Internet appendix to “New evidence on conditional factor models”

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1 Theoretical background

In this section, we provide a more detailed derivation of the conditional asset pricing framework presented in Section 2 in the paper. Specifically, we provide a link to time-varying stochastic discount factor (SDF) coefficients.

Consider the usual asset pricing equation in conditional form,

$$0 = \mathrm{E}_t(M_{t+1} R^e_{i,t+1}), \tag{1}$$

where $R^e_{i,t+1}$ denotes the excess return (relative to the risk-free rate) on an arbitrary risky asset i and M_{t+1} is the SDF.

Following Cochrane (1996, 2005) and Lettau and Ludvigson (2001b), we define an SDF that is linear on K original factors ($f_{j,t+1}$), but with coefficients that are linear functions of a predetermined instrument with zero mean (z_t):[1]

$$\begin{aligned} M_{t+1} &= a_t + \sum_{j=1}^{K} b_{j,t} f_{j,t+1}, & (2)\\ a_t &= a_0 + a_1 z_t, & (3)\\ b_{j,t} &= b_{j,0} + b_{j,1} z_t, j = 1, ..., K. & (4) \end{aligned}$$

In this specification, we are using a single instrument to simplify the algebra presented below, but the analysis can be generalized in a straightforward way to the case of multiple conditioning variables.

By applying the law of iterated expectations, we obtain the unconditional pricing equation,

$$0 = \mathrm{E}(M_{t+1} R^e_{i,t+1}), \tag{5}$$

[1] In a conditional pricing equation, even if one specifies an SDF with fixed coefficients it follows that by forcing the model to price an arbitrary set of test assets (e.g., its factors if they represent returns) the coefficients will be a function of conditional moments of the testing returns (and thus, will be time-varying). Cochrane (2005) (Chapter 8) provides a simple example with the CAPM, in which the model is forced to price the market return and the risk-free rate. This originates SDF coefficients that depend on the conditional mean and variance of the market return and also on the time-varying risk-free rate.

which can be defined in expected return-covariance representation as

$$\mathrm{E}(R^e_{i,t+1}) = -\frac{\mathrm{Cov}(R^e_{i,t+1}, M_{t+1})}{\mathrm{E}(M_{t+1})}. \tag{6}$$

By incorporating the time-varying SDF coefficients, we obtain the SDF as a function of the instrument and the scaled factors ($f_{j,t+1}z_t$):

$$M_{t+1} = a_0 + a_1 z_t + \sum_{j=1}^{K} b_{j,0} f_{j,t+1} + \sum_{j=1}^{K} b_{j,1} f_{j,t+1} z_t. \tag{7}$$

Following Cochrane (2005) (Chapter 6), it can be shown that, by substituting the new expression of the SDF into the expected return-covariance equation above, we obtain the following multifactor model in expected return-beta form,

$$\mathrm{E}(R^e_{i,t+1}) = \beta_{i,z}\lambda_z + \sum_{j=1}^{K} \beta_{i,j}\lambda_j + \sum_{j=1}^{K} \beta_{i,jz}\lambda_{jz}, \tag{8}$$

where the λs represent the factor risk prices and the factor loadings are obtained from the following time-series regression:

$$R^e_{i,t+1} = \alpha_i + \beta_{i,z} z_t + \sum_{j=1}^{K} \beta_{i,j} f_{j,t+1} + \sum_{j=1}^{K} \beta_{i,jz} f_{j,t+1} z_t + \varepsilon_{i,t+1}. \tag{9}$$

This model is identical to the unconditional representation of the conditional model presented in Lettau and Ludvigson (2001b). In what follows, we exclude the lagged instrument (z_t) from the list of factors in the model. This stems from previous empirical evidence showing that such factor has negligible explanatory power for cross-sectional risk premia (e.g., Lettau and Ludvigson (2001b)). Second, we assume that the betas with the lagged instrument are approximately equal to zero ($\beta_{i,z} \simeq 0$). Third, excluding the term ($\beta_{i,z}\lambda_z$) allows us to work only with traded factors, which enables to employ the time-series regression method to conduct the empirical tests of the factor models.

Thus, we have the following factor model where the role of conditioning information is captured by the scaled factors,

$$\mathrm{E}(R^e_{i,t+1}) = \sum_{j=1}^{K} \beta_{i,j}\lambda_j + \sum_{j=1}^{K} \beta_{i,jz}\lambda_{jz}, \tag{10}$$

with the factor loadings being obtained from

$$R^e_{i,t+1} = \alpha_i + \sum_{j=1}^{K} \beta_{i,j} f_{j,t+1} + \sum_{j=1}^{K} \beta_{i,jz} f_{j,t+1} z_t + \varepsilon_{i,t+1}. \tag{11}$$

This regression is equivalent to a conditional specification in which the loadings on the original factors are allowed to be time-varying and affine in the instrument:

$$R^e_{i,t+1} = \alpha_i + \sum_{j=1}^{K} (\beta_{i,j} + \beta_{i,jz} z_t) f_{j,t+1} + \varepsilon_{i,t+1}. \tag{12}$$

Thus, a K-factor conditional model is equivalent to a $2K$-factor model in the equivalent unconditional representation. Moreover, specifying a SDF with time-varying coefficients is equivalent to modelling a beta representation with time-varying factor loadings.

2 Selecting instruments

In this section, we provide detailed information on the instruments employed in Section 4.1 in the paper.

We use the following list of 21 predictors, many of them employed in the comprehensive analysis conducted in Welch and Goyal (2008):[2]

- Term spread ($TERM$, Campbell (1987), Fama and French (1989)). $TERM \equiv Y_{10} - Y_1$, where Y_{10} and Y_1 represent the yields associated with the ten-year and one-year Treasury bonds, respectively. Data source: St. Louis Fed.

[2] We do not use predictors like the variance risk premium (Bollerslev, Tauchen, and Zhou (2009)) or short interest Rapach, Ringgenberg, and Zhou (2016), since these are not available for our sample.

- Default spread (DEF, Keim and Stambaugh (1986), Fama and French (1989)). $DEF \equiv Y_{BAA} - Y_{AAA}$, where Y_{BAA} and Y_{AAA} represent the yields associated with the BAA and AAA corporate bonds from Moody's. Data source: St. Louis Fed.

- Dividend-to-price ratio (dp, Fama and French (1988, 1989), Campbell and Shiller (1988)). $dp \equiv d - p$, where d and p represent the log (annual) dividend and price level associated with the Standard & Poor's (S&P) 500 Index, respectively. Data source: Robert Shiller.

- T-bill rate (TB, Fama and Schwert (1977)). TB is the annualized one-month T-bill rate. Data source: Kenneth French.

- Dividend-payout ratio (de, Lamont (1998)). $de \equiv d - e$, where e represents the log (annual) earnings associated with S&P 500. Data source: Robert Shiller.

- Net equity expansion ($NTIS$, Welch and Goyal (2008)). $NTIS$ is the ratio of annual net issues to the market value of NYSE stocks. Data source: Amit Goyal.

- Cross-sectional portfolio return dispersion (RD, Stivers and Sun (2010), Maio (2016)). RD is the cross-sectional standard deviation of the returns on 100 portfolios sorted on size and book-to-market (see Maio (2016) for details). Data source: Kenneth French.

- Default return spread (DFR, Keim and Stambaugh (1986), Fama and French (1989), Welch and Goyal (2008)). $DFR \equiv R_{CB} - R_{TB}$, where R_{CB} and R_{TB} are the long-term returns on corporate and treasury bonds, respectively. Data source: Amit Goyal.

- Value spread (vs, Cohen, Polk, and Vuolteenaho (2003), Campbell and Vuolteenaho (2004), Liu and Zhang (2008)). vs is the difference in the log book-to-market ratios of small-value and small-growth portfolios (see Campbell and Vuolteenaho (2004) for details). Data source: Kenneth French.

- Realized stock market variance ($SVAR$, Guo (2006), Welch and Goyal (2008)). $SVAR$ is the sum of squared daily returns on the S&P 500 Index. Data source: Amit Goyal.

- Inflation rate (INF, Fama and Schwert (1977), Fama (1981)). $INF_t \equiv cpi_t - cpi_{t-1}$, $cpi \equiv \ln(CPI)$, where CPI is the Consumer Price Index (seasonally adjusted). Data source: St. Louis Fed.

- Change in the Fed funds rate (ΔFFR, Jensen, Mercer, and Johnson (1996), Patelis (1997), Maio (2014)). $\Delta FFR_t = FFR_t - FFR_{t-1}$, where FFR is the Fed funds rate. Data source: St. Louis Fed.

- Relative T-bill rate ($RREL$, Campbell (1991), Hodrick (1992)). $RREL_t = TB_{3t} - (1/12)\sum_{i=1}^{12} TB_{3,t-i}$ where TB_3 is the three-month treasury-bill rate. Data source: St. Louis Fed.

- Cross-sectional stock return dispersion (CSV, Goyal and Santa-Clara (2003), Garcia, Mantilla-Garcia, and Martellini (2014)). CSV is the cross-sectional standard deviation of individual stock returns. Data source: CRSP.

- Industrial Production (IPG, Cooper and Priestley (2009)). $IPG_t \equiv ip_t - ip_{t-1}$, $ip \equiv \ln(IP)$, where IP is the Industrial Production Index (seasonally adjusted). Data source: St. Louis Fed.

- Earnings-to-price ratio (ep, Campbell and Shiller (1988)). $ep \equiv e - p$. Data source: Robert Shiller.

- Stock-bond yield gap (yg, Asness (2003), Maio (2013)). $yg = e - p - \ln(1 + Y_{10})$. Data sources: Robert Shiller's webpage and St. Louis Fed.

- Price-earnings ratio (pe, Campbell and Vuolteenaho (2004)). $pe \equiv p - e10$, where $e10$ represents the log of a 10-year moving average of annual earnings associated with S&P 500. Data source: Robert Shiller.

- Book-to-market ratio (BM, Kothari and Shanken (1997), Pontiff and Schall (1998)). BM is the book-to-market ratio associated with the Dow Jones Industrial Average. Data source: Amit Goyal.

- Consumption-to-wealth ratio (cay, Lettau and Ludvigson (2001a, 2001b)). Data source: Amit Goyal.

- Investment-to-capital ratio (IK, Cochrane (1991)). Data source: Amit Goyal.[3]

3 Scaled factors

This section discusses the Wald tests on the joint significance of the scaled factor loadings associated with each original factor in the HXZ and FF models.

The results for the Wald tests on the factor loadings in the case of the HXZ model are reported in Table A.1. The scaled factors associated with ME and IA are jointly significant for 11 and 9 of the 25 high-minus-low spreads, respectively. In the case of the market factor, there is weaker evidence of time-varying factor betas as there are six anomalies with significant loadings on the scaled market factors. Nevertheless, only for five anomalies (IM, RS, CEI, POA, and OL) is there no evidence of jointly significant scaled factors corresponding to at least one of the raw equity factors.

The results for the FF model are presented in Table A.2. There are 13 anomalies in which the scaled factors associated with SMB are jointly significant, followed by HML and RMW (10 spreads each). It turns out that only for three anomalies (ABR, ABR*, and NEI) one can not find any evidence of significant scaled factor loadings (associated with at least one of the original factors) within the conditional FF model. This suggests evidence of higher time variation in the factor betas in comparison to the conditional HXZ model. The Wald tests associated with the original factors in the five-factor model (RM, SMB, HML, RMW, CMA)

[3]To construct the monthly series for both cay and IK, we use the most recent quarterly observation available (Golez (2014) uses a similar procedure). In comparison to linear interpolation, this procedure avoids producing a look-ahead bias in the monthly series.

show that these are not jointly significant for several of the momentum-based anomalies (SUE, ABR, IM, and ABR*) as indicated by the respective p-values above 5%. This is related with the fact that the five-factor model shows a substantially weaker performance than HXZ in terms of explaining the momentum anomalies (as clearly shown in the paper).

Overall, the results of this section suggest that some of the loadings associated with the scaled factors are statistically significant in most cases, and thus, it makes sense to conduct conditional asset pricing tests in order to evaluate these two multifactor models.

4 Bootstrap simulation

Following Maio (2017), the bootstrap algorithm used to obtain empirical p-values for assessing the statistical significance of the difference in R^2_C between each conditional multifactor model (and the corresponding unconditional model) contains the following steps. We use the HXZ scaled by IK for illustrating purposes.

1. We estimate the time-series regressions to obtain the factor loadings and alphas for the unconditional model,

$$R_{i,t+1}-R_{f,t+1}=\alpha_{i,U}+\beta_{i,M}RM_{t+1}+\beta_{i,ME}ME_{t+1}+\beta_{i,IA}IA_{t+1}+\beta_{i,ROE}ROE_{t+1}+\varepsilon_{i,U,t+1},$$

and the scaled model,

$$\begin{aligned}R_{i,t+1}-R_{f,t+1} &= \alpha_{i,C}+\beta_{i,M}RM_{t+1}+\beta_{i,M,IK}RM_{t+1}IK_t+\beta_{i,ME}ME_{t+1}+\beta_{i,ME,IK}ME_{t+1}IK_t \\ &+\beta_{i,IA}IA_{t+1}+\beta_{i,IA,IK}IA_{t+1}IK_t+\beta_{i,ROE}ROE_{t+1}+\beta_{i,ROE,IK}ROE_{t+1}IK_t+\varepsilon_{i,C,t+1}.\end{aligned}$$

The corresponding constrained cross-sectional regressions are given by

$$\overline{R_i-R_f}=\overline{RM}\beta_{i,M}+\overline{ME}\beta_{i,ME}+\overline{IA}\beta_{i,IA}+\overline{ROE}\beta_{i,ROE}+\alpha_{i,U},$$

and

$$\overline{R_i - R_f} = \overline{RM}\beta_{i,M} + \overline{RMIK}\beta_{i,M,IK} + \overline{ME}\beta_{i,ME} + \overline{MEIK}\beta_{i,ME,IK}$$
$$+\overline{IA}\beta_{i,IA} + \overline{IAIK}\beta_{i,IA,IK} + \overline{ROE}\beta_{i,ROE} + \overline{ROEIK}\beta_{i,ROE,IK} + \alpha_{i,C}.$$

We compute and save the sample spread in the explanatory ratios, $S = R^2_{C,C} - R^2_{C,U}$, where $R^2_{C,C}$ ($R^2_{C,U}$) denotes the constrained cross-sectional R^2 associated with the conditional (unconditional) model.

We also run the following auxiliary time-series regressions,

$$R_{i,t+1} - R_{f,t+1} = \overline{R_i - R_f} + \xi_{i,t+1},$$

and save the time-series average portfolio excess returns ($\overline{R_i - R_f}$) and the corresponding residuals, $\xi_{i,t+1}$.

2. In each replication $b = 1, ..., 5000$, we construct a pseudo-sample of the time-series residuals for each testing asset (of size T) by drawing with replacement:

$$\{\xi^b_{i,t+1}, t = s^b_1, s^b_2, ..., s^b_T\}, i = 1, ..., N,$$

where the time indices $s^b_1, s^b_2, ..., s^b_T$ are created randomly from the original time sequence $1, ..., T$. Notice that all residuals have the same time sequence in order to preserve the contemporaneous cross-correlation between asset returns.

3. For each replication $b = 1, ..., 5000$, we construct an independent pseudo-sample of the

risk factors in both models,

$$\{RM^b_{t+1}, ME^b_{t+1}, IA^b_{t+1}, ROE^b_{t+1}\}, t = r^b_1, r^b_2, ..., r^b_T,$$

$$\{RM^b_{t+1}, (RM_{t+1}IK_t)^b, ME^b_{t+1}, (ME_{t+1}IK_t)^b, IA^b_{t+1}, (IA_{t+1}IK_t)^b, ROE^b_{t+1}, (ROE_{t+1}IK_t)^b\},$$

$$t = q^b_1, q^b_2, ..., q^b_T,$$

where the time sequences $(r^b_1, r^b_2, ..., r^b_T)$ and $(q^b_1, q^b_2, ..., q^b_T)$ are independent from $s^b_1, s^b_2, ..., s^b_T$. On the other hand, the time sequence is the same for all the factors in a model in order to preserve their contemporaneous cross-correlations.

4. For each replication, the pseudo asset excess returns are constructed by imposing the null that the factors do not explain asset returns:

$$(R_{i,t+1} - R_{f,t+1})^b = \overline{R_i - R_f} + \xi^b_{i,t+1}.$$

5. In each replication, we estimate the model, but using the artificial data rather than the original data. The time-series regressions are given by

$$(R_{i,t+1} - R_{f,t+1})^b = \alpha^b_{i,U} + \beta^b_{i,M} RM^b_{t+1} + \beta^b_{i,ME} ME^b_{t+1} + \beta^b_{i,IA} IA^b_{t+1} + \beta^b_{i,ROE} ROE^b_{t+1} + \varepsilon^b_{i,U,t+1},$$

and

$$(R_{i,t+1} - R_{f,t+1})^b = \alpha^b_{i,C} + \beta^b_{i,M} RM^b_{t+1} + \beta^b_{i,M,IK}(RM_{t+1}IK_t)^b + \beta^b_{i,ME} ME^b_{t+1} + \beta^b_{i,ME,IK}(ME_{t+1}IK_t)^b$$
$$+ \beta^b_{i,IA} IA^b_{t+1} + \beta^b_{i,IA,IK}(IA_{t+1}IK_t)^b + \beta^b_{i,ROE} ROE^b_{t+1} + \beta^b_{i,ROE,IK}(ROE_{t+1}IK_t)^b + \varepsilon^b_{i,C,t+1}.$$

for the unscaled and scaled models, respectively. The corresponding constrained cross-sectional regressions are given by

$$\overline{R_i - R_f}^b = \overline{RM}^b \beta^b_{i,M} + \overline{ME}^b \beta^b_{i,ME} + \overline{IA}^b \beta^b_{i,IA} + \overline{ROE}^b \beta^b_{i,ROE} + \alpha^b_{i,U},$$

and

$$\overline{R_i - R_f}^b = \overline{RM}^b \beta^b_{i,M} + \overline{RMIK}^b \beta^b_{i,M,IK} + \overline{ME}^b \beta^b_{i,ME} + \overline{MEIK}^b \beta^b_{i,ME,IK}$$
$$+\overline{IA}^b \beta^b_{i,IA} + \overline{IAIK}^b \beta^b_{i,IA,IK} + \overline{ROE}^b \beta^b_{i,ROE} + \overline{ROEIK}^b \beta^b_{i,ROE,IK} + \alpha^b_{i,C}.$$

We compute the spread in R^2_C ($S^b = R^2_{C,C,b} - R^2_{C,U,b}$) for each pseudo sample.

6. The empirical p-value associated with the spread in R^2_C is computed as

$$p(S) = \begin{cases} \left[\# \left\{S^b \geq S\right\}\right]/5000, if\ S \geq 0 \\ \left[\# \left\{S^b < S\right\}\right]/5000, if\ S < 0 \end{cases},$$

where $\# \left\{S^b \geq S\right\}$ denotes the number of replications in which the pseudo spread is greater than or equal to the sample estimate.

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Table A.1: Wald tests for factor loadings: HXZ

This table presents the p-values of Wald tests for combinations of factor loadings associated with the Hou–Xue–Zhang four-factor model (HXZ). The test assets are "high-minus-low" portfolio return spreads associated with 25 anomalies. See Table 2 in the paper for a description of the different portfolio sorts. RM, ME, IA, and ROE represent the Hou–Xue–Zhang market, size, investment, and profitability factors, respectively. The lagged instruments (z) used in the time-series regressions are the value spread (vs), one-month T-bill rate (TB), investment-capital ratio (IK), and stock return dispersion (RD). The sample is 1972:01–2013:12. Bold p-values indicate rejection of the null hypothesis (that the slopes are jointly equal to zero) at the 5% level.

	$RM_{t+1}z_t$	$ME_{t+1}z_t$	$IA_{t+1}z_t$	$ROE_{t+1}z_t$	(RM, ME, IA, ROE)
BM	0.27	**0.02**	**0.02**	**0.02**	**0.00**
DUR	0.16	**0.00**	**0.00**	**0.00**	**0.00**
CFP	0.62	**0.03**	**0.01**	**0.01**	**0.00**
MOM	0.47	**0.01**	0.11	0.25	**0.00**
SUE	0.57	**0.01**	0.15	**0.01**	**0.00**
ABR	**0.01**	0.12	0.08	0.99	**0.00**
IM	0.44	0.23	0.25	0.39	**0.00**
ABR*	**0.00**	**0.01**	**0.02**	0.50	**0.00**
ROE	0.11	0.97	**0.00**	0.16	**0.00**
GPA	**0.00**	0.09	0.51	0.65	**0.00**
NEI	0.61	**0.00**	0.94	0.67	**0.00**
RS	0.38	0.05	0.88	0.13	**0.00**
IA	**0.01**	0.15	0.58	0.17	**0.00**
NSI	0.45	0.63	0.21	**0.01**	**0.00**
CEI	0.91	0.12	0.69	0.06	**0.00**
PIA	0.24	**0.04**	**0.00**	**0.00**	**0.00**
IG	**0.00**	0.33	0.69	**0.00**	**0.00**
IVC	0.51	0.19	**0.00**	0.27	**0.00**
IVG	0.48	0.07	**0.01**	0.94	**0.00**
NOA	0.06	**0.00**	0.22	0.65	**0.00**
OA	0.33	**0.00**	**0.00**	**0.00**	**0.00**
POA	0.59	0.08	0.31	0.40	**0.00**
PTA	0.27	**0.00**	0.61	0.56	**0.00**
OCA	**0.00**	0.53	0.16	1.00	**0.00**
OL	0.88	0.13	0.20	0.10	**0.00**

Table A.2: Wald tests for factor loadings: FF

This table presents the p-values of Wald tests for combinations of factor loadings associated with the Fama–French five-factor model (FF). The test assets are "high-minus-low" portfolio return spreads associated with 25 anomalies. See Table 2 in the paper for a description of the different portfolio sorts. RM, SMB, HML, RMW, and CMA represent the Fama–French market, size, value, profitability, and investment factors, respectively. The lagged instruments (z) used in the time-series regressions are the value spread (vs), relative T-bill rate ($RREL$), net equity expansion ($NTIS$), and stock return dispersion (RD). The sample is 1972:01–2013:12. Bold p-values indicate rejection of the null hypothesis (that the slopes are jointly equal to zero) at the 5% level.

	$RM_{t+1}z_t$	$SMB_{t+1}z_t$	$HML_{t+1}z_t$	$RMW_{t+1}z_t$	$CMA_{t+1}z_t$	(RM, SMB, HML, RMW, CMA)
BM	0.49	0.26	0.25	**0.00**	0.07	**0.00**
DUR	**0.00**	**0.00**	**0.01**	0.38	**0.00**	**0.00**
CFP	**0.00**	**0.00**	**0.02**	0.08	**0.04**	**0.00**
MOM	0.20	0.45	**0.00**	**0.00**	0.11	**0.01**
SUE	0.21	**0.03**	0.09	0.44	0.84	0.14
ABR	0.10	0.16	0.46	0.50	0.63	0.28
IM	**0.01**	0.98	**0.02**	**0.00**	**0.05**	0.09
ABR*	0.76	0.07	0.27	0.71	0.26	0.15
ROE	**0.00**	0.71	0.21	0.20	**0.00**	**0.00**
GPA	**0.04**	0.05	0.06	0.92	0.65	**0.00**
NEI	0.12	0.16	0.99	0.74	0.35	**0.00**
RS	0.16	**0.01**	0.86	0.96	0.56	**0.00**
IA	0.11	**0.00**	0.35	0.08	0.77	**0.00**
NSI	**0.00**	0.72	**0.04**	0.56	0.11	**0.00**
CEI	**0.04**	0.20	**0.01**	0.52	0.18	**0.00**
PIA	0.10	**0.00**	0.66	**0.01**	0.15	**0.00**
IG	0.23	**0.00**	0.20	**0.01**	0.57	**0.00**
IVC	0.05	**0.00**	**0.00**	0.24	**0.01**	**0.00**
IVG	0.20	**0.00**	**0.00**	**0.05**	**0.01**	**0.00**
NOA	0.10	**0.00**	**0.00**	**0.00**	0.12	**0.00**
OA	0.38	**0.00**	0.08	**0.00**	**0.01**	**0.00**
POA	0.29	**0.01**	0.05	**0.02**	0.12	**0.00**
PTA	0.46	**0.00**	0.27	0.24	0.53	**0.00**
OCA	**0.00**	0.97	**0.01**	**0.01**	0.53	**0.00**
OL	**0.05**	0.68	0.85	0.37	0.81	**0.00**

Table A.3: Spreads "high-minus-low" for CAPM

This table presents alphas for "high-minus-low" portfolio return spreads associated with the unconditional and scaled CAPM. See Table 2 in the paper for a description of the different portfolio sorts. In the first conditional CAPM, the lagged instruments are the value spread (VS), one-month T-bill rate (TB), investment-capital ratio (IK), and stock return dispersion (RD). In the second conditional CAPM, the lagged instruments are VS, RD, relative T-bill rate (RREL), and net equity expansion (NTIS). The sample is 1972:01–2013:12. Bold values indicate statistical significance at the 5% level.

	CAPM	CAPM(VS,TB,IK,RD)	CAPM(VS,RREL,NTIS,RD)
BM	**0.75**	**0.60**	**0.74**
DUR	**−0.61**	**−0.58**	**−0.62**
CFP	**0.63**	**0.55**	**0.62**
MOM	**1.29**	**1.31**	**1.30**
SUE	**0.50**	**0.48**	**0.52**
ABR	**0.76**	**0.76**	**0.73**
IM	**0.61**	**0.61**	**0.64**
ABR*	**0.30**	**0.34**	**0.31**
ROE	**0.93**	**0.87**	**0.85**
GPA	**0.32**	0.26	0.28
NEI	**0.37**	**0.38**	**0.37**
RS	**0.31**	**0.35**	**0.32**
IA	**−0.52**	**−0.38**	**−0.46**
NSI	**−0.79**	**−0.75**	**−0.76**
CEI	**−0.79**	**−0.72**	**−0.78**
PIA	**−0.56**	**−0.53**	**−0.55**
IG	**−0.43**	**−0.40**	**−0.43**
IVC	**−0.49**	**−0.48**	**−0.53**
IVG	**−0.43**	**−0.38**	**−0.43**
NOA	**−0.38**	**−0.39**	**−0.39**
OA	**−0.30**	**−0.34**	**−0.35**
POA	**−0.51**	**−0.42**	**−0.48**
PTA	**−0.51**	**−0.43**	**−0.49**
OCA	**0.65**	**0.58**	**0.62**
OL	**0.43**	**0.39**	**0.37**

Table A.4: Comparing scaled multifactor models

This table reports spreads in the cross-sectional constrained R^2 (R_C^2) between the scaled HXZ and FF models and respective empirical p-values (obtained from a bootstrap simulation) for testing the null hypothesis that the difference in explanatory ratios is equal to zero. vs and RD refer to comparison of single-instrument scaled models in which the instruments are the value spread and stock return dispersion, respectively. "all" refers to a comparison of an augmented scaled HXZ model (based on vs, RD, one-month T-bill rate (TB), and investment-capital ratio (IK)) and an augmented scaled FF model (based on vs, RD, relative T-bill rate ($RREL$), and net equity expansion ($NTIS$)). "Full" refers to asset pricing tests including the full cross-section of stock returns. The other asset pricing tests represent combinations of 25 different portfolios sorts that correspond to the categories defined in Table 2 in the paper. The sample is 1972:01–2013:12.

	vs	RD	all
Full	0.22	0.29	0.25
	(0.08)	(0.02)	(0.09)
Value-growth	−0.65	−0.42	−0.60
	(0.04)	(0.12)	(0.09)
Momentum	0.62	0.83	0.59
	(0.01)	(0.00)	(0.03)
Profitability	0.63	0.59	0.62
	(0.01)	(0.01)	(0.02)
Investment	0.08	0.05	0.18
	(0.32)	(0.35)	(0.19)
Intangibles	0.27	0.15	0.30
	(0.14)	(0.24)	(0.17)

Table A.5: Time-series tests for other anomalies

This table presents time-series tests of unconditional and conditional factor models for selected individual anomalies. The portfolios are sorted on CFP, SUE, GPA, NEI, RS, IA, PIA, IG, IVC, IVG, POA, PTA, and OL. See Table 2 in the paper for a description of the different portfolio sorts. The models are the Hou–Xue–Zhang four-factor model (HXZ) and the Fama–French five-factor model (FF). In the conditional HXZ models, the lagged instruments are the value spread (vs), one-month T-bill rate (TB), investment-capital ratio (IK), and stock return dispersion (RD). In the conditional FF models, the lagged instruments are vs, RD, relative T-bill rate ($RREL$), and net equity expansion ($NTIS$). The sample is 1972:01–2013:12. MAA denotes the mean absolute alpha. $\# < 0.05$ represents the number of portfolios in which the alphas are significant at the 5% level. χ^2 denotes the p-value associated with the χ^2 specification test. R^2_C is the cross-sectional constrained R^2. The numbers in parentheses represent empirical p-values (obtained from a bootstrap simulation) for testing the null hypothesis that the difference in R^2_C between each conditional multifactor model (and the corresponding unconditional model) is equal to zero.

	CFP	SUE	GPA	NEI	RS	IA	PIA	IG	IVC	IVG	POA	PTA	OL
							Panel A: HXZ (Uncond.)						
MAA	0.14	0.06	0.10	0.09	0.09	0.09	0.14	0.10	0.07	0.11	0.12	0.08	0.11
$\# < 0.05$	2	1	1	3	1	1	3	3	0	2	2	1	1
χ^2	0.01	0.22	0.21	0.03	0.03	0.00	0.00	0.00	0.62	0.08	0.00	0.05	0.05
R^2_C	−0.23	0.84	−0.39	0.36	−0.53	−0.28	−0.26	0.36	0.65	−0.36	−0.16	0.24	0.00
							Panel B: HXZ (IK)						
MAA	0.12	0.07	0.08	0.08	0.08	0.08	0.10	0.09	0.06	0.10	0.10	0.08	0.08
$\# < 0.05$	2	1	1	1	1	1	1	1	0	1	1	1	1
χ^2	0.02	0.07	0.32	0.11	0.08	0.02	0.00	0.01	0.79	0.07	0.01	0.14	0.29
R^2_C	−0.27	0.79	0.23	0.55	−0.01	0.28	0.17	0.40	0.83	−0.04	0.19	0.57	0.53
	(0.47)	(0.43)	(0.05)	(0.25)	(0.08)	(0.07)	(0.06)	(0.42)	(0.26)	(0.16)	(0.13)	(0.15)	(0.09)
							Panel C: HXZ (vs)						
MAA	0.12	0.06	0.08	0.10	0.10	0.09	0.11	0.09	0.06	0.09	0.10	0.09	0.10
$\# < 0.05$	2	1	0	1	1	1	2	3	0	1	2	1	0
χ^2	0.02	0.15	0.40	0.02	0.01	0.01	0.00	0.00	0.63	0.29	0.01	0.04	0.15
R^2_C	−0.32	0.86	0.14	0.41	−0.60	0.06	0.23	0.32	0.73	0.29	0.07	0.31	0.52
	(0.42)	(0.46)	(0.08)	(0.41)	(0.46)	(0.17)	(0.04)	(0.45)	(0.39)	(0.03)	(0.21)	(0.39)	(0.10)
							Panel D: HXZ (vs, TB, IK, RD)						
MAA	0.12	0.07	0.07	0.09	0.09	0.08	0.09	0.08	0.05	0.08	0.09	0.08	0.08
$\# < 0.05$	2	0	0	0	1	2	2	2	0	1	1	1	0
χ^2	0.02	0.18	0.41	0.09	0.05	0.01	0.02	0.01	0.51	0.17	0.02	0.11	0.35
R^2_C	−0.22	0.86	0.40	0.54	−0.11	0.25	0.42	0.45	0.78	0.37	0.24	0.47	0.66
	(0.44)	(0.44)	(0.02)	(0.23)	(0.12)	(0.08)	(0.01)	(0.34)	(0.30)	(0.01)	(0.11)	(0.21)	(0.05)
							Panel E: FF (Uncond.)						
MAA	0.12	0.11	0.08	0.16	0.13	0.09	0.12	0.06	0.08	0.11	0.11	0.07	0.09
$\# < 0.05$	1	1	1	3	3	2	2	1	1	2	4	1	1
χ^2	0.10	0.02	0.24	0.00	0.01	0.01	0.00	0.18	0.30	0.03	0.01	0.11	0.16
R^2_C	0.26	0.28	−0.22	−0.27	−2.41	−0.20	−0.10	0.64	0.46	−0.34	−0.18	0.24	0.07
							Panel F: FF (vs)						
MAA	0.09	0.13	0.07	0.17	0.13	0.08	0.11	0.08	0.09	0.10	0.10	0.07	0.09
$\# < 0.05$	1	2	0	5	2	2	2	1	1	1	2	2	1
χ^2	0.25	0.00	0.32	0.00	0.00	0.01	0.00	0.11	0.13	0.06	0.02	0.10	0.06
R^2_C	0.47	0.12	0.22	−0.39	−2.67	0.11	0.10	0.61	0.33	−0.11	−0.01	0.36	−0.00
	(0.24)	(0.25)	(0.08)	(0.33)	(0.24)	(0.15)	(0.19)	(0.49)	(0.32)	(0.19)	(0.25)	(0.31)	(0.45)
							Panel G: FF ($NTIS$)						
MAA	0.13	0.10	0.08	0.14	0.13	0.10	0.11	0.06	0.09	0.12	0.10	0.07	0.09
$\# < 0.05$	2	1	1	3	3	1	2	1	2	2	2	1	1
χ^2	0.06	0.06	0.43	0.00	0.01	0.01	0.00	0.17	0.12	0.01	0.03	0.19	0.18
R^2_C	0.24	0.41	−0.20	−0.19	−2.22	−0.26	0.01	0.57	0.33	−0.49	−0.01	0.30	0.14
	(0.49)	(0.26)	(0.45)	(0.33)	(0.24)	(0.44)	(0.30)	(0.40)	(0.28)	(0.30)	(0.24)	(0.40)	(0.40)
							Panel H: FF ($vs, RREL, NTIS, RD$)						
MAA	0.08	0.11	0.06	0.16	0.11	0.09	0.11	0.07	0.10	0.10	0.09	0.06	0.07
$\# < 0.05$	1	1	0	3	2	2	2	1	2	1	1	1	1
χ^2	0.47	0.01	0.57	0.00	0.01	0.01	0.00	0.16	0.05	0.08	0.12	0.29	0.25
R^2_C	0.59	0.32	0.26	−0.27	−1.86	0.03	0.18	0.67	0.21	−0.01	0.27	0.59	0.38
	(0.16)	(0.40)	(0.07)	(0.42)	(0.05)	(0.22)	(0.12)	(0.40)	(0.23)	(0.12)	(0.06)	(0.10)	(0.17)

Table A.6: Spreads "high-minus-low": alternative instruments I

This table presents alphas for "high-minus-low" portfolio return spreads associated with unconditional and conditional factor models. See Table 2 for a description of the different portfolio sorts. The models are the CAPM, Hou–Xue–Zhang four-factor model (HXZ), and Fama–French five-factor model (FF). In the first set of conditional models, the lagged instruments are the value spread (vs), one-month T-bill rate (TB), earnings yield (ep), and stock return dispersion (RD). In the second set of conditional models, the lagged instruments are vs, RD, relative T-bill rate ($RREL$), and consumption-wealth ratio (cay). The sample is 1972:01–2013:12. Bold values indicate statistical significance at the 5% level.

	Uncond.			**Cond.(vs, TB, ep, RD)**			**Cond.($vs, RREL, cay, RD$)**		
	CAPM	HXZ	FF	CAPM(all)	HXZ(ep)	HXZ(all)	CAPM(all)	FF(cay)	FF(all)
BM	**0.75**	0.23	0.04	**0.64**	0.30	**0.41**	**0.79**	0.06	0.08
DUR	**−0.61**	−0.27	−0.15	**−0.58**	−0.31	**−0.39**	**−0.67**	−0.15	−0.07
CFP	**0.63**	0.22	0.07	**0.58**	0.26	0.31	**0.67**	0.10	0.00
MOM	**1.29**	0.26	**1.22**	**1.23**	0.27	0.09	**1.28**	**1.02**	**1.04**
SUE	**0.50**	0.16	**0.44**	**0.46**	0.13	0.02	**0.51**	**0.41**	**0.42**
ABR	**0.76**	**0.64**	**0.84**	**0.74**	**0.58**	**0.51**	**0.74**	**0.80**	**0.79**
IM	**0.61**	0.05	**0.60**	**0.56**	0.00	−0.10	**0.59**	0.39	0.29
ABR*	**0.30**	**0.26**	**0.44**	**0.31**	**0.21**	0.14	**0.31**	**0.41**	**0.40**
ROE	**0.93**	0.02	**0.54**	**0.88**	0.14	0.20	**0.85**	**0.55**	**0.67**
GPA	**0.32**	0.11	0.11	0.27	0.13	0.14	0.29	0.13	0.10
NEI	**0.37**	0.15	**0.44**	**0.39**	0.10	0.06	**0.33**	**0.36**	**0.39**
RS	**0.31**	0.18	**0.50**	**0.34**	0.12	0.07	0.27	**0.43**	**0.45**
IA	**−0.52**	0.13	0.11	**−0.40**	0.03	0.01	**−0.47**	0.09	0.05
NSI	**−0.79**	**−0.26**	**−0.26**	**−0.75**	**−0.37**	**−0.44**	**−0.79**	**−0.28**	**−0.27**
CEI	**−0.79**	−0.21	−0.20	**−0.74**	−0.26	**−0.29**	**−0.76**	−0.16	−0.08
PIA	**−0.56**	−0.24	**−0.30**	**−0.51**	−0.24	−0.22	**−0.57**	**−0.32**	**−0.32**
IG	**−0.43**	0.07	−0.02	**−0.41**	−0.01	−0.02	**−0.43**	−0.02	−0.04
IVC	**−0.49**	−0.26	**−0.34**	**−0.49**	−0.22	−0.20	**−0.51**	**−0.32**	**−0.33**
IVG	**−0.43**	0.02	−0.08	**−0.38**	0.02	−0.00	**−0.45**	−0.14	−0.11
NOA	**−0.38**	**−0.37**	**−0.43**	**−0.35**	**−0.34**	−0.28	**−0.41**	**−0.48**	**−0.42**
OA	**−0.30**	**−0.53**	**−0.51**	**−0.34**	**−0.38**	**−0.31**	**−0.31**	**−0.46**	**−0.41**
POA	**−0.51**	−0.11	−0.12	**−0.43**	−0.14	−0.11	**−0.50**	−0.13	−0.13
PTA	**−0.51**	−0.11	−0.06	**−0.46**	−0.17	−0.18	**−0.49**	−0.06	−0.03
OCA	**0.65**	0.11	**0.30**	**0.57**	0.21	0.24	**0.67**	**0.31**	**0.39**
OL	**0.43**	−0.06	0.02	**0.38**	0.10	0.10	**0.39**	0.03	0.06

Table A.7: Joint time-series tests: alternative instruments I

This table presents joint time-series tests of unconditional and conditional factor models. The test portfolios are the 25 different portfolios sorts defined in Table 2. The unconditional models are the CAPM, Hou–Xue–Zhang four-factor model (HXZ), and Fama–French five-factor model (FF). In Panel A, the lagged variables used in the (single-instrument) conditional specifications of HXZ are the value spread (vs), one-month T-bill rate (TB), earnings yield (ep), and stock return dispersion (RD). In Panel B, the lagged variables used in the (single-instrument) conditional specifications of FF are vs, RD, relative T-bill rate ($RREL$), and consumption-wealth ratio (cay). "all" refers to conditional HXZ and FF models in which all the corresponding four instruments are employed. "CAPM(all)" denotes the conditional CAPM containing all four instruments. The sample is 1972:01–2013:12. MAA denotes the mean absolute alpha. $\# < 0.05$ represents the number of portfolios in which the alphas are significant at the 5% level. $\#\chi^2$ denotes the number of portfolio groups in which the model is not rejected by the χ^2 specification test. R^2_C is the cross-sectional constrained R^2.

Panel A: HXZ (vs, TB, ep, RD)								
	CAPM	CAPM(all)	HXZ	vs	TB	ep	RD	all
MAA	0.15	0.13	0.11	0.10	0.10	0.10	0.11	0.10
$\# < 0.05$	82	71	39	30	37	32	38	33
$\#\chi^2$	4	5	7	8	7	9	9	10
R^2_C	−0.46	−0.22	0.30	0.41	0.33	0.46	0.39	0.49
Panel B: FF $(vs, RREL, cay, RD)$								
	CAPM	CAPM(all)	FF	vs	$RREL$	cay	RD	all
MAA	0.15	0.14	0.11	0.11	0.11	0.11	0.11	0.10
$\# < 0.05$	82	74	56	46	56	50	50	42
$\#\chi^2$	4	5	8	9	8	9	8	8
R^2_C	−0.46	−0.36	0.07	0.19	0.04	0.19	0.10	0.28

Table A.8: Spreads "high-minus-low": alternative instruments II

This table presents alphas for "high-minus-low" portfolio return spreads associated with unconditional and conditional factor models. See Table 2 for a description of the different portfolio sorts. The models are the CAPM, Hou–Xue–Zhang four-factor model (HXZ), and Fama–French five-factor model (FF). The lagged instruments are the term spread ($TERM$), one-month T-bill rate (TB), default spread (DEF), and log dividend yield (dp). The sample is 1972:01–2013:12. Bold values indicate statistical significance at the 5% level.

	Uncond.			**Cond.**($TERM, TB, DEF, dp$)			**Cond.**($TERM, TB, DEF, dp$)		
	CAPM	HXZ	FF	CAPM(all)	HXZ(dp)	HXZ(all)	CAPM(all)	FF(dp)	FF(all)
BM	**0.75**	0.23	0.04	**0.62**	0.33	**0.38**	**0.62**	0.02	−0.02
DUR	**−0.61**	−0.27	−0.15	**−0.59**	−0.28	−0.32	**−0.59**	−0.02	0.07
CFP	**0.63**	0.22	0.07	**0.57**	0.28	**0.40**	**0.57**	−0.08	−0.09
MOM	**1.29**	0.26	**1.22**	**1.35**	0.00	0.07	**1.35**	**1.13**	**0.95**
SUE	**0.50**	0.16	**0.44**	**0.48**	0.07	0.04	**0.48**	**0.50**	**0.41**
ABR	**0.76**	**0.64**	**0.84**	**0.77**	**0.52**	**0.54**	**0.77**	**0.84**	**0.81**
IM	**0.61**	0.05	**0.60**	**0.64**	−0.13	−0.16	**0.64**	**0.55**	0.34
ABR*	**0.30**	**0.26**	**0.44**	**0.34**	0.14	0.13	**0.34**	**0.41**	**0.36**
ROE	**0.93**	0.02	**0.54**	**0.87**	0.23	0.21	**0.87**	**0.84**	**0.84**
GPA	**0.32**	0.11	0.11	0.27	0.20	0.10	0.27	0.07	0.12
NEI	**0.37**	0.15	**0.44**	**0.37**	0.11	−0.01	**0.37**	**0.47**	**0.41**
RS	**0.31**	0.18	**0.50**	**0.33**	0.09	0.01	**0.33**	**0.52**	**0.53**
IA	**−0.52**	0.13	0.11	**−0.41**	0.04	−0.02	**−0.41**	0.06	0.03
NSI	**−0.79**	**−0.26**	**−0.26**	**−0.75**	**−0.35**	**−0.41**	**−0.75**	−0.18	−0.19
CEI	**−0.79**	−0.21	−0.20	**−0.73**	−0.24	**−0.28**	**−0.73**	−0.07	−0.07
PIA	**−0.56**	−0.24	**−0.30**	**−0.53**	−0.10	−0.15	**−0.53**	−0.21	**−0.24**
IG	**−0.43**	0.07	−0.02	**−0.41**	0.03	0.03	**−0.41**	−0.05	−0.07
IVC	**−0.49**	−0.26	**−0.34**	**−0.49**	−0.14	−0.18	**−0.49**	−0.26	**−0.28**
IVG	**−0.43**	0.02	−0.08	**−0.41**	0.08	0.01	**−0.41**	−0.02	−0.06
NOA	**−0.38**	**−0.37**	**−0.43**	**−0.39**	−0.26	**−0.32**	**−0.39**	−0.26	**−0.39**
OA	**−0.30**	**−0.53**	**−0.51**	**−0.32**	**−0.36**	−0.27	**−0.32**	**−0.37**	**−0.28**
POA	**−0.51**	−0.11	−0.12	**−0.44**	−0.14	−0.17	**−0.44**	−0.12	−0.10
PTA	**−0.51**	−0.11	−0.06	**−0.43**	−0.17	−0.20	**−0.43**	−0.00	−0.00
OCA	**0.65**	0.11	**0.30**	**0.59**	0.22	**0.28**	**0.59**	**0.40**	**0.44**
OL	**0.43**	−0.06	0.02	**0.36**	0.07	0.13	**0.36**	0.04	0.07

Table A.9: Joint time-series tests: alternative instruments II

This table presents joint time-series tests of unconditional and conditional factor models. The test portfolios are the 25 different portfolios sorts defined in Table 2. The unconditional models are the CAPM, Hou–Xue–Zhang four-factor model (HXZ), and Fama–French five-factor model (FF). The lagged variables used in the (single-instrument) conditional specifications of HXZ and FF are the term spread ($TERM$), one-month T-bill rate (TB), default spread (DEF), and log dividend yield (dp). "all" refers to conditional HXZ and FF models in which all the four instruments are employed. "CAPM(all)" denotes the conditional CAPM containing all four instruments. The sample is 1972:01–2013:12. MAA denotes the mean absolute alpha. $\# < 0.05$ represents the number of portfolios in which the alphas are significant at the 5% level. $\#\chi^2$ denotes the number of portfolio groups in which the model is not rejected by the χ^2 specification test. R^2_C is the cross-sectional constrained R^2.

Panel A: HXZ ($TERM, TB, DEF, dp$)								
	CAPM	CAPM(all)	HXZ	$TERM$	TB	DEF	dp	all
MAA	0.15	0.13	0.11	0.10	0.10	0.11	0.10	0.10
$\# < 0.05$	82	67	39	36	37	43	34	33
$\#\chi^2$	4	6	7	7	7	6	12	10
R^2_C	−0.46	−0.26	0.30	0.32	0.33	0.29	0.53	0.53
Panel B: FF ($TERM, TB, DEF, dp$)								
	CAPM	CAPM(all)	FF	$TERM$	TB	DEF	dp	all
MAA	0.15	0.13	0.11	0.10	0.11	0.11	0.10	0.09
$\# < 0.05$	82	67	56	45	53	57	39	32
$\#\chi^2$	4	6	8	8	10	8	12	12
R^2_C	−0.46	−0.26	0.07	0.21	0.09	0.12	0.26	0.34

Table A.10: Spreads "high-minus-low": alternative sample

This table presents alphas for "high-minus-low" portfolio return spreads associated with unconditional and conditional factor models. See Table 2 in the paper for a description of the different portfolio sorts. The models are the CAPM, Hou–Xue–Zhang four-factor model (HXZ), and Fama–French five-factor model (FF). In the first set of conditional models, the lagged instruments are the value spread (vs), one-month T-bill rate (TB), investment-capital ratio (IK), and stock return dispersion (RD). In the second set of conditional models, the lagged instruments are vs, RD, relative T-bill rate ($RREL$), and net equity expansion ($NTIS$). The sample is 1976:07–2013:12. Bold values indicate statistical significance at the 5% level.

	Uncond.			**Cond.**(vs, TB, IK, RD)			**Cond.**($vs, RREL, NTIS, RD$)		
	CAPM	HXZ	FF	CAPM(all)	HXZ(IK)	HXZ(all)	CAPM(all)	FF(vs)	FF(all)
BM	**0.69**	0.23	0.07	**0.56**	0.35	**0.41**	**0.68**	0.04	0.03
DUR	**−0.51**	−0.21	−0.15	**−0.49**	−0.30	−0.30	**−0.54**	−0.09	−0.02
CFP	**0.58**	0.19	0.12	**0.52**	0.28	0.25	**0.58**	0.00	−0.06
NPY	**0.84**	**0.32**	**0.25**	**0.77**	**0.41**	**0.44**	**0.82**	0.25	0.23
MOM	**1.18**	0.00	**0.92**	**1.19**	−0.25	−0.27	**1.14**	0.72	**0.76**
SUE	**0.46**	0.15	**0.33**	**0.43**	0.09	0.00	**0.45**	**0.35**	0.27
ABR	**0.73**	**0.62**	**0.79**	**0.71**	**0.57**	**0.49**	**0.69**	**0.76**	**0.68**
IM	**0.56**	−0.07	0.40	**0.56**	−0.19	−0.23	**0.57**	0.25	0.15
ABR*	**0.28**	0.23	**0.40**	**0.30**	0.16	0.08	**0.28**	**0.40**	**0.35**
RE	**0.94**	0.07	**0.86**	**0.92**	0.04	−0.11	**0.90**	**0.77**	**0.76**
ROE	**1.00**	−0.03	**0.41**	**0.92**	0.07	0.12	**0.88**	**0.48**	**0.51**
GPA	**0.40**	0.12	0.08	**0.34**	0.15	0.13	**0.35**	0.07	0.12
NEI	**0.39**	0.14	**0.38**	**0.41**	0.12	0.05	**0.39**	**0.40**	**0.41**
RS	**0.38**	0.22	**0.48**	**0.40**	0.19	0.08	**0.37**	**0.51**	**0.51**
IA	**−0.53**	0.10	0.04	**−0.40**	0.06	−0.02	**−0.47**	0.01	−0.04
NSI	**−0.78**	−0.24	−0.24	**−0.75**	**−0.29**	**−0.36**	**−0.74**	−0.24	−0.22
CEI	**−0.76**	−0.18	−0.17	**−0.70**	−0.19	−0.20	**−0.74**	−0.10	−0.03
PIA	**−0.51**	−0.22	**−0.31**	**−0.48**	−0.08	−0.12	**−0.51**	**−0.32**	**−0.28**
IG	**−0.39**	0.11	-0.00	**−0.37**	0.13	0.06	**−0.40**	−0.01	−0.06
IVC	**−0.47**	−0.27	**−0.39**	**−0.47**	−0.14	−0.21	**−0.51**	**−0.40**	**−0.41**
IVG	**−0.42**	-0.00	−0.14	**−0.39**	0.07	0.08	**−0.43**	−0.13	−0.14
NOA	**−0.49**	**−0.48**	**−0.59**	**−0.50**	**−0.37**	−0.25	**−0.50**	**−0.50**	**−0.54**
OA	−0.26	**−0.50**	**−0.50**	**−0.32**	**−0.38**	−0.25	**−0.34**	**−0.48**	**−0.44**
POA	**−0.50**	−0.11	−0.14	**−0.42**	−0.13	−0.11	**−0.47**	−0.13	−0.14
PTA	**−0.48**	−0.09	−0.08	**−0.42**	−0.12	−0.17	**−0.47**	−0.09	−0.10
OCA	**0.76**	0.17	**0.34**	**0.68**	0.19	0.27	**0.71**	**0.37**	**0.42**
OL	**0.60**	0.03	0.16	**0.54**	0.11	0.11	**0.53**	0.24	0.18
ADM	**0.78**	0.09	−0.06	**0.65**	0.28	0.25	**0.77**	−0.10	−0.01
RDM	0.46	**0.59**	0.37	0.40	**0.62**	0.45	0.42	0.35	0.41

Table A.11: Joint time-series tests: alternative sample

This table presents joint time-series tests of unconditional and conditional factor models. The test portfolios are the 29 different portfolios sorts defined in Table 2. The unconditional models are the CAPM, Hou–Xue–Zhang four-factor model (HXZ), and Fama–French five-factor model (FF). In Panel A, the lagged variables used in the (single-instrument) conditional specifications of HXZ are the value spread (vs), one-month T-bill rate (TB), investment-capital ratio (IK), and stock return dispersion (RD). In Panel B, the lagged variables used in the (single-instrument) conditional specifications of FF are vs, RD, relative T-bill rate ($RREL$), and net equity expansion ($NTIS$). "all" refers to conditional HXZ and FF models in which all the corresponding four instruments are employed. "CAPM(all)" denotes the conditional CAPM containing all four instruments. The sample is 1976:07–2013:12. MAA denotes the mean absolute alpha. $\# < 0.05$ represents the number of portfolios in which the alphas are significant at the 5% level. $\#\chi^2$ denotes the number of portfolio groups in which the model is not rejected by the χ^2 specification test. R^2_C is the cross-sectional constrained R^2.

Panel A: HXZ (vs, TB, IK, RD)								
	CAPM	CAPM(all)	HXZ	vs	TB	IK	RD	all
MAA	0.15	0.13	0.11	0.11	0.11	0.11	0.12	0.10
$\# < 0.05$	89	71	42	36	40	38	46	30
$\#\chi^2$	7	10	11	14	11	17	14	20
R^2_C	−0.50	−0.22	0.18	0.31	0.20	0.36	0.26	0.44
Panel B: FF $(vs, RREL, NTIS, RD)$								
	CAPM	CAPM(all)	FF	vs	$RREL$	$NTIS$	RD	all
MAA	0.15	0.14	0.11	0.11	0.12	0.11	0.11	0.11
$\# < 0.05$	89	73	60	54	62	60	57	42
$\#\chi^2$	7	11	12	12	11	11	11	11
R^2_C	−0.50	−0.31	0.09	0.20	0.01	0.12	0.11	0.20

Table A.12: Joint Time-Series Tests by Category: Restricted Conditional Models

This table presents joint time-series tests of restricted conditional factor models. The test portfolios are combinations of 25 different portfolios sorts that correspond to the categories defined in Table 2. For example, the value-growth category contains the BM, DUR, and CFP deciles. The models are the Hou–Xue–Zhang four-factor model (HXZ) and the Fama–French five-factor model (FF). In the conditional HXZ models, the lagged instruments are the value spread (VS), one-month T-bill rate (TB), investment-capital ratio (IK), and stock return dispersion (RD). In the conditional FF models, the lagged instruments are VS, RD, relative T-bill rate (RREL), and net equity expansion (NTIS). "All" refers to conditional HXZ and FF models in which all the corresponding four instruments are employed. Only the investment and profitability factors in both models are scaled. MAA denotes the mean absolute alpha. $\# < 0.05$ represents the number of portfolios in which the alphas are significant at the 5% level. $\#\chi^2$ denotes the number of portfolio groups in which the model is not rejected by the χ^2 specification test. R^2_C is the cross-sectional constrained R^2. The numbers in parentheses represent empirical p-values (obtained from a bootstrap simulation) for testing the null hypothesis that the difference in R^2_C between each conditional multifactor model (and the corresponding unconditional model) is equal to zero.

	HXZ(TB)	HXZ(RD)	HXZ(VS)	HXZ(IK)	HXZ(All)	FF(RREL)	FF(RD)	FF(NTIS)	FF(VS)	FF(All)
Panel A. Value-Growth										
MAA	0.10	0.12	0.12	0.12	0.13	0.07	0.07	0.08	0.07	0.06
$\# < 0.05$	2	6	5	5	9	1	0	1	1	1
$\#\chi^2$	2	2	2	2	2	3	3	3	3	3
R^2_C	0.40	0.24	0.16	0.27	0.22	0.69	0.71	0.67	0.72	0.78
	(0.46)	(0.37)	(0.31)	(0.38)	(0.37)	(0.46)	(0.42)	(0.49)	(0.40)	(0.33)
Panel B. Momentum										
MAA	0.10	0.10	0.09	0.10	0.09	0.16	0.16	0.16	0.15	0.14
$\# < 0.05$	7	6	6	6	3	16	16	16	14	14
$\#\chi^2$	2	2	2	2	2	0	0	0	0	0
R^2_C	0.46	0.54	0.56	0.56	0.63	−0.22	−0.29	−0.25	−0.14	−0.05
	(0.43)	(0.30)	(0.28)	(0.27)	(0.20)	(0.29)	(0.40)	(0.34)	(0.17)	(0.10)
Panel C. Profitability										
MAA	0.10	0.10	0.09	0.08	0.09	0.12	0.12	0.12	0.12	0.12
$\# < 0.05$	7	5	5	6	3	9	9	9	9	8
$\#\chi^2$	1	2	1	3	2	1	1	1	1	1
R^2_C	0.45	0.49	0.49	0.58	0.55	−0.05	−0.09	−0.05	−0.11	−0.10
	(0.45)	(0.46)	(0.45)	(0.33)	(0.35)	(0.45)	(0.46)	(0.46)	(0.44)	(0.47)
Panel D. Investment										
MAA	0.11	0.11	0.10	0.10	0.09	0.10	0.10	0.10	0.10	0.10
$\# < 0.05$	20	19	15	11	12	26	22	24	23	21
$\#\chi^2$	2	2	2	3	4	3	3	3	3	4
R^2_C	0.13	0.24	0.27	0.41	0.46	0.15	0.20	0.18	0.21	0.27
	(0.42)	(0.22)	(0.17)	(0.05)	(0.03)	(0.46)	(0.43)	(0.48)	(0.39)	(0.24)
Panel E. Intangibles										
MAA	0.12	0.10	0.10	0.09	0.09	0.10	0.10	0.10	0.10	0.09
$\# < 0.05$	3	3	2	3	1	4	3	3	3	2
$\#\chi^2$	1	1	1	2	2	1	1	1	1	1
R^2_C	0.10	0.29	0.41	0.55	0.60	0.24	0.20	0.19	0.21	0.40
	(0.50)	(0.23)	(0.12)	(0.05)	(0.03)	(0.37)	(0.44)	(0.45)	(0.42)	(0.14)

Table A.13: Decomposition of spreads high-minus-low for the restricted scaled HXZ: IK

This table reports the risk premium (beta times risk price) for each factor from the Hou–Xue–Zhang four-factor model (HXZ) when tested on the spreads high-minus-low in average returns. See Table 2 in the paper for a description of the different portfolio sorts. E(R) denotes the original spread in average returns, and α represents the corresponding alpha. RM, ME, IA, and ROE represent the market, size, investment, and profitability factors, respectively. The lagged instrument used in the scaled model is the investment-capital ratio (IK). The sample is 1972:01–2013:12. All the numbers are in %.

	E(R)	RM_{t+1}	ME_{t+1}	IA_{t+1}	$IA_{t+1}IK_t$	ROE_{t+1}	$ROE_{t+1}IK_t$
BM	0.69	−0.02	0.15	0.51	0.01	−0.36	0.05
DUR	−0.52	0.06	−0.07	−0.28	−0.01	0.19	−0.02
CFP	0.49	−0.09	0.06	0.33	0.01	−0.20	0.05
MOM	1.17	−0.05	0.12	0.22	−0.01	0.95	−0.12
SUE	0.44	−0.04	0.03	0.07	−0.01	0.31	−0.02
ABR	0.73	−0.03	0.02	−0.01	−0.01	0.19	−0.03
IM	0.54	−0.04	0.09	0.08	−0.01	0.51	−0.06
ABR*	0.30	−0.02	0.02	−0.01	−0.01	0.14	−0.03
ROE	0.75	−0.05	−0.12	−0.04	0.01	0.80	0.05
GPA	0.34	0.02	0.01	−0.13	0.00	0.28	0.02
NEI	0.36	0.00	−0.03	−0.12	−0.01	0.37	0.02
RS	0.30	0.00	−0.03	−0.17	0.00	0.39	−0.02
IA	−0.42	0.02	−0.04	−0.57	0.00	0.11	−0.04
NSI	−0.69	0.02	0.05	−0.26	−0.01	−0.16	−0.02
CEI	−0.55	0.12	0.08	−0.46	0.00	−0.06	0.00
PIA	−0.49	0.02	−0.01	−0.46	0.01	0.02	0.05
IG	−0.38	−0.01	−0.03	−0.38	0.00	−0.05	0.01
IVC	−0.43	0.03	0.00	−0.38	0.02	0.05	0.01
IVG	−0.36	0.00	0.03	−0.46	0.01	0.00	0.00
NOA	−0.39	−0.01	0.02	−0.09	0.01	−0.06	0.02
OA	−0.27	0.03	0.08	−0.08	0.01	0.11	0.01
POA	−0.43	0.00	0.04	−0.38	0.00	0.04	−0.01
PTA	−0.40	0.03	0.06	−0.35	0.00	0.05	−0.02
OCA	0.55	−0.06	0.08	0.12	0.01	0.27	0.00
OL	0.39	−0.02	0.08	0.02	0.01	0.27	0.01

Table A.14: Decomposition of spreads high-minus-low for the restricted scaled HXZ: vs

This table reports the risk premium (beta times risk price) for each factor from the Hou–Xue–Zhang four-factor model (HXZ) when tested on the spreads high-minus-low in average returns. See Table 2 in the paper for a description of the different portfolio sorts. E(R) denotes the original spread in average returns, and α represents the corresponding alpha. RM, ME, IA, and ROE represent the market, size, investment, and profitability factors, respectively. The lagged instrument used in the scaled model is the value spread (vs). The sample is 1972:01–2013:12. All the numbers are in %.

	E(R)	RM_{t+1}	ME_{t+1}	IA_{t+1}	$IA_{t+1}vs_t$	ROE_{t+1}	$ROE_{t+1}vs_t$
BM	0.69	−0.02	0.15	0.58	0.02	−0.38	−0.01
DUR	−0.52	0.05	−0.08	−0.32	0.01	0.26	0.02
CFP	0.49	−0.08	0.07	0.38	0.03	−0.22	−0.01
MOM	1.17	−0.06	0.12	0.22	−0.19	1.00	0.01
SUE	0.44	−0.04	0.03	0.04	−0.01	0.31	0.01
ABR	0.73	−0.03	0.02	−0.02	−0.03	0.21	0.01
IM	0.54	−0.05	0.09	0.10	−0.09	0.57	0.01
ABR*	0.30	−0.02	0.02	−0.02	−0.04	0.15	0.00
ROE	0.75	−0.05	−0.12	−0.04	0.09	0.79	0.00
GPA	0.34	0.02	0.01	−0.14	0.05	0.28	0.00
NEI	0.36	0.01	−0.03	−0.13	0.00	0.38	0.00
RS	0.30	−0.01	−0.04	−0.18	−0.01	0.42	0.01
IA	−0.42	0.01	−0.04	−0.57	−0.03	0.13	0.00
NSI	−0.69	0.01	0.05	−0.27	0.00	−0.11	0.01
CEI	−0.55	0.12	0.08	−0.46	0.00	−0.05	0.00
PIA	−0.49	0.02	−0.02	−0.38	0.03	0.07	0.00
IG	−0.38	−0.02	−0.04	−0.35	0.01	0.00	0.01
IVC	−0.43	0.02	0.00	−0.30	0.01	0.09	0.00
IVG	−0.36	−0.01	0.03	−0.41	−0.01	0.04	0.00
NOA	−0.39	−0.02	0.02	−0.08	0.05	−0.09	−0.01
OA	−0.27	0.02	0.09	−0.07	0.04	0.08	−0.01
POA	−0.43	0.00	0.04	−0.37	−0.04	0.04	0.00
PTA	−0.40	0.02	0.06	−0.35	−0.04	0.08	0.01
OCA	0.55	−0.07	0.08	0.12	0.03	0.27	0.00
OL	0.39	−0.02	0.09	0.00	0.06	0.21	−0.01

Table A.15: Decomposition of spreads high-minus-low for the restricted scaled FF: vs

This table reports the risk premium (beta times risk price) for each factor from the Fama–French five-factor model (FF) when tested on the spreads high-minus-low in average returns. See Table 2 in the paper for a description of the different portfolio sorts. E(R) denotes the original spread in average returns, and α represents the corresponding alpha. RM, SMB, HML, RMW, and CMA denote the market, size, value, profitability, and investment factors, respectively. The lagged instrument used in the scaled model is the value spread (vs). The sample is 1972:01–2013:12. All the numbers are in %.

	E(R)	RM_{t+1}	SMB_{t+1}	HML_{t+1}	RMW_{t+1}	$RMW_{t+1}vs_t$	CMA_{t+1}	$CMA_{t+1}vs_t$
BM	0.69	0.04	0.12	0.47	−0.05	0.00	0.14	−0.03
DUR	−0.52	0.02	−0.08	−0.45	−0.01	0.00	0.08	0.09
CFP	0.49	−0.03	0.06	0.54	0.08	−0.01	−0.07	−0.05
MOM	1.17	−0.10	−0.01	−0.24	0.20	−0.02	0.27	−0.02
SUE	0.44	−0.05	−0.01	−0.08	0.03	0.00	0.06	0.02
ABR	0.73	−0.04	−0.02	−0.06	−0.01	−0.01	0.02	0.04
IM	0.54	−0.07	0.00	−0.10	0.10	−0.02	0.09	0.03
ABR*	0.30	−0.03	0.00	−0.05	−0.03	0.00	−0.02	−0.01
ROE	0.75	−0.07	−0.13	−0.14	0.34	0.01	0.02	0.11
GPA	0.34	0.04	0.01	−0.17	0.26	−0.01	0.06	0.06
NEI	0.36	−0.02	−0.04	−0.15	0.11	0.00	−0.04	0.02
RS	0.30	−0.03	−0.05	−0.19	0.09	0.00	−0.04	0.01
IA	−0.42	−0.02	−0.01	−0.07	0.02	0.00	−0.41	−0.03
NSI	−0.69	−0.01	0.02	−0.04	−0.22	0.00	−0.25	0.06
CEI	−0.55	0.08	0.06	−0.18	−0.18	0.01	−0.27	0.06
PIA	−0.49	0.01	0.00	0.02	0.07	0.00	−0.31	0.02
IG	−0.38	−0.02	−0.02	0.00	−0.02	−0.01	−0.28	0.03
IVC	−0.43	0.02	0.02	0.01	0.11	0.00	−0.23	0.00
IVG	−0.36	−0.01	0.04	−0.01	0.03	0.00	−0.30	0.01
NOA	−0.39	−0.02	0.03	0.15	−0.04	0.01	−0.18	0.01
OA	−0.27	0.03	0.06	−0.01	0.08	0.00	−0.02	0.06
POA	−0.43	−0.02	0.05	−0.07	−0.02	0.00	−0.25	−0.02
PTA	−0.40	0.00	0.04	−0.08	−0.07	0.00	−0.25	0.01
OCA	0.55	−0.06	0.05	−0.07	0.14	0.00	0.14	0.04
OL	0.39	−0.02	0.08	−0.01	0.20	0.01	0.01	0.03

Table A.16: Decomposition of spreads high-minus-low for the restricted scaled FF: $NTIS$

This table reports the risk premium (beta times risk price) for each factor from the Fama–French five-factor model (FF) when tested on the spreads high-minus-low in average returns. See Table 2 in the paper for a description of the different portfolio sorts. E(R) denotes the original spread in average returns, and α represents the corresponding alpha. RM, SMB, HML, RMW, and CMA denote the market, size, value, profitability, and investment factors, respectively. The lagged instrument used in the scaled model is the net equity expansion ($NTIS$). The sample is 1972:01–2013:12. All the numbers are in %.

	E(R)	RM_{t+1}	SMB_{t+1}	HML_{t+1}	RMW_{t+1}	$RMW_{t+1}NTIS_t$	CMA_{t+1}	$CMA_{t+1}NTIS_t$
BM	0.69	0.04	0.12	0.47	−0.06	0.05	0.09	0.00
DUR	−0.52	0.03	−0.08	−0.46	−0.02	−0.01	0.14	−0.01
CFP	0.49	−0.03	0.06	0.52	0.03	0.04	−0.14	0.00
MOM	1.17	−0.10	−0.01	−0.25	0.11	0.07	0.20	−0.01
SUE	0.44	−0.04	−0.01	−0.06	0.06	0.02	0.07	0.00
ABR	0.73	−0.04	−0.02	−0.07	−0.03	0.03	0.03	0.00
IM	0.54	−0.07	0.01	−0.12	0.05	0.05	0.08	0.00
ABR*	0.30	−0.03	0.00	−0.04	−0.04	0.01	−0.03	0.00
ROE	0.75	−0.05	−0.12	−0.11	0.41	0.01	0.09	0.00
GPA	0.34	0.04	0.02	−0.19	0.25	−0.01	0.11	0.00
NEI	0.36	−0.01	−0.04	−0.14	0.13	−0.01	−0.02	0.00
RS	0.30	−0.03	−0.05	−0.19	0.10	0.00	−0.03	0.00
IA	−0.42	−0.02	−0.01	−0.08	0.01	−0.02	−0.42	0.00
NSI	−0.69	−0.01	0.03	−0.06	−0.20	−0.02	−0.18	0.00
CEI	−0.55	0.09	0.06	−0.16	−0.13	−0.01	−0.22	0.00
PIA	−0.49	0.01	0.01	0.01	0.07	−0.02	−0.29	0.00
IG	−0.38	−0.02	−0.02	−0.01	−0.03	0.03	−0.28	0.00
IVC	−0.43	0.02	0.02	0.01	0.10	0.00	−0.23	0.00
IVG	−0.36	−0.01	0.04	−0.02	0.02	0.00	−0.29	0.00
NOA	−0.39	−0.02	0.03	0.16	0.03	−0.03	−0.15	0.01
OA	−0.27	0.03	0.06	0.00	0.10	−0.01	0.03	0.00
POA	−0.43	−0.02	0.04	−0.06	−0.02	−0.01	−0.26	0.00
PTA	−0.40	0.00	0.04	−0.08	−0.07	−0.01	−0.23	0.00
OCA	0.55	−0.06	0.05	−0.06	0.16	0.01	0.16	0.00
OL	0.39	0.00	0.07	0.03	0.26	0.02	0.02	0.00