Online Appendix to

"Time-varying state variable risk premia in the ICAPM"

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In this Online Appendix, we present results from a variety of robustness checks.

1. Time-varying parameters estimated with a Kalman filter

This section uses the Kalman filter to estimate the time-varying relation between consumption growth and the state variables. Consumption growth follows

$$c_{t+1} = a_{t,\boldsymbol{z}} + \boldsymbol{b}^{'}_{t,\boldsymbol{z}} \boldsymbol{z}_t + e_{t+1}, \qquad \text{where } e_{t+1} \sim N\left(0, \sigma^2\right). \tag{OA.1}$$

$\boldsymbol{B}_t = \left(a_{t,\boldsymbol{z}},\ \boldsymbol{b}'_{t,\boldsymbol{z}}\right)'$ follows a random walk

$$\boldsymbol{B}_t = \boldsymbol{B}_{t-1} + \boldsymbol{v}_t, \tag{OA.2}$$

where $\boldsymbol{v}_t \sim N\left(\boldsymbol{0}, \boldsymbol{Q}\right)$. As discussed in, e.g., Primiceri (2005), the random walk assumption is innocuous in a finite sample, and has the advantage to significantly reduce the number of parameters to be estimated. We use a Kalman filter to estimate the parameters (σ and the elements in the diagonal matrix $\boldsymbol{Q}$) and the time-varying coefficients $\boldsymbol{B}_t$. Notice that the parameters are estimated using the full sample, and thus even the filtered states, which use information up to t, contain some look-ahead bias. We use the Kalman filter to estimate the time-varying relation between quarterly and lagged state variables for all four models. Table OA.1 reports the correlation between the filtered values of $\boldsymbol{B}_t$ and their rolling window OLS counterparts. Except for LVL, the correlations are large and average to above 0.7. The last row of the table shows the correlation of predicted consumption growth using either the Kalman filtered estimates or the rolling window OLS estimates. This correlation is above 0.8 for all four models.

Table OA.1: Kalman filter estimates of the time-varying relation between state variables and consumption growth

This table presents the correlations between the Kalman-filtered estimates of $\boldsymbol{b}_{t,\boldsymbol{z}}$ from Eq. (OA.1) and predicted consumption $\widehat{c_{t+1}} = a_{t,\boldsymbol{z}} + \boldsymbol{b}'_{t,\boldsymbol{z}}\boldsymbol{z}_t$ with the corresponding rolling window OLS regression estimates from Eq. (6) in the paper.

Model 1		Model 2		Model 3		Model 4	
$b_{t,DY}$	0.51	$b_{t,DY}$	0.63	$b_{t,TS}$	0.87	$b_{t,DY}$	0.67
$b_{t,DS}$	0.64	$b_{t,DS}$	0.56	$b_{t,PE}$	0.85	$b_{t,CP}$	0.77
$b_{t,TS}$	0.93	$b_{t,RF}$	0.73	$b_{t,VS}$	0.66	$b_{t,LVL}$	-0.05
$\widehat{c_{t+1}}$	0.88	$\widehat{c_{t+1}}$	0.81	$\widehat{c_{t+1}}$	0.94	$\widehat{c_{t+1}}$	0.82

2. Additional empirical evidence

Table OA.2: Conditional consumption growth predictability controlling for lagged consumption
This table is similar to Table 2 of the paper, but controls for lags of consumption growth in the second stage of our test for conditional consumption growth predictability. The sample in the second stage regression runs from the second quarter of 1967 to the fourth quarter of 2017. The t-statistics are based on Newey and West (1987) standard errors with H lags.

	Model 1		Model 2		Model 3		Model 4	
Panel A: Quarterly consumption growth ($H = 1$)								
d_0^c	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00
	(2.91)	(2.95)	(3.65)	(3.25)	(2.23)	(2.49)	(2.66)	(2.52)
d_1^c	0.42	0.37	0.37	0.31	0.49	0.43	0.31	0.23
	(4.16)	(3.44)	(3.75)	(2.98)	(4.43)	(3.11)	(2.54)	(1.60)
c_t	0.30	0.33	0.33	0.35	0.28	0.33	0.37	0.38
	(3.80)	(4.54)	(4.07)	(4.57)	(3.47)	(4.39)	(4.55)	(5.27)
c_{t-1}		-0.02		0.00		-0.02		0.02
		(-0.22)		(-0.01)		(-0.21)		(0.22)
c_{t-2}		0.28		0.30		0.26		0.31
		(3.61)		(3.83)		(3.26)		(3.74)
c_{t-3}		-0.23		-0.23		-0.24		-0.23
		(-3.47)		(-3.25)		(-3.70)		(-3.28)
R^2	31.62	37.37	30.05	36.32	31.75	37.09	27.44	34.29
Panel B: Annual consumption growth ($H = 4$)								
d_0^c	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(3.52)	(3.44)	(4.55)	(4.08)	(3.02)	(3.04)	(3.68)	(3.50)
d_1^c	0.29	0.31	0.30	0.30	0.27	0.28	0.20	0.21
	(3.52)	(3.84)	(4.02)	(3.73)	(2.08)	(2.10)	(1.80)	(1.94)
c_t	0.26	0.28	0.25	0.28	0.27	0.29	0.31	0.32
	(4.94)	(5.20)	(4.14)	(4.86)	(4.32)	(4.94)	(4.65)	(5.20)
c_{t-1}		0.03		0.03		0.04		0.05
		(0.77)		(0.82)		(0.98)		(1.25)
c_{t-2}		0.03		0.04		0.04		0.06
		(0.60)		(0.72)		(0.68)		(1.09)
c_{t-3}		-0.14		-0.13		-0.14		-0.14
		(-2.07)		(-2.00)		(-2.14)		(-2.13)
R^2	29.78	31.32	31.84	33.03	27.65	29.15	25.50	27.25

Table OA.3: Time-varying state variable risk premia in subsamples
This table presents the coefficient estimates from our pooled tests in two subsamples, pre- and post-1990. We regress state variable risk premia (at the annual horizon, $H = 4$) on either the conditional relation between a state variable and future consumption growth, b_{t,z_k}, or a dummy variable that equals one when b_{t,z_k} is above the median for a state variable z_k in a particular subsample. We focus on the pooled regressions with fixed effects, because we are interested in time-variation and in these shorter subsamples there is relatively more variation across state variables (in both average λ_{t+1,z_k} and b_{t,z_k}).

	Pre-1990		Post-1990	
Fixed effects	✓	✓	✓	✓
$I_{b_{t,z_k}>\text{median}}$	8.66		3.81	
	(2.70)		(2.52)	
b_{t,z_k}		200.02		298.35
		(1.03)		(1.84)
R^2	12.36	8.98	2.55	2.25
Marginal effect		2.44		2.42

Table OA.4: Does variance help to predict consumption growth?
In this table, we test whether the conditional variances of the state variables help to predict consumption growth in our conditional tests. To this end, we augment our two-stage procedure for consumption growth predictability with an additional first stage for the conditional variances. Thus, we run:
First stage (Levels): $c_{s+1:s+H} = a^H_{t,\boldsymbol{z}} + \boldsymbol{b}^{H\prime}_{t,\boldsymbol{z}} \boldsymbol{z}_s + e_{s+1:s+H}$,
First stage (Variances): $c_{s+1:s+H} = f^H_{t,\boldsymbol{z}} + \boldsymbol{g}^{H\prime}_{t,\boldsymbol{z}} \boldsymbol{\sigma}^2_{\boldsymbol{s},\boldsymbol{z}} + u_{s+1:s+H}$,
Second stage: $c_{t+1:t+H} = d^H_0 + d^H_{\text{Level}}(a^H_{t,\boldsymbol{z}} + \boldsymbol{b}^{H\prime}_{t,\boldsymbol{z}} \boldsymbol{z}_t) + d^H_{\text{Var}}(f^H_{t,\boldsymbol{z}} + \boldsymbol{g}^{H\prime}_{t,\boldsymbol{z}} \boldsymbol{\sigma}^2_{t,z}) + e^c_{t+1:t+H}$.
The second stage test thus asks whether the composite predictor based on the conditional variances of the state variables $(f^H_{t,\boldsymbol{z}} + \boldsymbol{g}^{H\prime}_{t,\boldsymbol{z}} \boldsymbol{\sigma}^2_{t,z})$ helps to predict consumption growth when controlling for the best predictor of consumption growth based on the levels of the state variables $(a^H_{t,\boldsymbol{z}} + \boldsymbol{b}^{H\prime}_{t,\boldsymbol{z}} \boldsymbol{z}_t)$. For each of the four models with different state variables, we present the coefficient estimates with Newey and West (1987) t-statistics in parentheses (with lag length H).

	Model 1	Model 2	Model 3	Model 4
Panel A: Quarterly consumption growth ($H = 1$)				
d^1_0	0.01	0.01	0.00	0.01
	(3.58)	(4.55)	(1.73)	(3.31)
d^1_{Level}	0.62	0.61	0.70	0.57
	(6.61)	(6.15)	(7.88)	(5.55)
d^1_{Var}	0.00	-0.04	0.04	-0.06
	(0.14)	(-0.48)	(0.29)	(-0.83)
R^2	25.31	22.23	26.49	17.13
Panel B: Annual consumption growth ($H = 4$)				
d^4_0	0.01	0.01	0.01	0.01
	(3.73)	(6.17)	(2.52)	(4.61)
d^4_{Level}	0.49	0.45	0.44	0.32
	(4.64)	(6.06)	(3.38)	(3.06)
d^4_{Var}	-0.03	-0.02	0.04	-0.13
	(-1.37)	(-1.08)	(0.57)	(-2.03)
R^2	20.76	22.60	17.04	14.56

Table OA.5: Conditional variance of state variables and risk premia: Robustness checks

This table is similar to Table 5 and presents in columns one to three pooled predictive regressions of state variable risk premia on the conditional relation between each state variable and future consumption growth interacted with the GARCH(1,1) conditional variance of the state variables: $\lambda_{t+1:t+H,z_k} = g_0 + g_1 b^H_{t,z_k} + g_2\sigma^2_{t,z_k} + g_3\sigma^2_{t,z_k} \times b^H_{t,z_k} + \varepsilon_{t+1:t+H,z_k}$. Conditional variance, σ^2_{t,z_k}, is standardized to have mean equal to zero and variance equal to one for each state variable z_k. In columns four to six, we estimate a dummy specification, replacing b^H_{t,z_k} with the indicator $I_{b^H_{t,z_k}>0}$ and σ^2_{t,z_k} with the indicator $I_{\sigma^2_{t,z_k}>\text{median}}$. In columns seven to nine, we estimate an alternative dummy specification, replacing b^H_{t,z_k} with the indicator $I_{b^H_{t,z_k}>\text{median}}$ and σ^2_{t,z_k} with the indicator $I_{\sigma^2_{t,z_k}>\text{median}}$. The first two columns in each block of results use as dependent variables the risk premia for eight unique state variables, and either use quarterly ($H = 1$) or semi-annual ($H = 2$) returns. In the third column in each block, we use annual returns as in the paper, but now use all twelve state variables from the four different ICAPM models. This means that we are including in the pool three (two) different, but correlated, risk premia for the dividend yield (default spread and term spread). To grasp the economic significance of the estimates, we focus on the predicted risk premium in quarters with b^H_{t,z_k} one standard deviation below or above the mean versus σ^2_{t,z_k} at the mean or one standard deviation above the mean. For the dummy specifications, we present the implied risk premium in quarters with positive or negative b^H_{t,z_k} (or $I_{b^H_{t,z_k}>\text{median}} = 1$ or $= 0$) and conditional variance below or above median. $HH - LH$ presents the difference between case one and four. The t-statistic in parentheses underneath each estimate is based on asymptotic Driscoll and Kraay (1998) standard errors.

	Continuous: b^H_{t,z_k} and σ^2_{t,z_k}			Dummy: $I_{b^H_{t,z_k}>0}$ and $I_{\sigma^2_{t,z_k}>\text{median}}$			Dummy: $I_{b^H_{t,z_k}>\text{median}}$ and $I_{\sigma^2_{t,z_k}>\text{median}}$		
	$H = 1$	$H = 2$	$H = 4$ (All)	$H = 1$	$H = 2$	$H = 4$ (All)	$H = 1$	$H = 2$	$H = 4$ (All)
Low b^H_{t,z_k}, High σ^2_{t,z_k}	-4.19	-5.00	-3.85	-2.43	-4.11	-4.51	-4.42	-4.66	-3.57
	(-1.24)	(-1.86)	(-2.14)	(-1.37)	(-2.59)	(-2.28)	(-2.17)	(-2.44)	(-2.00)
Low b^H_{t,z_k}, Low σ^2_{t,z_k}	-2.87	-3.01	-2.20	-1.68	-1.26	-1.38	-1.75	-1.25	-1.83
	(-2.12)	(-2.42)	(-1.62)	(-1.35)	(-1.19)	(-1.18)	(-1.25)	(-1.12)	(-1.75)
High b^H_{t,z_k}, Low σ^2_{t,z_k}	1.95	2.34	2.28	0.52	0.56	0.42	0.14	0.16	0.93
	(1.37)	(1.67)	(1.61)	(0.36)	(0.47)	(0.40)	(0.11)	(0.16)	(0.86)
High b^H_{t,z_k}, High σ^2_{t,z_k}	1.79	3.50	4.80	3.11	5.12	4.64	3.99	4.23	4.28
	(0.64)	(1.22)	(2.14)	(1.20)	(2.01)	(2.32)	(1.72)	(1.80)	(2.02)
$LH - HH$	5.98	8.50	8.65	5.54	9.23	9.15	8.41	8.89	7.85
	(1.04)	(1.66)	(2.83)	(1.39)	(2.41)	(2.58)	(2.12)	(2.24)	(2.26)

Table OA.6: Macro-uncertainty and state variable risk premia: Robustness checks
This table presents a number of robustness checks for Table 6 in the paper. We run the following pooled predictive regression $\lambda_{t+1:t+H,z_k} = g_0 + g_1 b^H_{t,z_k} + g_2\sigma^2_t + g_3\sigma^2_t \times b^H_{t,z_k} + \varepsilon_{t+1:t+H,z_k}$, both with and without fixed effects. We present the predicted state variable risk premia (at the annual horizon, $H = 4$) calculated from the model's estimated coefficients in the same four cases as before. We also present these predicted risk premia for a dummy specification of the regression, but including fixed effects.

Continuous: b_{t,z_k} and	$\sigma_t^{2,*}$	$\sigma_t^{2,**}$	$\sigma_t^{2,*}$	$\sigma_t^{2,**}$	Dummy: $I_{b_{t,z_k}>0}$ and	$I_{\sigma_t^{2,*}>\text{median}}$	$I_{\sigma_t^{2,**}>\text{median}}$
Fixed effects			✓	✓		✓	✓
Low b_{t,z_k}, High σ_t^2	-5.80	-4.97	-5.71	-4.91		-4.06	-4.03
	(-4.14)	(-2.96)	(-4.00)	(-2.88)		(-2.93)	(-3.08)
	[-2.61]	[-2.23]	[-2.55]	[-2.18]		[-2.21]	[-2.18]
Low b_{t,z_k}, Low σ_t^2	-3.25	-3.15	-3.06	-2.97		-1.13	-1.15
	(-2.54)	(-2.35)	(-2.48)	(-2.28)		(-0.98)	(-0.97)
	[-2.36]	[-2.31]	[-1.98]	[-1.93]		[-0.71]	[-0.72]
High b_{t,z_k}, Low σ_t^2	2.75	2.76	2.56	2.59		1.10	1.13
	(1.65)	(1.65)	(1.76)	(1.76)		(0.86)	(0.92)
	[1.88]	[1.89]	[1.60]	[1.62]		[0.66]	[0.69]
High b_{t,z_k}, High σ_t^2	2.97	3.57	2.92	3.50		3.63	3.63
	(1.72)	(1.72)	(1.77)	(1.80)		(2.05)	(1.90)
	[1.36]	[1.64]	[1.32]	[1.59]		[1.97]	[1.94]
$HH - LH$	8.77	8.54	8.63	8.41		7.70	7.66
	(3.02)	(2.45)	(3.03)	(2.50)		(2.88)	(2.67)
	[2.22]	[2.18]	[2.16]	[2.11]		[2.46]	[2.43]

Table OA.7: Conditional variance of state variables net of macroeconomic uncertainty (Continuous specification)

This table is similar to Table 7, but runs a continuous specification to analyze the effect of the conditional variance of the state variables net of macro-uncertainty. We set σ^2_{t,z_k} equal to its time-series median in quarters when one of the two alternative measures of the conditional variance of consumption growth, $\sigma^{2,*}_t$ or $\sigma^{2,**}_t$, is above median. We present predicted risk premia in four cases (at the annual horizon, $H = 4$) estimated from a pooled regression of state variable risk premia on the conditional relation between each state variable and future consumption growth, b_{t,z_k}, as well as σ^2_{t,z_k} (plus their interaction). The t-statistic in parentheses underneath each estimate is based on asymptotic Driscoll and Kraay (1998) standard errors. In the first column, we report results for the unadjusted measure of conditional variance of the state variables, σ^2_{t,z_k}, for the sake of comparison.

	Unadjusted:	Adjusted: σ^2_{t,z_k} = median when	
	σ^2_{t,z_k}	$\sigma^{2,*}_t >$ median	$\sigma^{2,**}_t >$ median
Low b_{t,z_k}, High σ^2_{t,z_k}	-4.36	-3.62	-3.58
	(-2.64)	(-3.95)	(-3.17)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-2.90	-3.10	-3.27
	(-2.13)	(-2.35)	(-2.25)
High b_{t,z_k}, Low σ^2_{t,z_k}	2.44	2.75	2.80
	(1.62)	(1.68)	(1.64)
High b_{t,z_k}, High σ^2_{t,z_k}	4.73	3.71	3.13
	(1.93)	(1.51)	(2.00)
$HH - LH$	9.09	7.33	6.71
	(2.86)	(2.87)	(3.01)

Table OA.8: Fama-MacBeth state variable risk premia and benchmark factors
This table is similar to Table 8 of the paper, but uses the state variable risk premia estimated using Fama-MacBeth cross-sectional regressions. We ask whether the results from the pooled predictive regressions of Table 5 (focusing on the annual horizon $H = 4$) are robust to controlling for unconditional exposure to the benchmark asset pricing factors of the CAPM, Fama-French three-factor model (FF3M), Carhart four-factor model (FFCM) and Fama-French five-factor model (FF5M). We report the predicted risk premia in the four cases that analyze the joint effect of variation in the conditional relation between the state variables and consumption growth and the GARCH(1,1) conditional variance of the state variables (plus their interaction term). We consider both the continuous specification (using b_{t,z_k} and σ^2_{t,z_k}) and the dummy specification (using $I_{b_{t,z_k}>0}$ and $I_{\sigma^2_{t,z_k}>\text{median}}$). In both panels, the bottom row presents the fraction of the original effect (i.e., without controlling for the benchmark factors, reported in the first and sixth column) that remains after controlling for exposures in a particular factor model. The t-statistics in parenthesis are based on asymptotic standard errors calculated following Driscoll and Kraay (1998).

	No controls	CAPM	FF3M	FFCM	FF5M
Panel A: Continuous specification with b_{t,z_k} and σ^2_{t,z_k}					
Low b_{t,z_k}, High σ^2_{t,z_k}	-4.36	-5.01	-3.64	-3.72	-2.57
	(-2.64)	(-3.06)	(-2.05)	(-2.30)	(-1.48)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-2.90	-3.42	-2.18	-2.51	-1.12
	(-2.13)	(-2.73)	(-1.60)	(-1.82)	(-0.84)
High b_{t,z_k}, Low σ^2_{t,z_k}	2.44	1.99	1.04	0.49	1.02
	(1.62)	(1.33)	(0.75)	(0.41)	(0.69)
High b_{t,z_k}, High σ^2_{t,z_k}	4.73	4.65	3.68	3.00	3.69
	(1.93)	(1.78)	(1.58)	(1.52)	(1.51)
$HH - LH$	9.09	9.65	7.32	6.71	6.26
	(2.86)	(3.09)	(2.42)	(2.61)	(2.06)
% $HH - LH$ remaining		1.06	0.81	0.74	0.69
Panel B: Dummy specification with $I_{b_{t,z_k}>0}$ and $I_{\sigma^2_{t,z_k}>\text{median}}$					
Low b_{t,z_k}, High σ^2_{t,z_k}	-4.89	-5.65	-3.72	-3.60	-2.77
	(-2.47)	(-2.95)	(-2.04)	(-2.10)	(-1.58)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-1.91	-2.61	-1.93	-2.03	-1.12
	(-2.05)	(-2.86)	(-2.28)	(-2.11)	(-1.32)
High b_{t,z_k}, Low σ^2_{t,z_k}	0.48	0.00	-1.18	-1.78	-0.87
	(0.46)	(0.00)	(-1.32)	(-1.63)	(-0.84)
High b_{t,z_k}, High σ^2_{t,z_k}	5.59	5.38	4.61	4.02	4.65
	(2.29)	(2.17)	(1.92)	(1.98)	(1.87)
$HH - LH$	10.49	11.03	8.33	7.62	7.42
	(2.51)	(2.67)	(2.17)	(2.26)	(1.96)
% $HH - LH$ remaining		1.05	0.79	0.73	0.71

Table OA.9: Are portfolios of the benchmark factors predictable consistent with the ICAPM? Fama-MacBeth state variable risk premia

This table is identical to Table 9 of the paper, but constructs a maximum correlation mimicking portfolio for each state variable risk premium estimated using a Fama-MacBeth cross-sectional regression. To do so, we regress realized risk premia on the benchmark factors: $\lambda_{t+1:t+4,z_k} = \alpha_{z_k} + \boldsymbol{\beta_{z_k}}'\boldsymbol{F}_{t+1:t+4} + \varepsilon_{t+1:t+4,z_k}$, where $\boldsymbol{F}_{t+1} = (r_{t+1,SMB}, r_{t+1,HML}, r_{t+1,RMW}, r_{t+1,CMA}, r_{t+1,WML})$. For the purpose of comparison, we rescale the mimicking portfolio returns, $\lambda^{MCM}_{t+1,z_k} = \boldsymbol{\beta_{z_k}}'\boldsymbol{F}_{t+1}$, to have the same standard deviation as λ_{t+1,z_k}. In Panel A, we present results from pooled predictive regressions of the mimicking portfolio returns on the conditional relation between a state variable and consumption growth. In Panel B, we present results from the augmented pooled predictive regression that incorporates the effect of time-variation in the conditional variance of the state variables. We present the predicted risk premia (at the annual horizon $H = 4$) in four different cases and run both the continuous and dummy specification with and without fixed effects. The t-statistics use Driscoll and Kraay (1998) asymptotic standard errors.

Panel A: $\lambda^{MCM}_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + \varepsilon_{t+1:t+4,z_k}$				
	$I_{b_{t,z_k}>0}$	$I_{b_{t,z_k}>\text{median}}$	b_{t,z_k}	b_{t,z_k}
Fixed effects		✓		✓
g_0	-4.96	-2.96	-0.30	
	(-3.76)	(-2.89)	(-0.64)	
g_1	8.85	4.39	510.59	321.17
	(3.58)	(2.24)	(4.67)	(2.80)
R^2	6.07	13.54	7.43	13.84
Panel B: $\lambda^{MCM}_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + g_2\sigma^2_{t,z_k} + g_3\sigma^2_{t,z_k} \times b_{t,z_k} + \varepsilon_{t+1:t+4,z_k}$				
	Continuous		Dummy	
Fixed effects		✓		✓
Low b_{t,z_k}, High σ^2_{t,z_k}	-6.39	-4.59	-7.30	-4.77
	(-5.29)	(-3.96)	(-5.36)	(-4.00)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-5.44	-3.65	-2.87	-0.47
	(-4.68)	(-3.53)	(-1.68)	(-0.33)
High b_{t,z_k}, Low σ^2_{t,z_k}	3.92	2.13	2.87	-0.10
	(3.36)	(1.60)	(1.54)	(-0.07)
High b_{t,z_k}, High σ^2_{t,z_k}	4.92	3.15	4.79	2.28
	(3.76)	(2.17)	(3.14)	(1.46)
$HH - LH$	11.31	7.74	12.08	7.05
	(5.75)	(3.50)	(4.71)	(2.84)

Table OA.10: Are portfolios of the benchmark factors predictable consistent with the ICAPM? Quarterly mimicking portfolios

This table is identical to Table 9 of the paper, but constructs the mimicking portfolio for each state variable by regressing quarterly risk premia on quarterly benchmark factor returns: $\lambda_{t+1,z_k} = \alpha_{z_k} + \boldsymbol{\beta_{z_k}}'\boldsymbol{F}_{t+1} + \varepsilon_{t+1,z_k}$. In Panel A, we present results from pooled predictive regressions of the mimicking portfolio returns on the conditional relation between a state variable and consumption growth. In Panel B, we present results from the augmented pooled predictive regression that incorporates the effect of time-variation in the conditional variance of the state variables. We present the predicted risk premia (at the annual horizon $H = 4$) in four different cases and run both the continuous and dummy specification with and without fixed effects. The t-statistics use Driscoll and Kraay (1998) asymptotic standard errors.

	Equal-weighted				Value-weighted			
Panel A: $\lambda^{MCM}_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + \varepsilon_{t+1:t+4,z_k}$								
	$I_{b_{t,z_k}>0}$	$I_{b_{t,z_k}>\text{median}}$	b_{t,z_k}	b_{t,z_k}	$I_{b_{t,z_k}>0}$	$I_{b_{t,z_k}>\text{median}}$	b_{t,z_k}	b_{t,z_k}
Fixed effects		✓		✓		✓		✓
g_0	-5.68	-2.76	-0.63		-4.57	-3.53	-1.64	
	(-4.39)	(-2.75)	(-1.12)		(-3.54)	(-4.04)	(-2.71)	
g_1	9.70	3.38	490.01	237.74	5.38	3.02	419.95	204.91
	(4.21)	(1.82)	(4.74)	(2.38)	(2.76)	(2.09)	(3.98)	(2.30)
R^2	7.14	13.45	6.69	13.55	2.41	12.20	5.40	12.22
Panel B: Predicted risk premia from $\lambda^{MCM}_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + g_2\sigma^2_{t,z_k} + g_3\sigma^2_{t,z_k} \times b_{t,z_k} + \varepsilon_{t+1:t+4,z_k}$								
	Continuous		Dummy		Continuous		Dummy	
Fixed effects		✓		✓		✓		✓
Low b_{t,z_k}, High σ^2_{t,z_k}	-6.14	-3.72	-7.84	-4.72	-7.10	-5.02	-6.57	-4.54
	(-4.10)	(-3.29)	(-5.42)	(-4.40)	(-4.50)	(-4.50)	(-4.91)	(-4.75)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-5.60	-3.23	-3.74	-1.32	-5.94	-3.90	-2.77	-1.41
	(-4.71)	(-3.24)	(-2.44)	(-1.05)	(-4.09)	(-3.73)	(-1.73)	(-1.04)
High b_{t,z_k}, Low σ^2_{t,z_k}	3.45	1.08	2.45	-0.54	1.90	-0.13	1.13	-0.55
	(3.09)	(0.89)	(1.28)	(-0.42)	(1.90)	(-0.12)	(0.74)	(-0.40)
High b_{t,z_k}, High σ^2_{t,z_k}	4.43	1.92	5.41	2.32	1.69	-0.47	0.51	-1.50
	(3.75)	(1.30)	(3.64)	(1.40)	(1.57)	(-0.32)	(0.34)	(-1.02)
$HH - LH$	10.58	5.63	13.26	7.04	8.79	4.55	7.09	3.04
	(5.62)	(2.76)	(5.68)	(3.03)	(5.16)	(2.81)	(3.28)	(1.63)

Table OA.11: Subsets of state variable mimicking portfolios

As in columns two and six in Panel A of Table 9 of the paper, this table presents results from pooled regressions of the returns of state variable mimicking portfolios on the dummy $I_{b_{t,z_k}>\text{median}}$. For each state variable, the maximum correlation mimicking portfolio is obtained by regressing realized risk premia on five benchmark factors. In Panel A of Table 9, we run the pooled regression for the large set of eight state variables (these results are repeated in the first and sixth column of this table). In this table, we run the regression also for each combination of three state variables in the four different ICAPM models: $\boldsymbol{z} = (DY, DS, TS)$ in Model 1, $\boldsymbol{z} = (DY, DS, RF)$ in Model 2, $\boldsymbol{z} = (TS, PE, VS)$ in Model 3, and $\boldsymbol{z} = (DY, CP, LVL)$ in Model 4.

	Equal-weighted					Value-weighted				
	All	Model 1	Model 2	Model 3	Model 4	All	Model 1	Model 2	Model 3	Model 4
g_0	-2.58	-1.82	-6.27	0.92	-1.29	-3.36	-2.76	-6.31	0.27	-3.46
	(-2.47)	(-1.05)	(-3.54)	(0.56)	(-0.84)	(-3.55)	(-1.90)	(-3.39)	(0.20)	(-2.43)
$I_{b_{t,z_k}>\text{median}}$	4.10	5.41	3.10	1.70	5.50	3.96	4.91	2.80	0.99	5.39
	(2.05)	(2.15)	(1.50)	(0.70)	(2.42)	(2.16)	(2.03)	(1.33)	(0.50)	(2.51)
R^2	14.19	11.68	3.83	11.17	15.19	12.50	9.28	1.44	10.57	12.62

Table OA.12: State variable mimicking portfolio weights

This table presents the weights of the mimicking portfolio for each of the eight state variables of interest. These weights are rescaled coefficient estimates from the following regression: $\lambda_{t+1:t+4,z_k} = \alpha_{z_k} + \boldsymbol{\beta_{z_k}}'\boldsymbol{F}_{t+1:t+4} + \varepsilon_{t+1:t+4,z_k}$, where $\boldsymbol{F}_{t+1} = \left(r_{t+1,SMB}, r_{t+1,HML}, r_{t+1,RMW}, r_{t+1,CMA}, r_{t+1,WML}\right)$. For the sake of comparison, we rescale the coefficients so that the standard deviation of the mimicking portfolio is identical to the standard deviation of the state variable risk premium. In parentheses, we present t-statistics based on Newey and West (1987) standard errors with 4 lags. We also present the adjusted $R^2(\times 100)$.

	Mimicking portfolio weights						(t-statistics)						
	α	SMB	HML	RMW	CMA	WML	α	SMB	HML	RMW	CMA	WML	R^2
Panel A: Equal-weighted High-minus-Low state variable risk premia													
DY	0.53	0.47	0.24	-0.20	-1.05	0.30	(0.24)	(3.30)	(1.66)	(-1.56)	(-5.33)	(2.09)	37.15
DS	2.04	-0.55	-0.03	0.13	-0.36	-0.01	(1.08)	(-4.51)	(-0.20)	(1.13)	(-1.90)	(-0.14)	24.74
TS	0.37	0.23	0.69	0.18	0.17	0.02	(0.18)	(2.51)	(4.13)	(1.07)	(0.80)	(0.13)	41.35
RF	-2.09	-0.24	-0.36	-0.35	-0.16	0.06	(-1.05)	(-2.16)	(-2.39)	(-2.57)	(-0.86)	(0.56)	29.31
PE	-1.81	0.07	-0.11	-0.25	0.81	-0.04	(-0.88)	(0.44)	(-0.72)	(-1.86)	(2.55)	(-0.29)	17.95
VS	1.75	0.00	-0.61	-0.67	0.02	0.02	(1.31)	(0.03)	(-3.23)	(-3.44)	(0.08)	(0.15)	50.51
CP	-3.26	0.64	0.31	0.45	0.31	0.01	(-2.01)	(5.54)	(2.48)	(2.19)	(1.62)	(0.12)	46.72
LVL	1.22	0.24	-0.38	-0.56	-0.12	-0.04	(0.81)	(2.71)	(-3.28)	(-5.87)	(-0.75)	(-0.62)	45.47
Panel B: Value-weighted High-minus-Low state variable risk premia													
DY	2.33	0.42	0.22	-0.57	-0.89	0.24	(1.47)	(3.51)	(1.66)	(-4.67)	(-5.04)	(2.67)	43.92
DS	0.68	-0.43	-0.08	-0.20	-0.05	0.08	(0.34)	(-4.01)	(-0.57)	(-1.26)	(-0.24)	(0.69)	17.71
TS	1.32	0.39	0.38	-0.29	0.17	0.08	(0.54)	(2.65)	(1.75)	(-1.12)	(0.81)	(0.49)	19.97
RF	-0.49	-0.34	-0.14	-0.05	-0.12	-0.01	(-0.21)	(-2.87)	(-0.75)	(-0.27)	(-0.62)	(-0.07)	8.51
PE	-0.83	-0.09	-0.12	0.36	0.49	-0.09	(-0.52)	(-0.55)	(-0.71)	(2.36)	(1.73)	(-0.74)	14.07
VS	4.07	-0.09	-0.47	-0.58	-0.15	0.03	(3.13)	(-0.73)	(-2.95)	(-3.90)	(-0.83)	(0.32)	49.56
CP	1.03	0.55	0.06	0.12	0.16	-0.04	(0.49)	(3.53)	(0.34)	(0.43)	(0.66)	(-0.37)	17.67
LVL	3.27	0.11	-0.32	-0.49	-0.11	-0.03	(2.47)	(1.24)	(-2.49)	(-4.32)	(-0.63)	(-0.44)	35.74

Table OA.13: Is the unexplained part of state variable risk premia predictable?
This table is similar to Table 9 of the paper, but asks whether the part of the state variable risk premia unexplained by the benchmark factors is predictable in the time series. This unexplained part is the residual $\varepsilon_{t+1:t+4,z_k}$ from the mimicking portfolio regression: $\lambda_{t+1:t+4,z_k} = \alpha_{z_k} + \boldsymbol{\beta}_{\boldsymbol{z_k}}{}' \boldsymbol{F}_{t+1:t+4} + \varepsilon_{t+1:t+4,z_k}$. For the purpose of comparison, we rescale the residuals to have the same standard deviation as the original state variable risk premia, λ_{t+1,z_k}. In Panel A, we present results from pooled predictive regressions of the unexplained returns on the conditional relation between a state variable and consumption growth. In Panel B, we present results from the augmented pooled predictive regression that incorporates the effect of time-variation in the conditional variance of the state variables. We present the predicted risk premia (at the annual horizon $H = 4$) in four different cases and run both the continuous and dummy specification with and without fixed effects. The t-statistics use Driscoll and Kraay (1998) asymptotic standard errors.

	Equal-weighted				Value-weighted			
Panel A: $\varepsilon_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + u_{t+1:t+4,z_k}$								
	$I_{b_{t,z_k}>0}$	$I_{b_{t,z_k}>\text{median}}$	b_{t,z_k}	b_{t,z_k}	$I_{b_{t,z_k}>0}$	$I_{b_{t,z_k}>\text{median}}$	b_{t,z_k}	b_{t,z_k}
Fixed effects		✓		✓		✓		✓
g_0	-0.90	-1.40	-0.21		1.18	0.99	1.71	
	(-0.93)	(-1.55)	(-0.38)		(1.27)	(0.87)	(2.50)	
g_1	1.41	2.35	12.48	58.47	1.03	1.36	36.51	97.37
	(0.75)	(1.46)	(0.12)	(0.51)	(0.59)	(0.93)	(0.38)	(0.94)
R^2	0.21	2.79	0.01	2.29	0.12	2.11	0.05	2.14
Panel B: Predicted risk premia from $\varepsilon_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + g_2 \sigma^2_{t,z_k} + g_3 \sigma^2_{t,z_k} \times b_{t,z_k} + u_{t+1:t+4,z_k}$								
	Continuous		Dummy		Continuous		Dummy	
Fixed effects		✓		✓		✓		✓
Low b_{t,z_k}, High σ^2_{t,z_k}	-0.45	-0.93	-0.51	-1.44	1.21	0.60	0.94	0.30
	(-0.35)	(-0.67)	(-0.35)	(-1.02)	(0.97)	(0.42)	(0.65)	(0.21)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-0.16	-0.61	-1.24	-1.92	1.50	0.90	1.40	0.91
	(-0.14)	(-0.50)	(-1.13)	(-1.65)	(1.34)	(0.68)	(1.37)	(0.83)
High b_{t,z_k}, Low σ^2_{t,z_k}	-0.29	0.17	-0.44	0.40	1.84	2.45	2.55	3.16
	(-0.24)	(0.14)	(-0.37)	(0.32)	(1.58)	(2.32)	(1.67)	(2.20)
High b_{t,z_k}, High σ^2_{t,z_k}	1.15	1.68	1.37	2.29	3.22	3.85	1.91	2.55
	(0.83)	(1.29)	(0.77)	(1.50)	(2.62)	(3.61)	(1.25)	(1.98)
$HH - LH$	1.59	2.61	1.88	3.73	2.01	3.26	0.97	2.25
	(0.81)	(1.32)	(0.67)	(1.51)	(1.17)	(1.81)	(0.42)	(1.13)

Table OA.14: Predicting consumption growth using principal components and Ludvigson and Ng (2009) factors This table presents coefficient estimates and measures of fit in the second stage of our two-stage test for consumption growth predictability, similar to Table 2 of the paper. We perform this test for three alternative models. The first alternative model includes the first two principal components extracted from our original set of eight state variables ($\boldsymbol{z} = (PC1, PC2)$). The second alternative model adds the third principal component ($\boldsymbol{z} = (PC1, PC2, PC3)$). The third alternative model uses the first three macro-factors of Ludvigson and Ng (2009), such that $\boldsymbol{z} = (LN1, LN2, LN3)$. We present t-statistics calculated using asymptotic Newey and West (1987) (with H lags) standard errors in parentheses. The sample in the second stage regression runs from the second quarter of 1967 to the fourth quarter of 2017.

	$PC1, PC2$			$PC1, PC2, PC3$			$LN1, LN2, LN3$		
H	1	2	4	1	2	4	1	2	4
d_0	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
	(2.08)	(2.47)	(2.86)	(3.36)	(4.30)	(4.51)	(1.62)	(2.11)	(1.69)
d_1	0.64	0.55	0.37	0.60	0.52	0.39	0.68	0.60	0.56
	(5.63)	(4.39)	(2.41)	(6.88)	(6.95)	(4.80)	(6.41)	(4.99)	(4.07)
R^2	15.89	13.93	6.75	21.04	22.89	14.93	23.15	18.93	16.25
R^2 vs Unconditional	15.65	13.01	1.91	16.30	17.02	5.63	8.47	5.49	6.17
R^2 vs Historical mean	13.08	10.73	4.73	18.40	20.02	13.09	20.58	15.91	14.43

Table OA.15: Predicted risk premia when state variables are principal components and Ludvigson and Ng (2009) factors

This table is similar to Table 5, but presents predicted risk premia for each of the three alternative combinations of state variables (see Table OA.14). These predicted risk premia come from pooled predictive regressions of the alternative state variable risk premia (at the annual horizon, $H = 4$) on the conditional relation between each state variable and future consumption growth controlling for the GARCH(1,1) conditional variance of the state variables: $\lambda_{t+1:t+4,z_k} = g_0 + g_1 b_{t,z_k} + g_2\sigma^2_{t,z_k} + g_3\sigma^2_{t,z_k} \times b_{t,z_k} + \varepsilon_{t+1:t+4,z_k}$. The risk premia for each alternative set of state variables is estimated by running cross-sectional regressions of individual stock returns on lagged exposures. We also consider a specification of this regression using dummy variables as well as specifications that include fixed effects. We focus on the predicted risk premium in the usual four cases. $HH - LH$ presents the difference between case one and four. The t-statistic in parentheses underneath each estimate is based on asymptotic Driscoll and Kraay (1998) standard errors. The sample period is the second quarter of 1967 to the fourth quarter of 2017.

	$PC1, PC2$				$PC1, PC2, PC3$				$LN1, LN2, LN3$			
	Continuous		Dummy		Continuous		Dummy		Continuous		Dummy	
Fixed effects		✓		✓		✓		✓		✓		✓
Low b_{t,z_k}, High σ^2_{t,z_k}	-3.58	-4.13	-8.22	-9.29	-13.32	-12.79	-9.38	-9.93	-10.70	-9.37	-6.15	-5.14
	(-0.50)	(-0.58)	(-2.00)	(-2.15)	(-4.78)	(-4.31)	(-4.26)	(-3.94)	(-3.41)	(-3.51)	(-2.10)	(-2.03)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-2.31	-3.13	-2.17	-2.81	-4.23	-4.08	-0.84	-1.31	-2.01	-0.83	3.43	5.02
	(-0.85)	(-1.29)	(-1.48)	(-1.92)	(-3.14)	(-2.63)	(-0.41)	(-0.62)	(-1.58)	(-0.76)	(2.85)	(3.54)
High b_{t,z_k}, Low σ^2_{t,z_k}	3.36	4.25	-2.46	-1.93	0.65	0.55	-1.84	-1.34	3.86	2.68	1.98	0.70
	(1.01)	(1.16)	(-1.23)	(-0.93)	(0.31)	(0.30)	(-1.27)	(-0.70)	(2.86)	(1.79)	(1.44)	(0.44)
High b_{t,z_k}, High σ^2_{t,z_k}	8.66	9.30	8.88	9.28	4.38	4.11	6.54	7.05	5.84	4.63	3.63	2.95
	(1.85)	(1.90)	(1.52)	(1.56)	(1.21)	(1.25)	(1.39)	(1.51)	(3.85)	(2.83)	(1.94)	(1.60)
$HH - LH$	12.24	13.43	17.10	18.56	17.70	16.90	15.92	16.99	16.53	14.00	9.78	8.09
	(2.03)	(2.20)	(2.49)	(2.51)	(3.25)	(3.33)	(2.69)	(2.77)	(4.67)	(4.60)	(2.58)	(2.49)

Table OA.16: Varying the rolling window
This table asks whether our results on the predictability of state variable risk premia are robust when we vary the rolling window used to estimate the conditional relation between a state variable and future consumption growth from 7.5 to 15 years. Panel A runs a pooled regression of state variable risk premia (at the annual horizon, $H = 4$) on a dummy that equals one when a state variable predicts consumption growth strongly relative to its own history, $I_{b_{t,z_k}>\text{median}}$. In Panel B, we run the full specification including also the dummy indicating high conditional variance of the state variables, $I_{\sigma^2_{t,z_k}>\text{median}}$. We present the predicted risk premia in the four usual cases. The t-statistic in parentheses underneath each estimate is based on asymptotic Driscoll and Kraay (1998) standard errors. The sample period is the second quarter of 1967 to the fourth quarter of 2017.

Rolling window in years	7.5	12.5	15
Panel A: Pooled regression on $I_{b_{t,z_k}>\text{median}}$			
g_0	-2.87	-2.75	-2.65
	(-2.66)	(-2.21)	(-2.12)
$I_{b_{t,z_k}>\text{median}}$	5.26	5.03	4.84
	(2.51)	(2.18)	(2.06)
R^2	2.21	2.02	1.87
Panel B: Interaction $I_{b_{t,z_k}>0}$ and $I_{\sigma^2_{t,z_k}>\text{median}}$			
Low b_{t,z_k}, High σ^2_{t,z_k}	-4.42	-4.37	-3.99
	(-2.52)	(-2.06)	(-1.98)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-1.97	-1.28	-1.25
	(-2.33)	(-1.42)	(-1.24)
High b_{t,z_k}, Low σ^2_{t,z_k}	0.44	-0.31	-0.46
	(0.44)	(-0.32)	(-0.48)
High b_{t,z_k}, High σ^2_{t,z_k}	5.20	5.50	5.47
	(2.27)	(2.05)	(1.94)
$HH - LH$	9.62	9.87	9.46
	(2.56)	(2.19)	(2.09)

Table OA.17: Predicting alternative measures of macroeconomic growth

This table is similar to Table 2 of the paper, but presents the results from a two-stage predictability test for three alternative measures of macroeconomic growth: real gross domestic product (GDP), industrial production growth (IPG), and the first principal component of the three macro growth series ($Macro-PC1$). In the first stage, we regress these alternative measures of growth on the lagged state variables over a backward-looking rolling window of ten years (see Eq. (6) in the paper). In the second stage, we use the estimated rolling coefficients and the state variables observed at time t to predict macroeconomic growth from quarter $t+1$ to $t+H$ (see Eq. (7) in the paper). This setup ensures that we use no forward-looking information in the second stage. We perform this test for each of the four models with $\boldsymbol{z}=(DY,DS,TS)$, $\boldsymbol{z}=(DY,DS,RF)$, $\boldsymbol{z}=(TS,PE,VS)$, and finally, $\boldsymbol{z}=(DY,CP,LVL)$. We present t-statistics calculated using asymptotic Newey and West (1987) standard errors in parentheses. We report the same three measures of fit as before. The sample period in the second stage regression runs from the second quarter of 1967 to the fourth quarter of 2017.

	GDP				IPG				$Macro-PC1$			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Panel A: Quarterly growth ($H=1$)												
d_0	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	-0.21	-0.01	-0.14	-0.37
	(3.54)	(4.06)	(2.93)	(3.60)	(1.81)	(2.01)	(1.51)	(1.59)	(-0.56)	(-0.03)	(-0.37)	(-0.87)
d_1	0.47	0.40	0.51	0.39	0.49	0.46	0.54	0.45	0.59	0.54	0.66	0.52
	(4.95)	(3.83)	(4.45)	(3.42)	(4.63)	(4.16)	(4.07)	(3.14)	(7.56)	(6.44)	(7.08)	(5.08)
R^2	14.87	9.93	14.30	7.86	21.43	17.95	16.08	13.94	34.08	26.93	32.11	21.43
R^2 vs Unconditional	8.76	6.86	8.66	2.96	15.01	15.72	8.96	9.78	27.81	24.17	26.57	15.03
R^2 vs Historical mean	15.14	10.22	14.57	8.15	21.70	18.23	16.37	14.24	33.13	25.88	31.13	20.30
Panel B: Semi-annual growth ($H=2$)												
d_0	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	-0.32	-0.10	-0.24	-0.34
	(3.86)	(4.59)	(3.59)	(4.37)	(1.99)	(2.38)	(1.69)	(2.16)	(-0.72)	(-0.22)	(-0.57)	(-0.68)
d_1	0.46	0.37	0.55	0.30	0.34	0.30	0.45	0.31	0.47	0.42	0.60	0.38
	(5.46)	(4.19)	(7.05)	(2.49)	(2.85)	(2.60)	(3.69)	(2.28)	(4.88)	(4.55)	(7.98)	(4.02)
R^2	21.78	14.50	25.72	7.85	12.90	9.64	14.84	7.59	26.59	21.25	31.72	13.42
R^2 vs Unconditional	13.98	13.22	17.08	2.08	5.96	8.51	6.74	4.85	19.78	20.01	25.39	7.43
R^2 vs Historical mean	22.14	14.90	26.06	8.28	13.31	10.07	15.25	8.03	26.11	20.74	31.28	12.85
Panel C: Annual growth ($H=4$)												
d_0	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.02	-0.62	-0.30	-0.43	-0.47
	(4.13)	(5.58)	(4.26)	(5.81)	(1.75)	(2.22)	(1.66)	(2.69)	(-1.22)	(-0.56)	(-0.85)	(-0.80)
d_1	0.41	0.32	0.43	0.18	0.31	0.31	0.42	0.21	0.42	0.38	0.46	0.27
	(4.87)	(4.34)	(5.80)	(1.94)	(2.39)	(2.42)	(4.57)	(2.24)	(4.45)	(4.63)	(5.76)	(3.38)
R^2	16.22	12.52	19.85	2.62	8.80	10.07	17.65	4.11	18.99	18.85	22.95	6.83
R^2 vs Unconditional	5.04	11.72	7.40	-3.34	-2.28	7.51	4.94	-0.22	9.32	18.24	13.07	-1.40
R^2 vs Historical mean	16.45	12.76	20.08	2.89	8.85	10.12	17.69	4.17	19.21	19.06	23.16	7.08

Table OA.18: State variable risk premia and alternative measures of macroeconomic growth
This table asks whether the conditional relation between state variables and three alternative measures of macroeconomic growth (GDP, IPG, and $Macro-PC1$) contains information about future state variable risk premia. Panel A runs a pooled regression of eight state variable risk premia (at the annual horizon, $H = 4$) on a dummy that equals one when a state variable predicts one of the alternative measures strongly relative to its own history, $I_{b_{t,z_k}>\text{median}}$. In Panel B, we run the full specification including also the dummy that equals one when the conditional variance of a state variable is above median, $I_{\sigma^2_{t,z_k}>\text{median}}$. We present the predicted risk premia in the four usual cases. The t-statistic in parentheses underneath each estimate is based on asymptotic Driscoll and Kraay (1998) standard errors. The sample period is the second quarter of 1967 to the fourth quarter of 2017.

	GDP	IPG	$Macro-PC1$
Panel A: Pooled regression on $I_{b_{t,z_k}>\text{median}}$			
g_0	-2.77	-2.25	-2.68
	(-2.63)	(-2.02)	(-2.45)
$I_{b_{t,z_k}>\text{median}}$	5.06	4.04	4.90
	(2.36)	(1.77)	(2.18)
R^2	2.04	1.30	1.91
Panel B: Interaction $I_{b_{t,z_k}>0}$ and $I_{\sigma^2_{t,z_k}>\text{median}}$			
Low b_{t,z_k}, High σ^2_{t,z_k}	-3.54	-3.31	-3.87
	(-2.19)	(-1.71)	(-2.09)
Low b_{t,z_k}, Low σ^2_{t,z_k}	-1.52	-2.12	-1.70
	(-1.71)	(-2.37)	(-1.82)
High b_{t,z_k}, Low σ^2_{t,z_k}	-0.01	0.57	0.10
	(-0.01)	(0.50)	(0.10)
High b_{t,z_k}, High σ^2_{t,z_k}	5.52	4.76	5.41
	(2.02)	(1.68)	(1.93)
$HH-LH$	9.06	8.07	9.28
	(2.23)	(1.80)	(2.11)

Table OA.19: Alternative measure for the conditional variance of the state variables
This table is similar to Table 5, but presents results for a measure of the conditional variance of the state variables that uses no forward-looking information. Conditional variance is defined as the square of a VAR(1) residual, ϵ^2_{t,z_k}, estimated in each quarter t using only data available at that point in time. We present the predicted risk premia in the four usual cases at the annual horizon ($H = 4$). The t-statistic in parentheses underneath each estimate is based on asymptotic Driscoll and Kraay (1998) standard errors.

	Dummy: $I_{b_{t,z_k}>0}$ and $I_{\epsilon^2_{t,z_k}>\text{median}}$	
Fixed effects		✓
Low b_{t,z_k}, High ϵ^2_{t,z_k}	-4.73	-4.00
	(-2.94)	(-2.83)
Low b_{t,z_k}, Low ϵ^2_{t,z_k}	-1.87	-1.12
	(-1.76)	(-1.07)
High b_{t,z_k}, Low ϵ^2_{t,z_k}	1.47	0.67
	(1.39)	(0.63)
High b_{t,z_k}, High ϵ^2_{t,z_k}	4.97	4.13
	(2.07)	(2.21)
$HH - LH$	9.70	8.13
	(2.62)	(2.83)

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