Addendum

"Multifactor models and their consistency with the ICAPM"

Paulo Maio[1] Pedro Santa-Clara[2]

This version: February 2012

[1]Hanken School of Economics. E-mail: paulofmaio@gmail.com.
[2]Nova School of Business and Economics, NBER, and CEPR. E-mail: psc@novasbe.pt.

1 Addendum to Section 3 in the paper

The results for the predictive regressions associated with the equity premium are displayed in Tables 1 and 2 below.

2 Addendum to Section 5 in the paper

We conduct robustness checks in addition to those available in Section 5 in the paper. Specifically, we estimate the multifactor models by first orthogonalizing the "hedging" factors relative to the market factor; exclude the excess market return from the menu of test assets; estimate the models with alternative equity portfolios; and employ a different measure of innovation in the state variables.

2.1 Estimating the model with orthogonal factors

Following Campbell (1996) and Petkova (2006), we reestimate each multifactor model by first orthogonalizing the hedge factors relative to the market factor. Hence, the information associated with each factor is independent from the information embedded in the aggregate equity premium. For each factor, we conduct the regression:

$$\Delta z_{t+1} = \psi_0 + \psi_1 RM_{t+1} + u_{t+1},$$

and construct the new innovation in the state variable as $\Delta \widehat{z}_{t+1} = \widehat{\psi}_0 + \widehat{u}_{t+1}$.

The results reported in Table 3 below show that the RRA estimates for Models HL, P, CV, and KLVN are now slightly above 2 in the tests with SBM25 and SM25, but none of the point estimates is statistically significant at the 10% level. Estimates for the intertemporal risk prices are numerically the same as in the benchmark test using the original factors, so among those four ICAPM specifications only KLVN (in the test with SBM25) satisfies the sign restrictions associated with the hedging risk prices. Thus, when we orthogonalize the factors against the market return, this model can be justified as an ICAPM application, although the risk aversion coefficient is still not statistically significant.

In the case of the empirical multifactor models (Table 4), the RRA estimates are also positive for all four models, varying between 1.71 and 2.20 in the tests with SBM25, and between 1.76 and 2.30 in the tests with SM25. Only the point estimates associated with FF3 and C in the tests with SM25 are marginally significant, however (at 10%).

The main difference relative to the benchmark test is that both PS and FF5 now have positive estimates for risk aversion, but it is still the case that the estimates associated with γ_{TERM} and γ_{DEF} are inconsistent with the corresponding slopes in the multiple predictive regressions. Thus, the PS model now satisfies the ICAPM criteria.

2.2 Excluding excess market return from the test assets

Next we reestimate the multifactor models by excluding the aggregate equity premium from the set of test assets. This enables us to assess to what degree forcing each model to price the excess market return (one of the factors) is driving the results. Moreover, most cross-sectional tests in the empirical asset pricing literature do not include the market in the menu of assets to be priced.

The results displayed in Tables 5 and 6 show that the risk price estimates associated with the market and hedging factors have the same signs and are very similar in size to the corresponding estimates in the benchmark test including the excess market return. These results are robust across all multifactor models and for both sets of equity portfolios. These findings are not surprising, given that in the GMM first-stage estimation where all assets receive the same weight, excluding one out of 26 assets should not have a major impact on the results.

2.3 Alternative equity portfolios

We test the multifactor models by using an alternative group of portfolios, 25 portfolios sorted on both size and long-term past returns (SLTR25), obtained from Kenneth French's data library. These portfolios are related with the long-term reversal in returns anomaly [De Bondt and Thaler (1985, 1987)], which refers to stocks with low returns in the long past (three to five years) having higher subsequent future returns, while past long-term winners having lower future returns.

The results reported in Table 7 show that all four ICAPM applications do a relatively good job in pricing the SLTR25 portfolios, with R^2 estimates around 60%. The signs of the risk prices are basically the same as in the test with the SBM25 portfolios. The sole exception is for the point estimate for γ in the KLVN model, which is now positive, although very close to zero (0.08). Therefore, as in the test with the size-BM portfolios, all four models do not meet the ICAPM criteria.

Regarding the empirical factor models, all four models have a large explanatory power over the SLTR25 portfolios, with R^2 estimates above 70% in all cases. The factor risk prices in both FF3 and C have the same signs as in the test with SBM25, thus, these two models continue to pass the ICAPM restrictions. In the case of PS, the risk aversion parameter becomes positive (6.20) and statistically significant, but the point estimate for γ_L becomes negative, which invalidates the model as a correct ICAPM application. In the case of FF5, all the factor risk prices in the model satisfy the sign restrictions. Yet, the point estimates for γ_{SMB}, γ_{TERM} and γ_{DEF} are not significant at the 10% level.

2.4 Using a different proxy for innovation in the state variables

We estimate the ICAPM specifications with innovations in the state variables from an AR(1) process instead of simply using first differences:

$$z_{t+1} = \psi + \phi z_t + \varepsilon_{t+1},$$

and compute the innovation as the residual, $\widehat{\varepsilon}_{t+1}$. Notice that the change in the state variables used in the benchmark specifications, $\Delta z_{t+1} \equiv z_{t+1} - z_t$, represents a special case when $\widehat{\phi} \simeq 1$; that is, when the state variable follows a random walk.[1] We estimate the HL, P, CV and KLVN models by using the new innovations associated with $TERM$, DEF, DY, RF, PE, VS and CP.

The results in Table 8 show that the signs of the hedging factor risk prices are nearly the same as in the benchmark case, with the exceptions of γ_{DEF} in P in the SM25 test and γ_{VS} in CV in both tests. When we use a different proxy for the innovations in the state variables, all four models do not meet the economic restrictions underlying the ICAPM.

2.5 Results analyzed in Section 5

Several results analyzed in Section 5 in the paper are presented below. The results associated with Section 5.1 ("Including an intercept in the cross-sectional tests") are presented in Tables 9 and 10. Tables 11 and 12 summarize the results for Section 5.2 ("Estimating by efficient GMM"). The evidence for Section 5.3 ("Pricing bond risk premia") is in Tables 13 and 14. The results for the GLS cross-sectional regressions in Section 5.4 ("Estimating the models in expected return-beta representation") are available in Tables 15 and 16. Tables 17 and 18 show

[1] In a similar approach, Campbell (1996) and Petkova (2006) derive the innovations in the state variables from a first-order VAR.

the results for Section 5.5 ("Bootstrap simulation in the predictive regressions"). The results in Section 5.6 ("Using different proxies for the state variables associated with SMB and HML") are reported in Table 19. Finally, the results in Section 5.7 ("Alternative proxy for the expected market return") are available in Tables 20 and 21.

3 Addendum to Section 6 in the paper

3.1 Alternative volatility measures

We conduct predictive regressions by using alternative proxies for the stock market return variance. The first alternative volatility measure is the one employed by Beeler and Campbell (2011) (BC11). We first conduct a one-month predictive regression on the relevant state variables. For example, in the case of the HL model, we have,

$$r_{t+1} = \kappa_0 + \kappa_1 TERM_t + \kappa_2 DEF_t + u_{t+1}, \tag{1}$$

and in a second step, we conduct the following regression of q-period cumulative squared residuals:

$$\frac{\sum_{j=1}^{q} u_{t+j}^2}{q} = a_q + b_q TERM_t + c_q DEF_t + \xi_{t,t+q}. \tag{2}$$

The second alternative volatility measure is the one used by Bansal, Khatchatrian and Yaron (2005) (BKY05). In a first step, we specify an AR(1) process for the log market return,

$$r_{t+1} = \phi_0 + \phi_1 r_t + u_{t+1}, \tag{3}$$

and in a second step, we conduct the following predictive regression:

$$\ln\left(\sum_{j=1}^{q} \mid u_{t+j} \mid\right) = a_q + b_q TERM_t + c_q DEF_t + \xi_{t,t+q}. \tag{4}$$

To save space, we discuss the results for the predictive regressions on the new volatility proxies only at the 60-month horizon. The results displayed in Table 22 show that most of the slopes in the new regressions have the same signs as in the multiple regressions associated with $SVAR$. The exceptions are the slopes associated with $TERM$ in the HL and P models (for both alternative measures of volatility), and the slope associated with DEF in the HL model, when the volatility measure is BC11. When we compare these slopes with the risk price estimates only the HL model (in the test with SBM25) meets the criteria for the hedging risk prices when the market volatility proxy is BC11. However, the associated RRA estimate is negative. Therefore, none of the four ICAPM applications can be justified on the grounds that the state variables forecast the alternative market volatility proxies.

Regarding the specifications using the state variables associated with the empirical factors, the results in Table 23 show that the coefficients associated with SMB^* and $CUMD$ flip sign relative to the regressions for $SVAR$. Yet, most predictive slopes are not significant at the 10% level. When we compare these slopes with the risk price estimates, none of the four empirical multifactor models satisfy the sign restrictions.

The third volatility measure that we consider is the conditional second moment of aggregate returns, computed from the following predictive regression:

$$r^2_{t,t+q} = a_q + b_q z_t + v_{t,t+q}, \tag{5}$$

where $v_{t,t+q}$ represents a forecasting error with zero conditional mean.

In the case of the HL, P, CV and KLVN models, results displayed in Table 24 show that the signs of the slopes at $q = 60$ (for which there is greater evidence of predictability) in the four multiple long-horizon regressions are the same as in the corresponding predictive regressions for expected returns. This implies that the HL and CV models satisfy the hedging risk price consistency criteria when the testing portfolios are SM25. However, the RRA estimate is negative in the case of CV tested on SM25, which implies that only HL satisfies all the ICAPM criteria when tested on the SM25 portfolios, for this alternative volatility proxy.

Regarding the predictive regressions associated with the empirical factor models, the results in Table 25 indicate that at $q = 60$ the signs of the slopes are the same as in the corresponding predictive regressions over the expected market return. Consequently, in none of the four factor models are the predictive slopes over the second moment of the market return consistent with the factor risk prices from the cross-sectional regressions.

Overall, when we consider all three alternative volatility measures, only the HL model tested on SM25 is consistent with the predictive slope of aggregate volatility (second moment of returns). Thus, the result in the paper that the FF3 model can be consistent with the corresponding state variables forecasting $SVAR$ does not generalize to the alternative volatility measures.

3.2 Results analyzed in Section 6

The results associated with the predictive regressions for $SVAR$ by using the alternative state variable proxies $CSMB$ and $CHML$ (Section 6.1) are available in Table 26. The results for Section 6.2 are displayed in Tables 27 and 28.

4 Addendum to Section 7 in the paper

We conduct a third Monte Carlo simulation to control for the bias associated with a missing risk factor in the ICAPM pricing equation. Specifically, we assume that the true ICAPM specification contains two hedging risk factors: one that is observable and hence used in the empirical test and another state variable that is not observable to the econometrician.

The first state variable, z, is calibrated to $TERM$, as before, with $\phi = 0.95$. We also simulate an AR(1) process for the second state variable, x:

$$x^b_{t+1} = \psi_x + \phi_x x^b_t + \varepsilon^b_{x,t+1}, b = 1, ..., 10000, \tag{6}$$

where $\varepsilon^b_{x,t+1}$ is a zero-mean normal forecasting error. This AR(1) process is calibrated to DEF, and ϕ_x is fixed at 0.99, thus making the unobservable state variable more persistent than the observable state variable. The errors for the two state variables, $\varepsilon^b_{z,t+1}, \varepsilon^b_{x,t+1}$, and the excess returns $\varepsilon^b_{i,t+1}$ are simulated from the sample covariance matrix of the state variables innovations and the excess portfolio returns, assuming a joint normal distribution.

The conditional market covariances are linear in both state variables:

$$\text{Cov}_t(R_{i,t+1} - R_{f,t+1}, RM_{t+1}) = a_i + b_i z_t + c_i x_t, i = 1, ..., N, \tag{7}$$

where the coefficients are estimated from the following time-series regressions:

$$(R_{i,t+1} - R_{f,t+1})RM_{t+1} = a_i + b_i TERM_t + c_i DEF_t + \nu_{i,t+1}, i = 1, ..., N. \tag{8}$$

Therefore, the return generating process is given by

$$(R_{i,t+1} - R_{f,t+1})^b = \mu_{it}^b + \varepsilon_{i,t+1}^b, b = 1, ..., 10000, i = 1, ..., N, \tag{9}$$

$$\mu_{it}^b = \gamma a_i + \gamma b_i z_t^b + \gamma c_i x_t^b + \gamma_z \operatorname{Cov}(R_{i,t+1} - R_{f,t+1}, \Delta z_{t+1}) + \gamma_x \operatorname{Cov}(R_{i,t+1} - R_{f,t+1}, \Delta x_{t+1}), \tag{10}$$

where the covariances with the innovation in the state variables, $\operatorname{Cov}(R_{i,t+1} - R_{f,t+1}, \Delta z_{t+1})$ and $\operatorname{Cov}(R_{i,t+1} - R_{f,t+1}, \Delta x_{t+1})$ are estimated from the original sample for $TERM$ and DEF, respectively. We calibrate γ at four and five, while γ_z is calibrated as above. γ_x is calibrated at -90, -170 and -340, where -170 corresponds approximately to the estimate obtained for the three-factor ICAPM with both $TERM$ and DEF in the test conducted in the original sample with SBM25. This gives a total of 18 alternative Monte Carlo simulations as in the previous experiment.

Table 29 below shows that the acceptance rates of the ICAPM vary between 54% and 60% in the case of the one-month predictive regression, while for the 60-month regression the range is between 51% and 56%. As expected, these acceptance rates are lower than in the previous experiment when there is no "missing risk factor." The reason is that the persistent unobservable variable dampens the role of the observable state variable in both the predictive and cross-sectional regressions due to the correlation between the two variables, and thus the number of pseudo samples with consistency in sign between the time-series and cross-sectional regressions is now lower. However, these fractions are still above 50%, thus showing that the ICAPM is reasonably robust to the bias caused by a missing state variable in the pricing equation.

References

Bansal, Ravi, Varoujan Khatchatrian, and Amir Yaron, 2005, Interpretable asset markets? European Economic Review 49, 531–560.

Beeler, Jason, and John Y. Campbell, 2011, The long-run risks model and aggregate asset prices: An empirical assessment, Working paper, Harvard University.

Campbell, John Y., 1996, Understanding risk and return, Journal of Political Economy 104, 298–345.

Cochrane, John H., 2008, The dog that did not bark: A defense of return predictability, Review of Financial Studies 21, 1533–1575.

De Bondt, Werner F., and Richard H. Thaler, 1985, Does the stock market overreact? Journal of Finance 40, 793–805.

De Bondt, Werner F., and Richard H. Thaler, 1987, Further evidence on investor overreaction and stock market seasonality, Journal of Finance 42, 557–581.

Petkova, Ralitsa, 2006, Do the Fama-French factors proxy for innovations in predictive variables? Journal of Finance, 61, 581–612.

Table 1: Multiple predictive regressions for ICAPM state variables (equity premium)

This table reports the results for multiple long-horizon regressions for the monthly continuously compounded excess return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); market dividend yield (DY); one-month Treasury bill rate (RF); market price-earnings ratio (PE); value spread (VS); and the Cochrane-Piazzesi factor (CP). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in line 2 are reported Newey-West t-ratios computed with q lags (in parenthesis). Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	$TERM$	DEF	DY	RF	PE	VS	CP	$R^2(\%)$
				Panel A ($q = 1$)				
1	0.25	0.37						0.42
	(1.42)	(0.73)						
2	0.23	0.18	0.01	−0.87				0.47
	(0.88)	(0.22)	(1.38)	(−0.44)				
3	0.32				−0.00	−0.01		0.55
	(*1.77*)				(−0.53)	(−1.02)		
4	0.05						0.34	1.36
	(0.22)						(2.22)	
				Panel B ($q = 12$)				
1	2.81	3.78						5.14
	(*1.68*)	(0.92)						
2	2.35	1.69	0.11	−11.13				9.36
	(1.26)	(0.37)	(*1.85*)	(−0.96)				
3	3.72				−0.02	−0.25		11.85
	(2.51)				(−0.53)	(−2.32)		
4	2.13						1.16	5.08
	(1.03)						(0.95)	
				Panel C ($q = 60$)				
1	9.39	14.47						18.78
	(2.03)	(1.51)						
2	18.52	−11.49	0.18	59.41				32.47
	(**3.04**)	(−0.81)	(2.33)	(2.05)				
3	10.62				−0.32	0.37		29.83
	(**3.27**)				(**−5.79**)	(**2.80**)		
4	7.47						3.58	16.94
	(*1.92*)						(1.96)	

Table 2: Multiple predictive regressions for empirical factors (equity premium)

This table reports the results for multiple long-horizon regressions for the monthly continuously compounded excess return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premium (SMB^*); value premium (HML^*); momentum factor ($CUMD$); and liquidity factor (CL). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in line 2 are reported Newey-West t-ratios computed with q lags (in parenthesis). Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. R^2(%) denotes the adjusted coefficient of determination (in %).

Row	SMB^*	HML^*	$CUMD$	CL	$TERM$	DEF	R^2(%)
			Panel A ($q = 1$)				
1	−0.00	0.00					0.32
	(−0.23)	(1.60)					
2	−0.00	0.00	−0.01				0.19
	(−0.22)	(1.53)	(−0.56)				
3	−0.01	0.01		0.01			0.57
	(−0.77)	(<u>2.13</u>)		(1.39)			
4	−0.00	0.00			0.28	0.08	0.47
	(−0.19)	(1.44)			(1.59)	(0.14)	
			Panel B ($q = 12$)				
1	−0.02	0.04					5.74
	(−0.22)	(<u>2.45</u>)					
2	−0.02	0.04	0.01				5.59
	(−0.22)	(<u>2.45</u>)	(0.13)				
3	−0.08	0.07		0.07			9.89
	(−0.91)	(**3.29**)		(*1.93*)			
4	−0.01	0.04			3.13	−0.42	10.14
	(−0.14)	(<u>2.37</u>)			(<u>2.00</u>)	(−0.10)	
			Panel C ($q = 60$)				
1	0.20	0.08					14.55
	(1.00)	(1.64)					
2	0.15	0.11	0.48				21.83
	(0.86)	(<u>2.03</u>)	(<u>2.19</u>)				
3	0.11	0.12		0.10			16.85
	(0.71)	(**3.49**)		(*1.69*)			
4	0.21	0.09			10.71	2.32	30.97
	(1.15)	(<u>2.33</u>)			(<u>2.41</u>)	(0.22)	

Table 3: Factor risk premia for ICAPM specifications (orthogonal factors)

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. The first line associated with each row presents the covariance risk price estimates, the second line reports the asymptotic GMM robust t-statistics (in parenthesis), and the third line shows empirical p-values from a bootstrap simulation (in brackets). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	MAE(%)	R^2_{OLS}
				Panel A (SBM25)						
1	2.21	608.84	−173.10						0.10	0.74
	(0.89)	(<u>2.45</u>)	(−0.30)							
2	2.08	436.86	234.60	−3.35	−1049.02				0.09	0.77
	(0.79)	(1.52)	(0.57)	(−0.19)	(−0.90)					
3	2.06	380.65				8.88	−2.29		0.08	0.78
	(1.18)	(**2.66**)				(0.98)	(−0.72)			
4	2.09	485.40						78.68	0.08	0.77
	(0.94)	(*1.69*)						(0.76)		
				Panel B (SM25)						
1	2.91	−503.90	−490.50						0.25	0.50
	(1.01)	(*−1.96*)	(−0.98)							
2	2.61	−614.81	−56.50	−2.29	−2242.96				0.20	0.67
	(0.98)	(<u>−2.16</u>)	(−0.11)	(−0.17)	(−1.61)					
3	2.62	−882.29				19.58	−5.37		0.21	0.60
	(0.66)	(<u>−2.12</u>)				(1.22)	(−0.77)			
4	2.80	−778.67						241.79	0.21	0.62
	(0.72)	(<u>−2.35</u>)						(1.53)		

Table 4: Factor risk premia for empirical risk factors (orthogonal factors)

This table reports the estimation of the factor risk premia from first-stage GMM with equally weighted errors. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{SMB}, \gamma_{HML}, \gamma_{UMD}, \gamma_{L}$ represent the risk prices associated with the Term-structure spread, default spread, size factor, value factor, momentum factor and liquidity factor, respectively. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{SMB}	γ_{HML}	γ_{UMD}	γ_{L}	γ_{TERM}	γ_{DEF}	MAE(%)	R^2_{OLS}
Panel A (SBM25)									
1	1.78	2.84	8.67					0.10	0.69
	(1.58)	(*1.87*)	(**5.49**)						
2	2.20	2.59	15.37	22.64				0.09	0.78
	(1.20)	(0.94)	(**4.45**)	(**3.23**)					
3	1.71	1.88	7.56		8.78			0.10	0.73
	(1.13)	(0.90)	(**3.81**)		(*1.86*)				
4	1.95	1.57	3.27			407.79	−1.51	0.09	0.76
	(1.09)	(0.61)	(0.91)			(<u>2.54</u>)	(−0.01)		
Panel B (SM25)									
1	1.99	2.76	−4.62					0.32	0.01
	(*1.91*)	(*1.78*)	(−1.58)						
2	2.30	2.08	10.57	7.24				0.13	0.84
	(*1.85*)	(1.14)	(**3.36**)	(**4.24**)					
3	1.79	−2.63	−18.04		43.01			0.31	0.19
	(0.44)	(−0.49)	(−1.24)		(<u>2.56</u>)				
4	1.76	6.16	16.41			−865.52	183.26	0.16	0.73
	(0.50)	(1.16)	(*1.76*)			(<u>−2.17</u>)	(0.25)		

Table 5: Factor risk premia for ICAPM specifications (excluding the market equity premium)
This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. The first line associated with each row presents the covariance risk price estimates, the second line reports the asymptotic GMM robust t-statistics (in parenthesis), and the third line shows empirical p-values from a bootstrap simulation (in brackets). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	MAE(%)	R^2_{OLS}
					Panel A (SBM25)					
1	2.82								0.23	−0.46
	(2.54)									
2	−2.11	606.69	−167.88						0.10	0.73
	(−0.84)	(2.46)	(−0.29)							
3	−4.23	435.00	215.01	−2.35	−1113.73				0.09	0.76
	(−0.51)	(1.51)	(0.52)	(−0.13)	(−0.89)					
4	−4.73	380.53				8.73	−2.29		0.09	0.77
	(−0.84)	(**2.66**)				(0.96)	(−0.72)			
5	−0.29	486.32						77.22	0.08	0.76
	(−0.08)	(*1.70*)						(0.76)		
					Panel B (SM25)					
1	2.35								0.35	−0.10
	(2.16)									
2	5.69	−512.35	−477.59						0.25	0.51
	(*1.77*)	(−2.00)	(−0.95)							
3	0.91	−609.00	−74.74	−1.47	−2257.59				0.20	0.67
	(0.15)	(−2.15)	(−0.15)	(−0.11)	(−1.64)					
4	−0.63	−883.20				19.20	−5.38		0.21	0.61
	(−0.06)	(−2.15)				(1.20)	(−0.78)			
5	10.80	−782.18						238.66	0.21	0.63
	(2.12)	(−2.38)						(1.51)		

Table 6: Factor risk premia for empirical risk factors (excluding the market equity premium)

This table reports the estimation of the factor risk premia from first-stage GMM with equally weighted errors. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{SMB}, \gamma_{HML}, \gamma_{UMD}, \gamma_L$ represent the risk prices associated with the Term-structure spread, default spread, size factor, value factor, momentum factor and liquidity factor, respectively. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{SMB}	γ_{HML}	γ_{UMD}	γ_L	γ_{TERM}	γ_{DEF}	MAE(%)	R^2_{OLS}
				Panel A (SBM25)					
1	3.29	2.88	8.70					0.10	0.68
	(**2.68**)	(*1.89*)	(**5.51**)						
2	7.34	2.49	15.60	23.65				0.09	0.77
	(**3.35**)	(0.87)	(**4.34**)	(**3.26**)					
3	−0.79	1.93	7.59		8.88			0.10	0.72
	(−0.36)	(0.91)	(**3.83**)		(*1.88*)				
4	−0.34	1.54	3.22			407.88	−5.80	0.09	0.75
	(−0.13)	(0.58)	(0.88)			(2.49)	(−0.02)		
				Panel B (SM25)					
1	0.26	2.74	−4.66					0.33	0.00
	(0.19)	(*1.75*)	(−1.59)						
2	5.03	1.98	10.42	7.25				0.13	0.84
	(**3.12**)	(1.08)	(**3.30**)	(**4.25**)					
3	−21.20	−2.61	−18.01		43.06			0.33	0.18
	(−2.08)	(−0.48)	(−1.24)		(2.53)				
4	10.58	6.26	16.47			−867.04	194.73	0.17	0.73
	(*1.80*)	(1.14)	(*1.73*)			(−2.14)	(0.26)		

Table 7: Factor risk premiums: Size/long-term reversal portfolios

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are the 25 size/long-term reversal portfolios (SLTR25). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. $\gamma_{SMB}, \gamma_{HML}, \gamma_{UMD} and \gamma_{L}$ represent the risk prices associated with the size factor, value factor, momentum factor and liquidity factor, respectively. The first line associated with each row presents the covariance risk price estimates, the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Panel A (ICAPM specifications)

Row	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	MAE(%)	R^2_{OLS}
1	3.06								0.17	−0.14
	(**2.77**)									
2	−0.57	413.90	−53.62						0.08	0.59
	(−0.26)	(**2.92**)	(−0.15)							
3	−3.49	310.64	206.90	−5.92	−257.38				0.09	0.61
	(−0.64)	(1.52)	(0.53)	(−0.49)	(−0.46)					
4	−1.27	325.37				3.41	−1.97		0.08	0.61
	(−0.26)	(*1.90*)				(0.43)	(−0.56)			
5	0.08	376.82						29.87	0.08	0.60
	(0.04)	(**2.81**)						(0.51)		

Panel B (empirical risk factors)

Row	γ	γ_{SMB}	γ_{HML}	γ_{UMD}	γ_{L}	γ_{TERM}	γ_{DEF}	MAE(%)	R^2_{OLS}
1	4.48	1.52	11.59					0.07	0.73
	(**3.36**)	(0.88)	(**4.83**)						
2	5.50	4.27	14.13	11.31				0.05	0.92
	(**2.95**)	(*1.86*)	(**3.61**)	(**3.67**)					
3	6.20	1.89	11.54		−3.95			0.07	0.74
	(2.24)	(1.08)	(**4.76**)		(−0.73)				
4	4.31	2.07	10.89			1.47	117.09	0.07	0.74
	(2.07)	(1.03)	(**2.99**)			(0.01)	(0.56)		

Table 8: Factor risk premiums for ICAPM specifications: AR(1)

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors, when the state variables follow an AR(1) process. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	MAE(%)	R^2_{OLS}
				Panel A (SBM25)						
1	−2.31	592.49	−121.39						0.09	0.79
	(−0.92)	(<u>2.42</u>)	(−0.21)							
2	−3.49	490.88	124.43	−1.11	−722.01				0.08	0.80
	(−0.42)	(1.63)	(0.31)	(−0.06)	(−0.58)					
3	−4.41	369.95				8.15	2.39		0.08	0.82
	(−0.82)	(<u>2.42</u>)				(0.96)	(0.65)			
4	−0.67	439.29						78.28	0.07	0.82
	(−0.25)	(*1.79*)						(1.22)		
				Panel B (SM25)						
1	5.55	−468.63	−531.72						0.26	0.46
	(*1.77*)	(<u>−2.00</u>)	(−1.14)							
2	0.10	−632.06	38.57	−4.44	−2127.89				0.20	0.64
	(0.02)	(<u>−2.32</u>)	(0.08)	(−0.31)	(−1.56)					
3	−0.71	−877.02				21.93	7.72		0.21	0.62
	(−0.07)	(<u>−2.19</u>)				(1.32)	(1.02)			
4	10.36	−823.21						291.05	0.22	0.61
	(<u>2.23</u>)	(<u>−2.23</u>)						(<u>1.96</u>)		

Table 9: Factor risk premiums for ICAPM specifications (intercept)

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. γ_0 denotes the intercept. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ_0	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	MAE(%)	R^2_{OLS}
Panel A (SBM25)											
1	0.01	−2.70								0.19	0.14
	(**3.11**)	(−1.29)									
2	0.00	−3.23	525.47	−281.12						0.10	0.76
	(0.47)	(−0.81)	(**2.70**)	(−0.74)							
3	0.01	−8.86	251.95	271.97	−8.44	−1091.61				0.08	0.81
	(0.90)	(−1.30)	(1.36)	(0.76)	(−0.64)	(−1.18)					
4	0.01	−8.97	376.73				10.69	−0.25		0.08	0.80
	(0.98)	(−1.46)	(**2.77**)				(1.24)	(−0.08)			
5	0.00	−0.76	377.75						97.95	0.08	0.79
	(0.45)	(−0.19)	(2.18)						(1.58)		
Panel B (SM25)											
1	0.01	−2.96								0.33	0.04
	(**3.92**)	(*−1.65*)									
2	0.01	−0.49	−435.24	−696.32						0.22	0.61
	(2.22)	(−0.14)	(*−1.67*)	(−1.40)							
3	−0.00	0.53	−614.91	−55.49	−2.26	−2250.89				0.20	0.67
	(−0.01)	(0.09)	(−2.15)	(−0.11)	(−0.18)	(*−1.86*)					
4	0.02	−14.71	−326.19				9.61	12.99		0.20	0.66
	(**3.57**)	(−1.96)	(*−1.74*)				(0.90)	(2.56)			
5	0.01	7.82	−737.94						224.38	0.21	0.65
	(0.58)	(1.23)	(−2.34)						(1.50)		

Table 10: Factor risk premiums for empirical risk factors (intercept)

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{SMB}, \gamma_{HML}, \gamma_{UMD}, \gamma_{L}$ represent the risk prices associated with the Term-structure spread, default spread, size factor, value factor, momentum factor and liquidity factor, respectively. γ_0 denotes the intercept. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ_0	γ	γ_{SMB}	γ_{HML}	γ_{UMD}	γ_L	γ_{TERM}	γ_{DEF}	MAE(%)	R^2_{OLS}
				Panel A (SBM25)						
1	0.01	−3.51	4.54	4.89					0.08	0.77
	(**3.94**)	(−1.63)	(**2.88**)	($\underline{2.53}$)						
2	0.01	1.83	3.65	10.78	14.50				0.08	0.79
	(1.63)	(0.53)	(1.62)	(**3.12**)	($\underline{2.47}$)					
3	0.01	−7.69	3.57	3.72		8.96			0.08	0.81
	(**3.17**)	($\underline{-2.42}$)	(1.61)	(1.48)		($\underline{2.00}$)				
4	0.01	−5.68	4.17	1.33			302.58	180.39	0.08	0.82
	($\underline{2.14}$)	(*−1.68*)	(*1.73*)	(0.46)			($\underline{2.21}$)	(0.79)		
				Panel A (SM25)						
1	0.03	−20.75	7.30	−21.88					0.20	0.64
	(**4.23**)	(**−3.28**)	($\underline{2.16}$)	($\underline{-2.56}$)						
2	0.00	4.54	2.17	10.03	7.14				0.13	0.84
	(0.13)	(1.15)	(1.02)	(*1.93*)	(**3.67**)					
3	0.03	−34.85	3.15	−30.46		30.89			0.17	0.73
	($\underline{2.41}$)	($\underline{-2.24}$)	(0.58)	(*−1.71*)		($\underline{2.25}$)				
4	0.02	−4.66	9.88	−2.03			−559.55	647.03	0.16	0.77
	(*1.84*)	(−0.65)	($\underline{2.09}$)	(−0.23)			($\underline{-2.21}$)	(1.27)		

Table 11: Factor risk premiums for ICAPM specifications (second-stage GMM)

This table reports the estimation of the factor risk premiums from second-stage GMM. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column R^2_{WLS} denotes the WLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	R^2_{WLS}
				Panel A (SBM25)					
1	2.60								−0.20
	(<u>2.50</u>)								
2	0.30	339.03	−110.65						0.60
	(0.15)	(<u>2.24</u>)	(−0.53)						
3	−6.49	243.87	117.16	−15.17	261.31				0.54
	(−1.26)	(1.37)	(0.39)	(−1.56)	(0.34)				
4	−1.12	179.62				6.59	−4.79		0.71
	(−0.30)	(1.54)				(1.22)	(<u>−1.97</u>)		
5	1.40	288.63						48.06	0.64
	(0.71)	(<u>2.11</u>)						(1.25)	
				Panel B (SM25)					
1	2.57								−0.07
	(<u>2.51</u>)								
2	2.54	−6.20	−308.40						0.08
	(1.08)	(−0.05)	(−0.98)						
3	1.02	−158.47	−61.47	1.78	−1776.83				0.38
	(0.21)	(−0.95)	(−0.18)	(0.18)	(<u>−2.11</u>)				
4	−1.32	−15.62				8.19	−2.57		−0.20
	(−0.18)	(−0.07)				(0.76)	(−0.61)		
5	2.89	−88.98						51.70	0.10
	(0.80)	(−0.44)						(0.69)	

Table 12: Factor risk premiums for empirical risk factors (second-stage GMM)

This table reports the estimation of the factor risk premiums from second-stage GMM. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{SMB}, \gamma_{HML}, \gamma_{UMD}, \gamma_{L}$ represent the risk prices associated with the term-structure spread, default spread, size factor, value factor, momentum factor and liquidity factor, respectively. The first line associated with each row presents the covariance risk price estimates, and the second line reports the asymptotic GMM robust t-statistics (in parenthesis). The column R^2_{WLS} denotes the WLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{SMB}	γ_{HML}	γ_{UMD}	γ_{L}	γ_{TERM}	γ_{DEF}	R^2_{WLS}
				Panel A (SBM25)				
1	4.15	3.44	10.17					0.65
	(**3.27**)	(2.28)	(**5.31**)					
2	6.40	3.49	14.29	16.68				0.76
	(**2.90**)	(1.50)	(**3.69**)	(**2.87**)				
3	1.27	1.82	8.51		6.17			0.72
	(0.67)	(1.04)	(**3.92**)		(1.57)			
4	2.85	2.88	5.81			159.01	48.32	0.69
	(1.35)	(1.30)	(1.98)			(1.24)	(0.28)	
				Panel B (SM25)				
1	2.01	3.16	0.31					−0.01
	(*1.67*)	(2.17)	(0.13)					
2	5.98	5.50	13.48	8.15				0.66
	(**3.75**)	(**3.33**)	(**4.62**)	(**4.73**)				
3	−1.53	4.61	7.70		10.69			−0.37
	(−0.27)	(1.04)	(0.83)		(1.12)			
4	2.07	6.90	7.59			58.19	−47.73	−0.46
	(0.57)	(1.62)	(1.38)			(0.30)	(−0.10)	

Table 13: Factor risk premiums for ICAPM specifications (bond returns)

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are 7 Treasury bond returns plus equity portfolios. The equity portfolios are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{DY}, \gamma_{RF}, \gamma_{PE}, \gamma_{VS}, \gamma_{CP}$ represent the risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. The first line associated with each row presents the covariance risk price estimates, the second line reports the asymptotic GMM robust t-statistics (in parenthesis), and the third line shows empirical p-values from a bootstrap simulation (in brackets). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{TERM}	γ_{DEF}	γ_{DY}	γ_{RF}	γ_{PE}	γ_{VS}	γ_{CP}	MAE(%)	R^2_{OLS}
					Panel A (SBM25)					
1	2.80								0.21	0.18
	(<u>2.53</u>)									
2	−1.03	452.65	−210.77						0.11	0.71
	(−0.53)	(**5.08**)	(−0.84)							
3	−2.31	168.18	184.97	3.31	−2543.40				0.09	0.79
	(−0.23)	(1.43)	(0.49)	(0.16)	(<u>−2.02</u>)					
4	−4.59	228.73				11.11	−3.78		0.08	0.85
	(−0.95)	(**2.72**)				(1.46)	(−1.32)			
5	0.51	389.77						86.56	0.10	0.78
	(0.23)	(**3.92**)						(1.36)		
					Panel B (SM25)					
1	2.35								0.30	0.05
	(<u>2.17</u>)									
2	5.57	−360.62	167.39						0.28	0.31
	(**2.97**)	(**−2.60**)	(0.63)							
3	1.94	−421.13	380.22	4.52	−3051.81				0.22	0.51
	(0.27)	(**−2.96**)	(1.13)	(0.33)	(<u>−2.11</u>)					
4	3.47	−282.39				0.56	2.72		0.29	0.32
	(0.75)	(<u>−2.30</u>)				(0.07)	(0.96)			
5	4.51	−313.60						−43.80	0.29	0.31
	(<u>2.25</u>)	(**−2.64**)						(−0.65)		

Table 14: Factor risk premiums for empirical risk factors (bond returns)

This table reports the estimation of the factor risk premiums from first-stage GMM with equally weighted errors. The testing assets are 7 Treasury bond returns plus equity portfolios. The equity portfolios are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). γ represents the risk price for the market factor. $\gamma_{TERM}, \gamma_{DEF}, \gamma_{SMB}, \gamma_{HML}, \gamma_{UMD}, \gamma_{L}$ represent the risk prices associated with the Term-structure spread, default spread, size factor, value factor, momentum factor and liquidity factor, respectively. The first line associated with each row presents the covariance risk price estimates, the second line reports the asymptotic GMM robust t-statistics (in parenthesis), and the third line shows empirical p-values from a bootstrap simulation (in brackets). The column MAE(%) presents the average absolute pricing error (in %). The column R^2_{OLS} denotes the OLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	γ	γ_{SMB}	γ_{HML}	γ_{UMD}	γ_{L}	γ_{TERM}	γ_{DEF}	MAE(%)	R^2_{OLS}
				Panel A (SBM25)					
1	3.42	2.60	8.66					0.10	0.79
	(**2.80**)	(*1.69*)	(**5.46**)						
2	7.06	2.59	15.23	22.17				0.08	0.87
	(**2.98**)	(0.96)	(**3.66**)	(<u>2.00</u>)					
3	4.13	2.80	8.86		−1.57			0.10	0.79
	(*1.72*)	(*1.75*)	(**5.44**)		(−0.32)				
4	2.08	2.67	6.86			142.65	76.52	0.08	0.84
	(1.42)	(1.50)	(**3.37**)			(**3.06**)	(0.49)		
				Panel B (SM25)					
1	0.56	2.39	−3.95					0.29	0.12
	(0.43)	(1.54)	(−1.37)						
2	5.19	1.92	11.04	7.34				0.12	0.86
	(**3.26**)	(1.04)	(**3.56**)	(**4.30**)					
3	−2.01	1.60	−5.40		5.34			0.29	0.14
	(−0.59)	(0.88)	(−1.26)		(0.87)				
4	7.21	7.92	8.74			−617.32	724.70	0.21	0.53
	(<u>2.30</u>)	(<u>2.15</u>)	(*1.66*)			(−**4.50**)	(*1.89*)		

Table 15: Beta factor risk premiums for ICAPM specifications (GLS)

This table reports the estimation of the beta factor risk premiums from GLS cross-sectional regressions. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). λ_M represents the beta risk price for the market factor. $\lambda_{TERM}, \lambda_{DEF}, \lambda_{DY}, \lambda_{RF}, \lambda_{PE}, \lambda_{VS}, \lambda_{CP}$ represent the beta risk prices associated with the Term-structure spread, default spread, market dividend yield, one-month Treasury bill rate, market price-earnings ratio, value spread, and the Cochrane-Piazzesi factor, respectively. The first line associated with each row presents the beta risk price estimates (multiplied by 100), and the second line reports the Shanken t-statistics (in parenthesis). The column R^2_{GLS} denotes the GLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	λ_M	λ_{TERM}	λ_{DEF}	λ_{DY}	λ_{RF}	λ_{PE}	λ_{VS}	λ_{CP}	R^2_{GLS}
				Panel A (SBM25)					
1	0.38								0.19
	(<u>1.98</u>)								
2	0.38	0.26	0.01						0.66
	(<u>1.98</u>)	(**3.76**)	(0.43)						
3	0.38	0.24	0.04	−1.32	−0.01				1.00
	(<u>1.98</u>)	(**3.13**)	(1.61)	(−**2.99**)	(−0.41)				
4	0.38	0.24				0.86	−1.33		0.97
	(<u>1.98</u>)	(**3.29**)				(<u>2.23</u>)	(−**2.62**)		
5	0.38	0.28						0.43	0.87
	(<u>1.98</u>)	(**3.66**)						(*1.68*)	
				Panel B (SM25)					
1	0.38								0.41
	(<u>1.98</u>)								
2	0.38	−0.04	0.01						0.13
	(<u>1.98</u>)	(−0.77)	(0.74)						
3	0.38	−0.03	0.01	−0.22	−0.06				0.32
	(<u>1.98</u>)	(−0.35)	(0.43)	(−0.56)	(−**2.60**)				
4	0.38	−0.10				0.17	−1.40		−0.09
	(<u>1.98</u>)	(*−1.68*)				(0.54)	(<u>−2.38</u>)		
5	0.38	−0.11						0.64	0.54
	(<u>1.98</u>)	(*−1.67*)						(**2.71**)	

Table 16: Beta factor risk premiums for empirical risk factors (GLS)

This table reports the estimation of the beta factor risk premiums from GLS cross-sectional regressions. The testing assets are the 25 size/book-to-market portfolios (SBM25, Panel A) and 25 size/momentum portfolios (SM25, Panel B). λ_M represents the beta risk price for the market factor. $\lambda_{TERM}, \lambda_{DEF}, \lambda_{SMB}, \lambda_{HML}, \lambda_{UMD}, \lambda_L$ represent the beta risk prices associated with the term-structure spread, default spread, size factor, value factor, momentum factor and liquidity factor, respectively. The first line associated with each row presents the beta risk price estimates (multiplied by 100), and the second line reports the Shanken t-statistics (in parenthesis). The column R^2_{GLS} denotes the GLS cross-sectional R^2. The sample is 1963:07-2008:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels, respectively.

Row	λ_M	λ_{SMB}	λ_{HML}	λ_{UMD}	λ_L	λ_{TERM}	λ_{DEF}	R^2_{GLS}
				Panel A (SBM25)				
1	0.38	0.24	0.44					0.99
	(1.98)	(*1.76*)	(**3.54**)					
2	0.38	0.25	0.46	2.37				0.97
	(1.98)	(*1.84*)	(**3.68**)	(**3.61**)				
3	0.38	0.24	0.44		1.84			0.99
	(1.98)	(*1.77*)	(**3.49**)		(*1.95*)			
4	0.38	0.23	0.41			0.18	0.02	1.00
	(1.98)	(*1.70*)	(**3.29**)			(**2.57**)	(0.77)	
				Panel B (SM25)				
1	0.38	0.29	0.40					0.61
	(1.98)	(2.06)	(2.28)					
2	0.38	0.26	0.59	0.92				0.99
	(1.98)	(*1.84*)	(**3.24**)	(**5.29**)				
3	0.38	0.32	0.32		1.39			0.55
	(1.98)	(2.23)	(*1.73*)		(1.58)			
4	0.38	0.28	0.37			−0.12	0.00	0.73
	(1.98)	(*1.92*)	(1.97)			(−2.01)	(0.09)	

Table 17: Multiple predictive regressions for ICAPM state variables (bootstrap)

This table reports the results for multiple long-horizon regressions for the monthly continuously compounded return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); market dividend yield (DY); one-month Treasury bill rate (RF); market price-earnings ratio (PE); value spread (VS); and the Cochrane-Piazzesi factor (CP). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in line 2 are reported empirical p-values from a bootstrap simulation (in parenthesis). $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	$TERM$	DEF	DY	RF	PE	VS	CP	$R^2(\%)$
				Panel A ($q = 1$)				
1	0.12	0.62						0.34
	(0.61)	(0.08)						
2	0.21	0.18	0.01	−0.01				0.55
	(0.42)	(0.65)	(0.70)	(0.99)				
3	0.21				−0.01	−0.01		0.56
	(0.38)				(0.74)	(0.85)		
4	−0.10						0.38	1.34
	(0.65)						(0.00)	
				Panel B ($q = 12$)				
1	1.48	6.84						4.62
	(0.06)	(0.00)						
2	2.09	1.75	0.12	−3.26				10.85
	(0.02)	(0.47)	(0.01)	(0.42)				
3	2.64				−0.06	−0.24		13.34
	(0.00)				(0.09)	(0.00)		
4	0.61						1.62	3.19
	(0.44)						(0.01)	
				Panel C ($q = 60$)				
1	5.86	25.81						18.15
	(0.00)	(0.00)						
2	17.11	−10.04	0.37	62.35				45.40
	(0.00)	(0.04)	(0.00)	(0.00)				
3	8.77				−0.48	0.23		43.08
	(0.00)				(0.00)	(0.03)		
4	3.39						5.11	10.60
	(0.04)						(0.00)	

Table 18:

Multiple predictive regressions for state variables constructed from empirical factors (bootstrap)

This table reports the results for multiple long-horizon regressions for the monthly continuously compounded return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premium (SMB^*); value premium (HML^*); momentum factor ($CUMD$); and liquidity factor (CL). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in line 2 are reported empirical p-values from a bootstrap simulation (in parenthesis). $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	SMB^*	HML^*	$CUMD$	CL	$TERM$	DEF	$R^2(\%)$
			Panel A ($q = 1$)				
1	0.00	0.00					0.65
	(1.00)	(0.87)					
2	0.00	0.00	−0.00				0.50
	(0.99)	(0.90)	(0.73)				
3	−0.01	0.01		0.01			0.98
	(0.58)	(0.58)		(0.24)			
4	−0.00	0.00			0.16	0.27	0.53
	(0.98)	(0.92)			(0.50)	(0.43)	
			Panel B ($q = 12$)				
1	0.01	0.05					9.91
	(0.75)	(0.00)					
2	0.01	0.05	0.02				9.81
	(0.78)	(0.00)	(0.58)				
3	−0.05	0.08		0.07			14.64
	(0.14)	(0.00)		(0.00)			
4	0.01	0.05			1.90	1.69	11.68
	(0.74)	(0.00)			(0.02)	(0.48)	
			Panel C ($q = 60$)				
1	0.32	0.15					36.99
	(0.00)	(0.00)					
2	0.27	0.17	0.45				42.49
	(0.00)	(0.00)	(0.00)				
3	0.27	0.17		0.05			37.38
	(0.00)	(0.00)		(0.22)			
4	0.31	0.14			7.99	6.11	45.79
	(0.00)	(0.00)			(0.00)	(0.19)	

Table 19: Multiple predictive regressions with alternative state variables for SMB and HML

This table reports the results for multiple long-horizon regressions for the monthly continuously compounded return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premium ($CSMB$); value premium ($CHML$); momentum factor ($CUMD$); and liquidity factor (CL). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in lines 2 and 3 are reported Newey-West (in parenthesis) and Hansen-Hodrick t-ratios (in brackets) computed with q lags. Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	$CSMB$	$CHML$	$CUMD$	CL	$TERM$	DEF	$R^2(\%)$
			Panel A ($q = 1$)				
1	0.00	0.01					−0.01
	(0.26)	(0.98)					
	[0.27]	[0.94]					
2	0.00	0.01	−0.00				−0.16
	(0.32)	(0.79)	(−0.43)				
	[0.33]	[0.75]	[−0.44]				
3	0.00	0.01		0.00			−0.09
	(0.17)	(1.21)		(0.67)			
	[0.18]	[1.18]		[0.68]			
4	−0.00	0.01			0.11	0.64	0.13
	(−0.03)	(1.03)			(0.63)	(1.17)	
	[−0.03]	[0.98]			[0.63]	[1.29]	
			Panel B ($q = 12$)				
1	0.02	0.15					4.06
	(0.34)	(2.00)					
	[0.30]	[*1.72*]					
2	0.02	0.17	0.04				4.07
	(0.29)	(2.02)	(0.34)				
	[0.25]	[*1.74*]	[0.29]				
3	0.01	0.20		0.04			5.32
	(0.22)	(2.26)		(1.06)			
	[0.20]	[1.96]		[0.91]			
4	0.00	0.16			1.33	7.08	8.33
	(0.01)	(2.25)			(0.82)	(*1.78*)	
	[0.01]	[*1.94*]			[0.77]	[*1.65*]	
			Panel C ($q = 60$)				
1	0.06	0.37					4.97
	(0.24)	(1.14)					
	[0.22]	[1.07]					
2	0.02	0.43	0.33				7.66
	(0.08)	(1.29)	(1.04)				
	[0.08]	[1.21]	[0.96]				
3	0.07	0.33		−0.04			5.14
	(0.27)	(1.03)		(−0.45)			
	[0.27]	[1.03]		[−0.45]			
4	−0.03	0.35			5.41	26.49	22.07
	(−0.17)	(1.26)			(0.96)	(2.18)	
	[−0.16]	[1.16]			[0.84]	[2.33]	

Table 20: Multiple regressions of DY on ICAPM state variables

This table reports the results for multiple contemporaneous regressions of the market log dividend yield on state variables. The state variables are the term-structure spread ($TERM$); default spread (DEF); market price-earnings ratio (PE); value spread (VS); and the Cochrane-Piazzesi factor (CP). The sample is 1963:07-2008:12. For each regression, in line 1 are reported the slope estimates, and in line 2 are reported heteroskedasticity-robust t-ratios (in parenthesis). Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	$TERM$	DEF	PE	VS	CP	$R^2(\%)$
1	−9.00	44.49				25.66
	(**−6.87**)	(**14.62**)				
2	−2.98		−0.87	0.07		88.50
	(**−4.96**)		(**−61.68**)	(1.52)		
3	−10.60				6.35	7.28
	(**−6.68**)				(**5.57**)	

Table 21: Multiple regressions of DY on state variables constructed from empirical factors

This table reports the results for multiple contemporaneous regressions of the market log dividend yield on state variables. The state variables are the term-structure spread ($TERM$); default spread (DEF); size premium (SMB^*); value premium (HML^*); momentum factor ($CUMD$); and liquidity factor (CL). The sample is 1963:07-2008:12. For each regression, in line 1 are reported the slope estimates, and in line 2 are reported heteroskedasticity-robust t-ratios (in parenthesis). Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	SMB^*	HML^*	$CUMD$	CL	$TERM$	DEF	$R^2(\%)$
1	0.38	0.30					67.37
	(**10.85**)	(**24.38**)					
2	0.38	0.30	0.14				67.77
	(**10.44**)	(**22.70**)	(2.48)				
3	0.39	0.30		−0.01			67.31
	(**9.40**)	(**16.61**)		(−0.34)			
4	0.34	0.27			−5.65	14.51	70.82
	(**9.78**)	(**20.66**)			(**−6.33**)	(**6.89**)	

Table 22: Multiple predictive regressions for state variables (market variance, new proxies)
This table reports the results for multiple long-horizon regressions for alternative proxies of market volatility, at the horizon of 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); market dividend yield (DY); one-month Treasury bill rate (RF); market price-earnings ratio (PE); value spread (VS); and the Cochrane-Piazzesi factor (CP). In Panels A and B the proxies used are those from Beeler and Campbell (2011) (BC11) and Bansal, Khatchatrian and Yaron (2005) (BKY05), respectively. The original sample is 1963:07-2008:12, and 60 observations are lost in each of the regressions. For each regression, in line 1 are reported the slope estimates, and in lines 2 and 3 are reported Newey-West (in parenthesis) and Hansen-Hodrick t-ratios (in brackets) computed with 60 lags. Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. R^2(%) denotes the adjusted coefficient of determination (in %).

Row	$TERM$	DEF	DY	RF	PE	VS	CP	R^2(%)
				Panel A (BC11)				
1	−0.01	0.01						4.30
	(−1.03)	(0.34)						
	[−0.86]	[0.35]						
2	−0.01	0.00	−0.00	0.07				6.60
	(−0.31)	(0.07)	(−0.92)	(0.71)				
	[−0.29]	[0.06]	[−0.97]	[0.80]				
3	−0.01				0.00	−0.00		14.95
	(−0.93)				(0.92)	(−**3.78**)		
	[−0.93]				[0.92]	[−**3.78**]		
4	−0.02						0.01	11.67
	(−2.06)						(**2.68**)	
	(−2.06)						(**2.67**)	
				Panel B (BKY05)				
1	−6.41	−1.07						13.99
	(−2.09)	(−0.15)						
	[−*1.79*]	[−0.15]						
2	−6.01	0.25	−0.09	9.59				15.64
	(−1.29)	(0.02)	(−0.77)	(0.33)				
	[−1.23]	[0.02]	[−0.78]	[0.33]				
3	−5.76				0.13	−0.52		26.14
	(−2.32)				(1.47)	(−**3.95**)		
	[−2.33]				[1.47]	[−**3.92**]		
4	−8.29						2.44	16.79
	(−**2.70**)						(**2.62**)	
	[−**2.71**]						[**2.60**]	

Table 23: Multiple predictive regressions for state variables constructed from empirical factors (market variance, new proxies)

This table reports the results for multiple long-horizon regressions for alternative proxies of market volatility, at the horizon of 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premiums (SMB^*); value premiums (HML^*); momentum factor ($CUMD$); and liquidity factor (CL). In Panels A and B the proxies used are those from Beeler and Campbell (2011) (BC11) and Bansal, Khatchatrian and Yaron (2005) (BKY05), respectively. The original sample is 1963:07-2008:12, and 60 observations are lost in each of the regressions. For each regression, in line 1 are reported the slope estimates, and in lines 2 and 3 are reported Newey-West (in parenthesis) and Hansen-Hodrick t-ratios (in brackets) computed with 60 lags. Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. R^2(%) denotes the adjusted coefficient of determination (in %).

Row	SMB^*	HML^*	$CUMD$	CL	$TERM$	DEF	R^2(%)
			Panel A (BC11)				
1	0.00	−0.00					1.77
	(0.50)	(−1.14)					
	[0.48]	[<u>−2.09</u>]					
2	0.00	−0.00	−0.00				3.57
	(0.71)	(−1.29)	(−0.69)				
	[0.68]	[−1.36]	[−0.59]				
3	0.00	−0.00		0.00			1.55
	(0.53)	(−0.70)		(0.18)			
	[0.53]	[−0.70]		[0.18]			
4	0.00	−0.00			−0.01	0.02	8.28
	(0.35)	(−1.53)			(−1.13)	(0.88)	
	[0.35]	[−1.53]			[−1.13]	[0.88]	
			Panel B (BKY05)				
1	0.04	−0.04					2.92
	(0.44)	(−1.09)					
	[0.50]	[−1.09]					
2	0.06	−0.05	−0.17				5.00
	(0.65)	(−1.22)	(−0.70)				
	[0.74]	[−1.07]	[−0.59]				
3	0.04	−0.04		−0.00			2.72
	(0.50)	(−1.24)		(−0.01)			
	[0.49]	[−1.23]		[−0.01]			
4	0.03	−0.05			−6.84	3.04	17.79
	(0.31)	(−1.24)			(<u>−2.12</u>)	(0.41)	
	[0.31]	[−1.25]			[<u>−2.13</u>]	[0.41]	

Table 24: Multiple predictive regressions for state variables (squared return)

This table reports the results for multiple long-horizon regressions for the monthly squared continuously compounded return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); market dividend yield (DY); one-month Treasury bill rate (RF); market price-earnings ratio (PE); value spread (VS); and the Cochrane-Piazzesi factor (CP). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in lines 2 and 3 are reported Newey-West (in parenthesis) and Hansen-Hodrick t-ratios (in brackets) computed with q lags. Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	$TERM$	DEF	DY	RF	PE	VS	CP	$R^2(\%)$
				Panel A ($q = 1$)				
1	−0.03	0.12						1.50
	(−1.59)	(**2.89**)						
	[*−1.68*]	[**2.95**]						
2	−0.04	0.16	−0.00	−0.03				1.47
	(−1.36)	(<u>2.10</u>)	(−1.24)	(−0.14)				
	[−1.45]	[<u>2.26</u>]	[−1.26]	[−0.15]				
3	−0.02				−0.00	0.00		0.45
	(−1.22)				(*−1.67*)	(<u>2.31</u>)		
	[−1.30]				[*−1.70*]	[<u>2.29</u>]		
4	−0.01						−0.01	0.21
	(−0.52)						(−0.80)	
	[−0.57]						[−0.86]	
				Panel B ($q = 12$)				
1	−0.51	2.44						7.62
	(−1.59)	(<u>2.01</u>)						
	[−1.54]	[<u>2.12</u>]						
2	−0.31	2.23	−0.01	2.24				7.91
	(−0.80)	(*1.74*)	(−1.26)	(0.81)				
	[−0.76]	[*1.70*]	[−1.28]	[0.77]				
3	−0.42				−0.02	0.04		4.49
	(−1.34)				(−1.51)	(1.37)		
	[−1.27]				[−1.59]	[1.31]		
4	−0.59						0.27	1.86
	(*−1.82*)						(1.13)	
	[*−1.82*]						[1.16]	
				Panel C ($q = 60$)				
1	4.61	22.81						13.78
	(0.83)	(*1.78*)						
	[0.71]	[*1.88*]						
2	15.89	−10.65	0.27	69.49				35.44
	(<u>2.36</u>)	(−0.63)	(**4.02**)	(<u>2.40</u>)				
	[<u>2.37</u>]	[−0.63]	[**4.04**]	[<u>2.40</u>]				
3	6.93				−0.42	0.30		31.10
	(*1.85*)				(**−5.10**)	(<u>2.17</u>)		
	[1.57]				[**−5.04**]	[<u>2.05</u>]		
4	1.98						5.11	8.67
	(0.41)						(<u>2.10</u>)	
	[0.37]						[<u>2.14</u>]	

Table 25: Multiple
predictive regressions for state variables constructed from empirical factors (squared return)

This table reports the results for multiple long-horizon regressions for the monthly squared continuously compounded return on the value-weighted market index, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premiums (SMB^*); value premiums (HML^*); momentum factor ($CUMD$); and liquidity factor (CL). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in lines 2 and 3 are reported Newey-West (in parenthesis) and Hansen-Hodrick t-ratios (in brackets) computed with q lags. Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. R^2(%) denotes the adjusted coefficient of determination (in %).

Row	SMB^*	HML^*	$CUMD$	CL	$TERM$	DEF	R^2(%)
			Panel A ($q = 1$)				
1	−0.00	0.00					0.23
	(−1.45)	(1.18)					
	[−1.50]	[1.25]					
2	−0.00	0.00	0.00				0.48
	(−1.51)	(2.07)	(*1.65*)				
	[−1.55]	[2.14]	[*1.81*]				
3	−0.00	0.00		0.00			0.05
	(−1.63)	(1.07)		(0.12)			
	[*−1.71*]	[1.11]		[0.12]			
4	−0.00	−0.00			−0.03	0.15	1.85
	(−2.01)	(−0.20)			(*−1.82*)	(**3.15**)	
	[−2.05]	[−0.21]			[*−1.89*]	[**3.27**]	
			Panel B ($q = 12$)				
1	−0.02	0.00					1.20
	(*−1.71*)	(0.93)					
	[*−1.67*]	[0.83]					
2	−0.02	0.01	0.00				2.65
	(*−1.81*)	(1.49)	(1.64)				
	[*−1.80*]	[1.36]	[1.64]				
3	−0.03	0.01		0.01			2.11
	(−2.20)	(1.37)		(1.12)			
	[−1.97]	[1.27]		[0.99]			
4	−0.03	−0.00			−0.58	3.05	10.27
	(−2.17)	(−0.59)			(*−1.95*)	(2.51)	
	[−1.97]	[−0.54]			[*−1.93*]	[**2.61**]	
			Panel C ($q = 60$)				
1	0.37	0.09					23.79
	(2.03)	(*1.91*)					
	[2.10]	[1.97]					
2	0.41	0.15	0.12				41.83
	(**2.92**)	(**4.20**)	(**4.10**)				
	[**3.00**]	[**4.91**]	[**4.25**]				
3	0.33	0.11		0.05			24.24
	(2.38)	(**2.99**)		(0.82)			
	[2.55]	[**3.73**]		[0.86]			
4	0.36	0.08			6.14	8.94	30.34
	(*1.86*)	(**2.76**)			(1.26)	(0.71)	
	[*1.88*]	[**2.99**]			[1.05]	[0.72]	

Table 26:
Multiple predictive regressions for $SVAR$ (alternative state variables for SMB and HML)
This table reports the results for multiple long-horizon regressions for the stock market variance ($SVAR$), at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premium ($CSMB$); value premium ($CHML$); momentum factor ($CUMD$); and liquidity factor (CL). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$. For each regression, in line 1 are reported the slope estimates, and in lines 2 and 3 are reported Newey-West (in parenthesis) and Hansen-Hodrick t-ratios (in brackets) computed with q lags. Italic, underlined and bold t-statistics denote statistical significance at the 10%, 5% and 1% levels, respectively. $R^2(\%)$ denotes the adjusted coefficient of determination (in %).

Row	$CSMB$	$CHML$	$CUMD$	CL	$TERM$	DEF	$R^2(\%)$
			Panel A ($q = 1$)				
1	−0.00	−0.00					0.85
	(−**3.22**)	(<u>−2.02</u>)					
	[−**3.90**]	[<u>−2.50</u>]					
2	−0.00	−0.00	0.00				0.87
	(−**3.77**)	(−1.58)	(1.01)				
	[−**4.63**]	[*−1.95*]	[1.19]				
3	−0.00	−0.00		−0.00			0.67
	(−**2.85**)	(*−1.65*)		(−0.22)			
	[−**3.37**]	[*−1.92*]		[−0.23]			
4	−0.00	−0.00			0.00	0.22	5.59
	(−**3.29**)	(−1.27)			(0.05)	(<u>2.29</u>)	
	[−**4.25**]	[−1.62]			[0.06]	[**3.02**]	
			Panel B ($q = 12$)				
1	−0.01	−0.02					5.98
	(*−1.81*)	(*−1.83*)					
	[−1.46]	[−1.46]					
2	−0.01	−0.02	0.00				5.83
	(*−1.70*)	(−1.61)	(0.10)				
	[−1.36]	[−1.31]	[0.09]				
3	−0.01	−0.01		0.00			6.28
	(*−1.81*)	(−1.25)		(0.55)			
	[−1.46]	[−1.01]		[0.46]			
4	−0.01	−0.02			−0.23	0.64	8.68
	(−**2.60**)	(*−1.67*)			(−1.31)	(1.63)	
	[<u>−2.14</u>]	[−1.35]			[−1.07]	[1.34]	
			Panel C ($q = 60$)				
1	−0.00	−0.04					2.17
	(−0.00)	(−0.68)					
	[−0.00]	[−0.61]					
2	−0.00	−0.03	0.03				3.39
	(−0.14)	(−0.55)	(1.22)				
	[−0.14]	[−0.55]	[1.22]				
3	−0.01	−0.00		0.03			11.66
	(−0.20)	(−0.08)		(*1.74*)			
	[−0.19]	[−0.08]		[*1.74*]			
4	0.00	−0.04			0.10	−0.85	2.24
	(0.16)	(−0.68)			(0.14)	(−0.42)	
	[0.16]	[−0.68]			[0.14]	[−0.42]	

Table 27: Multiple predictive regressions for state variables (Sharpe ratio)

This table reports the implied slopes of state variables on the Sharpe ratio, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); market dividend yield (DY); one-month Treasury bill rate (RF); market price-earnings ratio (PE); value spread (VS); and the Cochrane-Piazzesi factor (CP). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$.

Row	$TERM$	DEF	DY	RF	PE	VS	CP
			Panel A ($q = 1$)				
1	2.50	6.92					
2	52.89	−262.46	1.57	325.88			
3	4.23				−0.16	−0.39	
4	−16.76						21.87
			Panel B ($q = 12$)				
1	13.11	41.82					
2	23.87	−36.01	2.06	−89.30			
3	25.62				−0.64	−2.32	
4	4.72						14.57
			Panel C ($q = 60$)				
1	17.85	85.35					
2	50.32	−41.01	2.19	94.51			
3	28.49				−2.02	1.30	
4	13.94						11.24

Table 28: Multiple predictive regressions for state variables constructed from empirical factors (Sharpe ratio)

This table reports the implied slopes of state variables on the Sharpe ratio, at horizons of 1, 12 and 60 months ahead. The forecasting variables are the current values of the term-structure spread ($TERM$); default spread (DEF); size premiums (SMB^*); value premiums (HML^*); momentum factor ($CUMD$); and liquidity factor (CL). The original sample is 1963:07-2008:12, and q observations are lost in each of the respective q-horizon regressions, for $q = 1, 12, 60$.

Row	SMB^*	HML^*	$CUMD$	CL	$TERM$	DEF
			Panel A ($q = 1$)			
1	0.04	0.11				
2	0.05	0.11	−0.15			
3	−0.10	0.17		0.17		
4	0.55	0.42			4.53	−103.77
			Panel B ($q = 12$)			
1	0.35	0.47				
2	0.34	0.47	0.09			
3	−0.08	0.64		0.50		
4	0.51	0.55			21.47	−24.64
			Panel C ($q = 60$)			
1	1.06	0.68				
2	0.93	0.75	1.32			
3	1.05	0.69		0.01		
4	1.09	0.70			27.64	−0.00

Table 29: Monte Carlo simulation: missing state variable

This table reports results for a Monte Carlo simulation with 10,000 replications of an artificial two-factor ICAPM, when there is a missing state variable in the ICAPM equation. γ, γ_z, and γ_x denote the calibrated values for the risk aversion coefficient, risk price for the observable state variable, and risk price for the unobservable state variable, respectively. $t(b_1)$ ($t(b_{60})$) denotes the fraction of replications in which the predictive slope in the one-month (60-months) regression is statistically significant at the 5% level, while $t(\gamma_z)$ denotes the percentage of replications in which the risk price for the hedging factor is statistically significant. $Sign(b_1)$ ($Sign(b_{60})$) denotes the fraction of replications for which the predictive slope in the one-month (60-months) regression shares the same sign as the hedging risk price, and both coefficients are significant at the 5% level.

	$t(b_1)$	$t(b_{60})$	$t(\gamma_z)$	$Sign(b_1)$	$Sign(b_{60})$
$\gamma = 4, \gamma_z = 600, \gamma_x = -170$	0.90	0.82	0.84	0.59	0.55
$\gamma = 3, \gamma_z = 600, \gamma_x = -170$	0.90	0.86	0.80	0.54	0.51
$\gamma = 4, \gamma_z = 600, \gamma_x = -340$	0.90	0.82	0.83	0.60	0.56
$\gamma = 3, \gamma_z = 600, \gamma_x = -340$	0.90	0.86	0.80	0.56	0.54
$\gamma = 4, \gamma_z = 600, \gamma_x = -90$	0.90	0.82	0.84	0.60	0.56
$\gamma = 3, \gamma_z = 600, \gamma_x = -90$	0.90	0.86	0.80	0.55	0.52
$\gamma = 4, \gamma_z = 1200, \gamma_x = -170$	0.90	0.82	0.84	0.58	0.53
$\gamma = 3, \gamma_z = 1200, \gamma_x = -170$	0.90	0.85	0.79	0.54	0.51
$\gamma = 4, \gamma_z = 1200, \gamma_x = -340$	0.89	0.82	0.84	0.59	0.56
$\gamma = 3, \gamma_z = 1200, \gamma_x = -340$	0.90	0.87	0.79	0.55	0.52
$\gamma = 4, \gamma_z = 1200, \gamma_x = -90$	0.90	0.82	0.84	0.59	0.55
$\gamma = 3, \gamma_z = 1200, \gamma_x = -90$	0.90	0.86	0.80	0.54	0.52
$\gamma = 4, \gamma_z = 300, \gamma_x = -170$	0.90	0.82	0.84	0.60	0.56
$\gamma = 3, \gamma_z = 300, \gamma_x = -170$	0.90	0.86	0.80	0.56	0.53
$\gamma = 4, \gamma_z = 300, \gamma_x = -340$	0.90	0.82	0.84	0.60	0.56
$\gamma = 3, \gamma_z = 300, \gamma_x = -340$	0.89	0.86	0.80	0.56	0.54
$\gamma = 4, \gamma_z = 300, \gamma_x = -90$	0.89	0.82	0.84	0.60	0.56
$\gamma = 3, \gamma_z = 300, \gamma_x = -90$	0.90	0.86	0.81	0.56	0.54