72**	38.2	**0.23**	11.19	0.82	0.75
Netherlands	**0.92**	27.6	**0.95**	10.7	–0.03	–0.42	0.66	1.03
Norway	**0.83**	23.1	**0.69**	8.5	0.14	1.90	0.49	0.84
New Zealand	**0.91**	23.9	**0.70**	12.2	**0.21**	3.64	0.73	0.77
Singapore	**0.88**	47.4	**0.84**	19.5	0.04	0.94	0.68	0.96
Sweden	**0.91**	24.4	**0.91**	15.0	0.00	0.01	0.58	1.00

Exhibit A3

Cross-Sectional Regressions: Forecasting Changes in Book per Share

This exhibit reports Fama-MacBeth regression of changes in log book per share on log returns over the prior three years.

$$\Delta b^{*}_{t-12\to t} = \theta_0 + \theta_1 r_{t-12\to t} + \theta_2 r_{t-24\to t-12} + \theta_3 r_{t-36\to t-12} + \in_t$$

The left-hand side is equal changes in book value per share where lowercase indicated logs = log (B) , the asterisk * indicates that the quantity is adjusted for splits between the two dates and $r_{t\to s} = \log(1+R_{t\to s})$ is equal to the total log return between date t and $s > t$. The lags are in months. Cross sectional regressions are run every fiscal year. Panel A reports results for our U.S. sample. "All sample" reports results for the full sample. "(Non) December FYE" report results for firms with fiscal year (not) ending in December. "Industry Fixed Effect" reports results for regression including industry fixed effects based on 49-industry classification from Ken French's website. "ME-1" to "ME-10" reports results for each NYSE-based size percentiles. The last rows reports results by sample period. The sample period for the U.S. sample runs from 1950 to 2011. Panel B reports results for our International sample. "All sample" reports results for the full sample. "Large (Small) Cap" report results for firms above (below) the 80th percentiles (by country). The remaining rows report results by sample period and by country. The sample period for the International sample runs from 1983 to 2011. T-statistics are reported next to the coefficient estimates and five percent statistical significance is indicated in bold.

Panel A: U.S. Results

	Coeffiicient			***t*-statistics**			
	θ_1	θ_2	θ_3	θ_1	θ_2	θ_3	**R2**
All sample	**0.22**	**0.15**	**0.08**	17.42	19.38	15.24	0.15
December FYE only	**0.22**	**0.15**	**0.08**	16.04	16.92	12.60	0.14
Non-December FYE only	**0.22**	**0.16**	**0.08**	20.21	19.10	13.29	0.19
Industry Fixed Effects	**0.20**	**0.15**	**0.05**	12.29	12.19	3.99	0.38
ME-1 (small)	**0.24**	**0.15**	**0.08**	19.86	14.82	8.54	0.19
ME-2	**0.21**	**0.14**	**0.05**	15.06	10.50	4.47	0.16
ME-3	**0.18**	**0.16**	**0.07**	15.22	12.63	7.93	0.17
ME-4	**0.16**	**0.14**	**0.07**	13.71	12.36	6.55	0.16
ME-5	**0.20**	**0.13**	**0.06**	12.01	10.64	5.80	0.18
ME-6	**0.18**	**0.13**	**0.09**	12.65	9.48	8.39	0.20
ME-7	**0.17**	**0.14**	**0.08**	9.43	8.24	5.82	0.20
ME-8	**0.17**	**0.13**	**0.07**	10.43	9.39	3.87	0.16
ME-9	**0.12**	**0.13**	**0.10**	6.89	7.42	7.16	0.13
ME-10 (large)	**0.13**	**0.13**	**0.10**	8.23	11.08	6.75	0.13
1950–1970	**0.11**	**0.09**	**0.05**	10.39	11.72	6.49	0.09
1971–1990	**0.22**	**0.16**	**0.08**	14.26	14.41	12.91	0.15
1991–2000	**0.30**	**0.20**	**0.10**	40.80	28.04	9.63	0.17
2001–2011	**0.31**	**0.22**	**0.11**	28.04	24.73	9.06	0.22

EXHIBIT A3 (*Continued*)

Cross Sectional Regressions: Forecasting Changes in Book per Share

This exhibit reports Fama-MacBeth regression of changes in log book per share on log returns over the prior three years. Cross sectional regressions are run every fiscal year. Panel A reports results for our U.S. sample. "All sample" reports results for the full sample. "(Non) December FYE" report results for firms with fiscal year (not) ending in December. "Industry Fixed Effect" reports results for regression including industry fixed effects based on 49-industry classification from Ken French's website. "ME-1" to "ME-10" reports results for each NYSE-based size percentiles. The last rows reports results by sample period. The sample period for the U.S. sample runs from 1950 to 2011. Panel B reports results for our International sample. "All sample" reports results for the full sample. "Large (Small) Cap" report results for firms above (below) the 80th percentiles (by country). The remaining rows report results by sample period and by country. The sample period for the International sample runs from 1983 to 2011. T-statistics are reported next to the coefficient estimates and five percent statistical significance is indicated in bold.

Panel B: International Results

	Coeffiicient			*t*-statistics			
	θ_1	θ_2	θ_3	θ_1	θ_2	θ_3	R2
All sample	**0.26**	**0.15**	**0.09**	13.25	9.29	3.79	0.11
Large Cap	**0.17**	**0.12**	**0.10**	8.61	6.34	7.40	0.11
Small Cap	**0.28**	**0.16**	**0.09**	**12.91**	9.29	3.18	0.12
1983–1990	**0.29**	**0.17**	0.10	6.86	5.83	1.75	0.13
1991–2000	**0.24**	**0.13**	**0.08**	**14.13**	8.07	6.26	0.10
2001–2011							
Australia	**0.31**	**0.18**	**0.12**	**9.67**	11.66	5.15	0.23
Austria	**0.20**	**0.35**	0.10	2.63	3.18	0.90	0.06
Belgium	**0.32**	–0.02	**0.25**	**4.38**	–0.24	2.49	0.09
Canada	**0.33**	**0.19**	**0.09**	**15.25**	10.85	4.82	0.21
Switzerland	**0.41**	0.06	**0.08**	**5.07**	0.79	2.66	0.13
Germany	**0.31**	**0.17**	**0.09**	**14.00**	7.35	3.50	0.11
Denmrk	**0.25**	**0.18**	0.02	6.16	4.75	0.58	0.10
Spain	0.11	**0.18**	**0.28**	**1.56**	3.25	3.83	0.17
Finland	**0.22**	0.05	**0.11**	**2.05**	0.84	2.45	0.21
France	0.21	0.16	0.05	6.74	5.63	1.27	0.09
U.K.	**0.19**	**0.18**	**0.10**	**3.53**	5.88	2.40	0.12
Honk Hong	**0.16**	**0.15**	**0.08**	**2.65**	6.98	3.62	0.13
Italy	**0.42**	0.12	**0.30**	**4.53**	1.01	2.18	0.15
Japan	**0.16**	**0.12**	**0.07**	**12.88**	12.30	6.81	0.08
Netherlands	**0.23**	**0.21**	**0.11**	**6.02**	4.71	2.36	0.14
Norway	**0.37**	**0.27**	0.03	6.39	7.85	0.73	0.20
New Zealand	**0.32**	**0.18**	–0.01	6.13	4.71	–0.14	0.19
Singapore	**0.17**	**0.15**	**0.04**	**9.67**	6.46	2.87	0.09
Sweden	**0.30**	**0.20**	**0.12**	**7.62**	6.90	5.34	0.29

Exhibit A4

HML: Univariate Results, 1950–2011

This exhibit reports returns of value portfolios (HML). The value factors are constructed using three book-to-price (B/P) measures: The first measure is equal to book value per share divided by price at fiscal year-end both in local currency. We denote this value portfolio as $HML^{annual,lagged}$. The second measure is equal to book value per share (adjusted for splits, dividends and other corporate actions between fiscal year-end and portfolio formation dates) divided by current price. We denote this value portfolio as $HML^{annual,current}$. Both annual measures are refreshed in June. The third measure is equal to book value per share (adjusted for splits, dividends and other corporate actions between fiscal year-end and portfolio formation dates) divided by current price, updated monthly. We denote this value portfolio as $HML^{monthly,current}$. We construct portfolios within each country in our sample. At the end of June of year *t* (at the end of each calendar month for the monthly measure), stocks are assigned to two size-sorted portfolios based on their market capitalization. The size breakpoint for the U.S. sample is the median NYSE market equity. The size breakpoint for the international sample is the 80th percentile by country. Portfolios are value-weighted, refreshed every June (refreshed every month for the monthly measure), and rebalanced every calendar month to maintain value weights. The value factor HML is the average return on the two value portfolios minus the average return on the two growth portfolios. This exhibit includes all available stocks in our U.S. and International sample. The sample period runs from 1950 to 2011. Country portfolios are aggregated into Global portfolios using the country's total market capitalization as of the prior month. Returns, volatilities and Sharpe ratios are annualized, *t*-statistics are reported below the coefficient estimates and five percent statistical significant is indicated in bold.

	U.S.				**International**				**Global**			
Measure Refreshing frequency Method to lag price	**HML Annual Lagged**	**HML Annual Current**	**HML Monthly Current**	**UMD Monthly Current**	**HML Annual Lagged**	**HML Annual Current**	**HML Monthly Current**	**UMD Monthly Current**	**HML Annual Lagged**	**HML Annual Current**	**HML Monthly Current**	**UMD Monthly Current**
Full Sample												
Mean	**4.04**	**3.44**	**3.10**	**8.70**	**6.65**	**6.07**	**6.99**	**6.97**	**4.92**	**4.42**	**4.32**	**8.71**
t-statistics	3.35	2.70	2.09	4.83	4.53	3.50	3.48	2.65	4.76	3.94	3.36	5.49
Volatility	9.32	9.84	11.44	13.91	7.66	9.05	10.47	13.72	7.99	8.68	9.93	12.26
SR	0.43	0.35	0.27	0.63	0.87	0.67	0.67	0.51	0.62	0.51	0.44	0.71
Corr with UMD	–0.13	–0.39	–0.64	1.00	0.01	–0.27	–0.61	1.00	–0.09	–0.36	–0.62	1.00
1951–1989												
Mean	**4.60**	**4.31**	**3.34**	**10.04**	6.22	7.07	4.47	7.14	**4.72**	**4.54**	**3.62**	**9.79**
t-statistics	3.62	3.12	2.23	6.05	1.74	1.59	0.92	1.52	3.71	3.28	2.40	5.91
Volatility	7.89	8.57	9.30	10.30	8.75	10.86	11.86	11.52	7.89	8.58	9.37	10.27
SR	0.58	0.50	0.36	0.97	0.71	0.65	0.38	0.62	0.60	0.53	0.39	0.95
Corr with UMD	–0.15	–0.42	–0.56	1.00	–0.17	–0.29	–0.47	1.00	–0.14	–0.40	–0.55	1.00
1990–2011												
Mean	3.04	1.87	2.65	6.27	**6.77**	**5.79**	**7.70**	**6.92**	**5.28**	**4.21**	**5.58**	**6.75**
t-statistics	1.22	0.73	0.84	1.54	4.25	3.14	3.53	2.23	2.98	2.18	2.37	2.05
Volatility	11.49	11.81	14.56	18.76	7.34	8.50	10.06	14.30	8.19	8.88	10.87	15.22
SR	0.26	0.16	0.18	0.33	0.92	0.68	0.77	0.48	0.65	0.47	0.51	0.44
Corr with UMD	–0.12	–0.37	–0.70	1.00	0.06	–0.27	–0.66	1.00	–0.04	–0.33	–0.70	1.00

Exhibit A5

Robustness Checks: 5-Factor Alphas

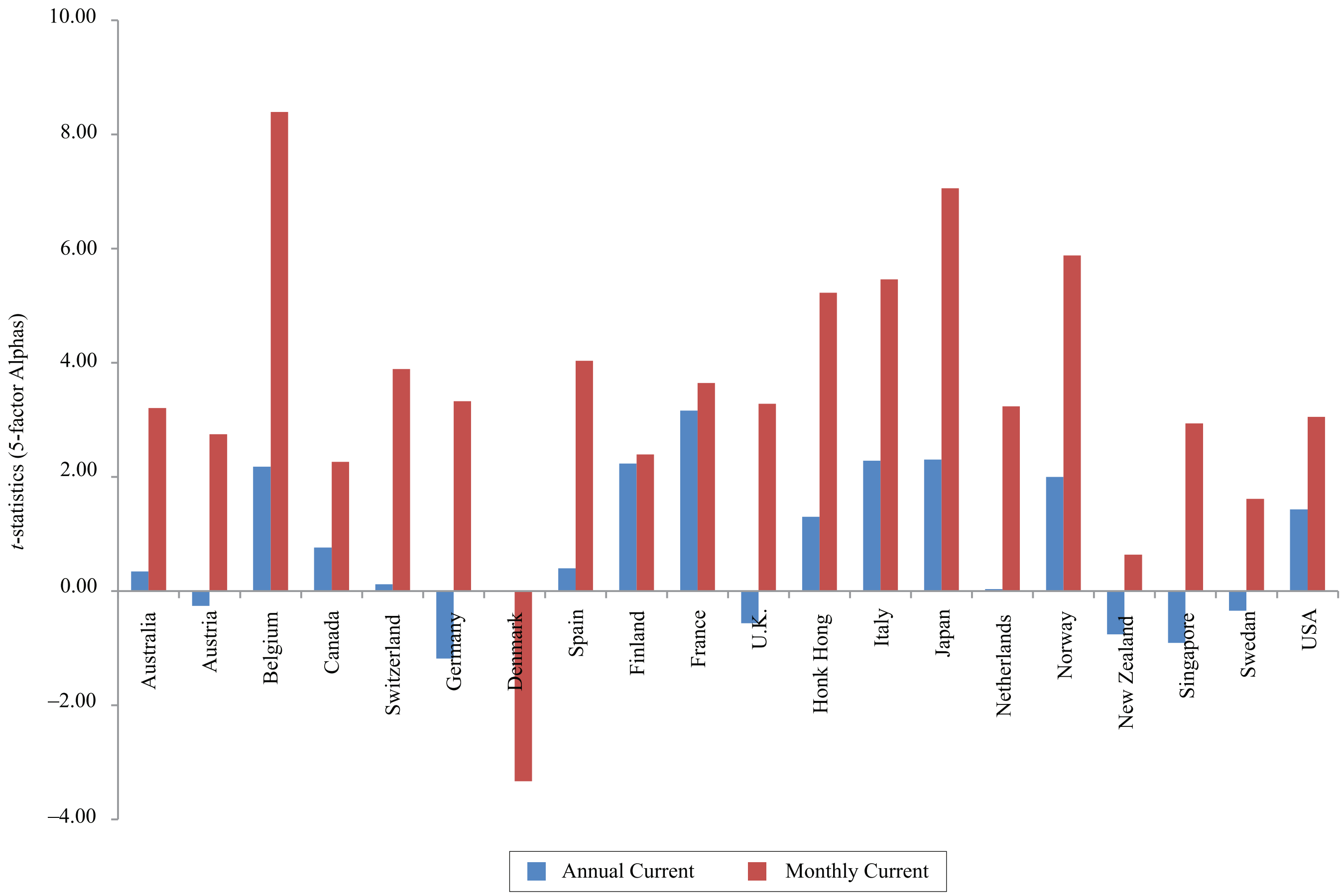
This exhibit reports portfolio returns. We run time series regressions on monthly excess returns of value portfolios (HML) on monthly excess returns on a set of explanatory portfolios. The value factors are constructed using three book-to-price (B/P) measures: The first measure is equal to book value per share divided by price at fiscal year-end both in local currency. We denote this value portfolio as $HML^{annual,lagged}$. The second measure is equal to book value per share (adjusted for splits, dividends and other corporate actions between fiscal year-end and portfolio formation dates) divided by current price. We denote this value portfolio as $HML^{annual,current}$. Both annual measures are refreshed in June. The third measure is equal to book value per share (adjusted for splits, dividends and other corporate actions between fiscal year-end and portfolio formation dates) divided by current price, updated monthly. We denote this value portfolio as $HML^{monthly,current}$. We construct portfolios within each country in our sample. At the end of June of year t (at the end of each calendar month for the monthly measure), stocks are assigned to two size-sorted portfolios based on their market capitalization. The size breakpoint for the U.S. sample is the median NYSE market equity. The size breakpoint for the international sample is the 80th percentile by country. Portfolios are value-weighted, refreshed every June (refreshed every month for the monthly measure), and rebalanced every calendar month to maintain value weights. The value factor HML is the average return on the two value portfolios minus the average return on the two growth portfolios. This exhibit includes all available stocks in our U.S. and International sample. The sample period runs from 1950 to 2011. Country portfolios are aggregated into International and Global portfolios using the country's total market capitalization as of the prior month. Alpha is the intercept in a regression of monthly excess return. The explanatory variables are market excess returns (MKT), a size portfolio (SMB) a momentum portfolio (UMD) and, short term reversal (STR) portfolio and the value measure (HML) indicated in the exhibit. Alphas are annualized, *t*-statistics are reported next to the coefficient estimates and five percent statistical significant is indicated in bold.

Left hand side: HML	Annual Lagged		Annual Lagged		Annual Current		Monthly Current	
	Annual Current		Monthly Current		Annual Lagged		Annual Lagged	
HML measure on right hand side	Alpha	*t*-stat	Alpha	*t*-stat	Alpha	*t*-stat	Alpha	*t*-stat
Panel A: U.S. sample								
All sample	–0.58	–1.35	**–1.61**	–2.92	**1.43**	3.4	**3.05**	5.92
December FYE only	–0.68	–1.44	**–1.91**	–3.07	**1.49**	3.4	**3.48**	6.09
Non-December FYE only	1.30	1.75	0.20	0.25	1.05	1.3	**3.21**	3.49
Large Cap	**–1.54**	–2.94	**–2.73**	–4.14	**2.14**	4.3	**3.79**	6.21
Small Cap	0.81	1.54	0.52	0.71	0.74	1.4	**2.74**	3.82
1950–1970	–0.89	–1.26	0.65	0.70	**1.97**	2.8	1.00	1.14
1971–1990	**–2.22**	–2.90	**–2.83**	–3.67	**3.25**	4.4	**3.86**	5.29
1991–2000	**2.30**	2.10	1.84	1.27	–0.75	–0.7	0.82	0.63
2001–2010	0.06	0.05	–1.70	–1.12	0.41	0.3	2.70	1.77
Panel B: International sample								
All sample	1.05	1.52	–1.24	–1.59	0.56	0.71	**3.78**	4.58
December FYE only	0.26	0.31	–1.55	–1.54	**1.78**	2.17	**4.73**	5.04
Non-December FYE only	0.78	0.79	–1.21	–1.05	1.14	1.10	**4.67**	3.88
Large Cap	1.28	1.42	–1.77	–1.89	0.32	0.32	**3.88**	4.04
Small Cap	0.88	1.05	0.35	0.33	1.73	1.89	**4.88**	4.23
1983–1990	1.12	0.62	1.33	0.72	1.56	0.70	1.44	0.63
1991–2000	0.23	0.27	**–2.88**	–3.22	0.67	0.78	**3.96**	4.77
2001–2010	1.43	1.49	–1.36	–1.29	0.35	0.30	**4.61**	3.70
Panel C: Global sample								
All sample	–0.43	–1.07	**–1.72**	–3.48	**1.51**	3.69	**3.36**	7.14
December FYE only	0.64	0.75	–0.59	–0.55	1.54	1.81	**4.34**	4.21
Non-December FYE only	1.24	1.20	–0.36	–0.30	1.02	0.92	**4.42**	3.42
Large Cap	**–1.53**	–3.13	**–3.11**	–5.38	**2.39**	4.99	**4.33**	8.03
Small Cap	0.84	1.74	0.50	0.76	0.87	1.74	**2.99**	4.56
1983–1990	–1.57	–1.94	**–2.57**	–3.15	**2.94**	3.66	**4.01**	5.04
1991–2000	1.19	1.65	–1.05	–1.21	–0.29	–0.39	**2.26**	2.90
2001–2010	0.47	0.48	**–2.40**	–2.26	0.52	0.51	**4.16**	3.70

Exhibit A6

Robustness Checks: T-statistics of 5-Factor Alpha by Country

This exhibit report *t*-statistics of abnormal portfolio returns. We run time series regressions on monthly excess returns of value portfolios (HML) on monthly excess returns on a set of explanatory portfolios. The value factors are constructed using three book-to-price (B/P) measures: The first measure is equal to book value per share divided by price at fiscal year-end both in local currency. We denote this value portfolio as $HML^{annual,lagged}$. The second measure is equal to book value per share (adjusted for splits, dividends and other corporate actions between fiscal year-end and portfolio formation dates) divided by current price. We denote this value portfolio as $HML^{annual,current}$. Both annual measures are refreshed in June. The third measure is equal to book value per share (adjusted for splits, dividends and other corporate actions between fiscal year-end and portfolio formation dates) divided by current price, updated monthly. We denote this value portfolio as $HML^{monthly,current}$. We construct portfolios within each country in our sample. At the end of June of year (at the end of each calendar month for the monthly measure), stocks are assigned to two size-sorted portfolios based on their market capitalization. The size breakpoint for the U.S. sample is the median NYSE market equity. The size breakpoint for the international sample is the 80th percentile by country. Portfolios are value-weighted, refreshed every June (refreshed every month for the monthly measure), and rebalanced every calendar month to maintain value weights. The value factor HML is the average return on the two value portfolios minus the average return on the two growth portfolios. This exhibit includes all available stocks in our U.S. and International sample. We plot *t*-statistics of five-factor alphas. Alpha is the intercept in a regression of monthly excess return. The left hand sides are return of the $HML^{annual,current}$ factor or $HML^{monthly,current}$. The explanatory variables are market excess returns (MKT), a size portfolio (SMB) a momentum portfolio (UMD) and, short term reversal (STR) portfolio and the value portfolio $HML^{annual,lagged}$.



ENDNOTES

We thank Aaron Brown, Kent Daniel, Tobias Moskowitz, Lars Nielsen, Lasse Pedersen, and seminar participants at the 2012 JOIM Conference for useful comments and suggestions. An early draft of this article circulated under the title "Lagging Value, AQR Capital Management Paper, 2011."

[1]From Exhibit 6.

[2]This is HML as used in its now-ubiquitous academic meaning, not as the Internet texting shorthand with a very different meaning. For a brief time centered around the 1999 tech stock bubble, the two meanings became interchangeable.

[3]In the appendix, we show that our more timely value portfolios earn lower raw returns than traditional value portfolios, but have larger four- and five-factor alphas.

[4]We assign individual issues to the corresponding market, based on the primary exchange's location. For international companies with securities traded in multiple markets, we use the primary trading vehicle that XpressFeed identifies.

[5]Throughout the paper, we use lowercase letters to indicated logs: bp=log(BP).

[6]For firms with fiscal years ending in December, this is the same measure as in Fama and French [1992]. For firms with fiscal year not ending in December, we use prices at the fiscal year-end date, while Fama and French [1992] use December prices for all firms, thus introducing a slight mismatch. Our results are unchanged if we adopt Fama and French's [1992] convention, or if we restrict our sample to firms with fiscal year-ends in December.

[7]The adjust factor adjusts for splits and other corporate actions between the fiscal year-end and the current date.

[8]Because some countries have a small cross-section of stocks in the early years of the sample period, for the international sample we use conditional sorts (first sorting on size, then on B/PB/P) to ensure we have enough securities in each portfolio (the U.S. sorts are always independent).

[9]We use the standard annual lagged method to compute SMB. Using either of the alternative methods of computing B/P has a negligible impact on SMB returns and on our main results.

[10]Corresponds to the standard HML factor used in the literature. From Exhibit 7, over our sample returned 4.0 percent a year, with an annualized volatility of 9.3 percent a year. For comparison, over the common sample period, returns of the HML factor from Ken French's data library were 4.5 percent a year, with 9.5 percent volatility. The correlation between the two series was 0.95. The small (and statistically insignificant) discrepancy between the two series is due to our choice of using price at fiscal year-end (as opposed to December price for all firms, as in Fama and French [1992]), and the fact that our portfolio skips one trading day between rebalancing and investment.

[11]We include delisting returns when available in CRSP. Delisting returns are not available for our international sample. If a firm is delisted but the delisting return is missing, we investigate the reason for disappearance. If the delisting is performance related, we follow Shumway [1997] and assume a –30 percent delisting return. This assumption does not affect any of the results.

[12]Skipping a day serves two purposes. First, it ensures that our portfolios are implementable, in that they use only information available at portfolio formation. Second, it avoids mechanic negative autocorrelation in returns induced by bid-ask bounce, which would tend to overstate returns to STR.

[13]We run annual regressions using annual measures, to put both forecasting variables on an equal footing. In practice on December 2000, we also observe Book (December 31, 1999)/Price (November 29th 2000). Regressions using our monthly measure yield even stronger results, but we prefer to report results based on the annual measure, in order to keep a clean comparison between the two alternatives.

[14]Indicates that the quantity is adjusted for splits between the two dates, and that lags are in months.

[15]For brevity, we do not report results for lags of more than three years, as the coefficients tend to be insignificant.

[16]Later we will argue that the standard method avoids too much shorting of the UMD factor, but in a suboptimal manner versus our more timely measures. This issue would remain even if the coefficients here summed to near 100 percent.

[17]As shown in Exhibit 4, this global portfolio is on average 40 percent U.S. and 60 percent international stocks, with less weight in the U.S. in the most recent period. Our international sample is quite short (starting in 1983 for Canada, with the full set of countries not available until the early 1990s). Because we are estimating expected returns, we tend to emphasize U.S. and global results that are based on a longer time series.

[18]We include STR purely for conservatism. Although we lag a day in constructing our portfolios, it is possible that using more timely measures of price introduces an exposure to the known one-month reversal factor, a factor that is more difficult to implement, and more open to microstructure biases, than our other factors. Our results are still very strong, but are very slightly and intuitively weakened by adding this factor. Skipping a day in portfolio construction and including this factor ensures that our results are not driven by exposure to this higher turnover factor. Repeating our tests on the more standard four-factor model would show slightly stronger results, with no changes in conclusion.

[19]For those used to looking at cumulative returns to value and seeing a big dip during the technology bubble of 1999, please note these are not returns to value investing, but returns to one form of value investing versus another form of value investing (and additional risk factors).

REFERENCES

Asness, C. "Momentum in Japan." *The Journal of Portfolio Management*, 37 (2011), pp. 67-75.

Daniel, K. "Momentum Crashes." Working paper, Columbia University, 2011.

Fama, E., and K. French. "The Cross-Section of Expected Stock Returns." *The Journal of Finance*, 47 (1992), pp. 427-465.

——. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics*, 33 (1993), pp. 3-56.

——. "Multifactor Explanations of Asset Pricing Anomalies." *The Journal of Finance*, 51 (1996), pp. 55-84.

Fama, E., and J. MacBeth. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy*, 81 (1973), pp. 607-636.

Shumway, T. "The Delisting Bias in CRSP Data." *The Journal of Finance*, 52 (1997), pp. 327-340.