A Tale of Fear and Euphoria in the Stock Market - Online Appendix

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We provide details of model deviations in Section A, additional calibration results in Section B, data descriptions in Section C, and supplemental empirical results in Section D.

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A. Model Derivations

A. Consumption Dynamics

Aggregate consumption dynamics are as follows

$$\Delta c_{t+1} = \mu_c + x_t + \sigma_{g,t}\eta_{t+1} - \psi_x \sigma_{x,t} e_{t+1},$$

$$x_{t+1} = \rho x_t + \varphi_\eta \sigma_{g,t}\eta_{t+1} + \varphi_e \sigma_{x,t} e_{t+1},$$

$$\sigma^2_{g,t+1} = \sigma^2_g + v_g(\sigma^2_{g,t} - \sigma^2_g) + \sigma_1 z_{1,t+1},$$

$$\sigma^2_{x,t+1} = \sigma^2_x + v_x(\sigma^2_{x,t} - \sigma^2_x) + \sigma_2 z_{1,t+1} + \sigma_3 z_{2,t+1}.$$

The shocks $\eta_{t+1}, e_{t+1}, z_{1,t+1}, z_{2,t+1}$ are i.i.d. standard normal.

Using the log-linear approximation of Campbell and Shiller (1988), we can write the log return on the claim to aggregate consumption as

$$\begin{aligned} r_{a,t+1} &= \ln \frac{P_{t+1} + C_{t+1}}{P_t} = \ln \frac{P_{t+1} + C_{t+1}}{C_{t+1}} - \ln \frac{P_t}{C_t} + \ln \frac{C_{t+1}}{C_t} \\ &= k_0 + k_1 z_{t+1} - z_t + \Delta c_{t+1}, \end{aligned} \tag{1}$$

where $z_t = \ln \frac{P_t}{C_t}$, $\bar{z} = \mathbb{E}[z_t]$, $k_1 = \dfrac{e^{\bar{z}}}{e^{\bar{z}} + 1} < 1$, $k_0 = \ln(e^{\bar{z}} + 1) - \dfrac{\bar{z}e^{\bar{z}}}{e^{\bar{z}} + 1}$. From Epstein and Zin (1989), the log pricing kernel is

$$m_{t+1} = \ln M_{t+1} = \theta \ln \delta - \frac{\theta}{\psi}\Delta c_{t+1} + (\theta - 1) r_{a,t+1}. \tag{2}$$

The Euler equation for return on any asset i is $\mathbb{E}_t[M_{t+1}R_{i,t+1}] = 1$, which can be rewritten as

$$\mathbb{E}_t\big[\exp\big(\theta \ln \delta - \frac{\theta}{\psi}\Delta c_{t+1} + (\theta - 1) r_{a,t+1} + r_{i,t+1}\big)\big] = 1. \tag{3}$$

Equation (3) holds for the return on the claim to aggregate consumption $r_{a,t+1}$

(4) $$\mathbb{E}_t\Big[\exp\big(\theta\ln\delta - \frac{\theta}{\psi}\Delta c_{t+1} + \theta r_{a,t+1}\big)\Big] = 1.$$

The log price-consumption ratio is a linear function of state variables:

(5) $$z_t = A_0 + A_1\sigma_{g,t}^2 + A_2\sigma_{x,t}^2 + A_3 x_t,$$

where A_0, A_1, A_2, A_3 are constants to be determined below. Combining equation (1) and equation (5), we have

$$\begin{aligned} r_{a,t+1} &= c_1 + (k_1 v_g - 1)A_1\sigma_{g,t}^2 + (k_1 v_x - 1)A_2\sigma_{x,t}^2 + (k_1 A_1\sigma_1 + k_1 A_2\sigma_2)z_{1,t+1} \\ &\quad + k_1 A_2\sigma_3 z_{2,t+1} + (k_1 A_3\rho - A_3 + 1)x_t + (k_1 A_3\varphi_e - \psi_x)\sigma_{x,t}e_{t+1} \\ &\quad + (k_1 A_3\varphi_\eta + 1)\sigma_{g,t}\eta_{t+1}, \end{aligned}$$

where $c_1 = k_0 + (k_1 - 1)A_0 + k_1 A_1\sigma_g^2(1 - v_g) + k_1 A_2\sigma_x^2(1 - v_x) + \mu_c$. Note that

$$\begin{aligned} & \theta\ln\delta - \frac{\theta}{\psi}\Delta c_{t+1} + \theta r_{a,t+1} \\ = \; & \theta\ln\delta + \theta c_1 - \frac{\theta}{\psi}\mu_c + [A_3\theta(\rho k_1 - 1) + 1 - \gamma]x_t + \theta(k_1 v_g - 1)A_1\sigma_{g,t}^2 + \theta(k_1 v_x - 1)A_2\sigma_{x,t}^2 \\ & + \theta k_1(A_1\sigma_1 + A_2\sigma_2)z_{1,t+1} + \theta k_1 A_2\sigma_3 z_{2,t+1} \\ & + [\theta k_1 A_3\varphi_e + (\gamma - 1)\psi_x]\sigma_{x,t}e_{t+1} + (1 - \gamma + \theta k_1 A_3\varphi_\eta)\sigma_{g,t}\eta_{t+1}. \end{aligned}$$

Using equation (4) and the fact that $\ln(\mathbb{E}[X]) = \mathbb{E}[\ln(X)] - \frac{1}{2}\mathrm{Var}[\ln(X)]$ for log normal distributed variable X, we have

$$
\begin{aligned}
&A_3\theta(\rho k_1 - 1) + 1 - \gamma = 0, \\
&\theta(k_1 v_g - 1)A_1 + \frac{1}{2}(1 - \gamma + \theta k_1 A_3 \varphi_\eta)^2 = 0, \\
&\theta(k_1 v_x - 1)A_2 + \frac{1}{2}[\theta k_1 A_3 \varphi_e + (\gamma - 1)\psi_x]^2 = 0, \\
&\theta \ln \delta + \theta c_1 - \frac{\theta}{\psi}\mu_c + \frac{1}{2}\theta^2 k_1^2 (A_1\sigma_1 + A_2\sigma_2)^2 + \frac{1}{2}\theta^2 k_1^2 A_2^2 \sigma_3^2 = 0,
\end{aligned}
$$

from which we get

$$
\begin{aligned}
A_3 &= \frac{1 - \frac{1}{\psi}}{1 - k_1\rho}, \\
A_1 &= \frac{(1 - \gamma + \theta k_1 A_3 \varphi_\eta)^2}{2\theta(1 - k_1 v_g)}, \\
A_2 &= \frac{[\theta k_1 A_3 \varphi_e + (\gamma - 1)\psi_x]^2}{2\theta(1 - k_1 v_x)}, \\
A_0 &= \frac{1}{1 - k_1}\Big[\ln \delta + k_0 + (1 - \frac{1}{\psi})\mu_c + \frac{1}{2}\theta k_1^2 (A_1\sigma_1 + A_2\sigma_2)^2 + \frac{1}{2}\theta k_1^2 A_2^2 \sigma_3^2 \\
&\qquad + k_1 A_1 \sigma_g^2 (1 - v_g) + k_1 A_2 \sigma_x^2 (1 - v_x)\Big].
\end{aligned}
$$

B. Pricing kernel

The log pricing kernel is

$$
\begin{aligned}
m_{t+1} &= \theta \ln \delta - \frac{\theta}{\psi}\Delta c_{t+1} + (\theta - 1) r_{a,t+1} \\
&= c_2 + [A_3(\theta - 1)(\rho k_1 - 1) - \gamma] x_t + (\theta - 1)(k_1 v_g - 1) A_1 \sigma_{g,t}^2 \\
&\quad + (\theta - 1)(k_1 v_x - 1) A_2 \sigma_{x,t}^2 \\
&\quad + k_1(\theta - 1)(A_1\sigma_1 + A_2\sigma_2) z_{1,t+1} + (\theta - 1) k_1 A_2 \sigma_3 z_{2,t+1} \\
&\quad + [(\theta - 1) k_1 A_3 \varphi_e + \gamma \psi_x] \sigma_{x,t} e_{t+1} - [\gamma - (\theta - 1) k_1 A_3 \varphi_\eta] \sigma_{g,t} \eta_{t+1},
\end{aligned} \tag{6}
$$

where $c_2 = \theta \ln \delta - \frac{\theta}{\psi}\mu_c + (\theta - 1)c_1$. The shock to the pricing kernel is

$$
\begin{aligned}
& m_{t+1} - \mathbb{E}_t[m_{t+1}] \\
= \; & k_1(\theta - 1)(A_1\sigma_1 + A_2\sigma_2)z_{1,t+1} + (\theta - 1)k_1 A_2 \sigma_3 z_{2,t+1} \\
& +[(\theta - 1)k_1 A_3 \varphi_e + \gamma\psi_x]\sigma_{x,t}e_{t+1} - [\gamma - (\theta - 1)k_1 A_3 \varphi_\eta]\sigma_{g,t}\eta_{t+1}.
\end{aligned}
$$

Substituting $A_3 = \frac{1-\frac{1}{\psi}}{1-k_1\rho}$ into equation (6), we have

$$
\begin{aligned}
m_{t+1} - \mathbb{E}_t[m_{t+1}] &= k_1(\theta - 1)(A_1\sigma_1 + A_2\sigma_2)z_{1,t+1} + k_1(\theta - 1)A_2\sigma_3 z_{2,t+1} \\
&\quad +[\gamma\psi_x + k_1\varphi_e \frac{\frac{1}{\psi} - \gamma}{1 - k_1\rho}]\sigma_{x,t}e_{t+1} - [\gamma - k_1\varphi_\eta \frac{\frac{1}{\psi} - \gamma}{1 - k_1\rho}]\sigma_{g,t}\eta_{t+1}.
\end{aligned} \tag{7}
$$

C. Equity premium, Conditional Stock Market Variance, and Risk-Free Rate

Using the log linear approximation for the stock market return, we have

$$
\begin{aligned}
r_{m,t+1} &= \ln \frac{P_{m,t+1} + D_{t+1}}{P_{m,t}} = \ln \frac{P_{m,t+1} + D_{t+1}}{D_{t+1}} - \ln \frac{P_{m,t}}{D_t} + \ln \frac{D_{t+1}}{D_t} \\
&= k_{0,m} + k_{1,m} z_{m,t+1} - z_{m,t} + \Delta d_{t+1},
\end{aligned} \tag{8}
$$

where $z_{m,t} = \ln \frac{P_{m,t}}{D_t}$, $\bar{z}_m = \mathbb{E}[z_{m,t}]$, $k_{1,m} = \dfrac{e^{\bar{z}_m}}{e^{\bar{z}_m} + 1} < 1$, and $k_{0,m} = \ln(e^{\bar{z}_m} + 1) - \dfrac{\bar{z}_m e^{\bar{z}_m}}{e^{\bar{z}_m} + 1}$. The market portfolio's dividend growth process is

$$
\Delta d_{t+1} = \mu_d + \phi x_t + \pi_\eta \sigma_{g,t}\eta_{t+1} + \pi_e \sigma_{x,t} e_{t+1}.
$$

Suppose that the log stock market price-dividend ratio is a linear function of state variables

$$
z_{m,t} = A_{0,m} + A_{1,m}\sigma^2_{g,t} + A_{2,m}\sigma^2_{x,t} + A_{3,m}x_t, \tag{9}
$$

where $A_{0,m}, A_{1,m}, A_{2,m}, A_{3,m}$ are constants to be determined below. Combining equations (8) and

(9), we have

$$
\begin{aligned}
r_{m,t+1} &= k_{0,m} + k_{1,m}z_{m,t+1} - z_{m,t} + \Delta d_{t+1} \\
&= c_3 + (k_{1,m}v_g - 1)A_{1,m}\sigma^2_{g,t} + (k_{1,m}v_x - 1)A_{2,m}\sigma^2_{x,t} + (k_{1,m}A_{3,m}\rho - A_{3,m} + \phi)x_t \\
&\quad +(k_{1,m}A_{1,m}\sigma_1 + k_{1,m}A_{2,m}\sigma_2)z_{1,t+1} + k_{1,m}A_{2,m}\sigma_3 z_{2,t+1} \\
&\quad +(k_{1,m}A_{3,m}\varphi_e + \pi_e)\sigma_{x,t}e_{t+1} + (\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)\sigma_{g,t}\eta_{t+1}, \qquad (10)
\end{aligned}
$$

where $c_3 = k_{0,m} + (k_{1,m} - 1)A_{0,m} + k_{1,m}A_{1,m}\sigma^2_g(1 - v_g) + k_{1,m}A_{2,m}\sigma^2_x(1 - v_x) + \mu_d$.

Combining equations (6) and (10), we have

$$
\begin{aligned}
& m_{t+1} + r_{m,t+1} \\
=\;& \theta \ln\delta - \frac{\theta}{\psi}\Delta c_{t+1} + (\theta - 1)r_{a,t+1} + r_{m,t+1} \\
=\;& c_2 + c_3 + [A_3(\theta - 1)(\rho k_1 - 1) - \gamma + k_{1,m}A_{3,m}\rho - A_{3,m} + \phi]x_t \\
& +[(\theta - 1)(k_1 v_g - 1)A_1 + (k_{1,m}v_g - 1)A_{1,m}]\sigma^2_{g,t} \\
& +[(\theta - 1)(k_1 v_x - 1)A_2 + (k_{1,m}v_x - 1)A_{2,m}]\sigma^2_{x,t} \\
& +[k_1(\theta - 1)(A_1\sigma_1 + A_2\sigma_2) + k_{1,m}(A_{1,m}\sigma_1 + A_{2,m}\sigma_2)]z_{1,t+1} \\
& +[(\theta - 1)k_1 A_2 + k_{1,m}A_{2,m}]\sigma_3 z_{2,t+1} \\
& +[(\theta - 1)k_1 A_3\varphi_e + \gamma\psi_x + k_{1,m}A_{3,m}\varphi_e + \pi_e]\sigma_{x,t}e_{t+1} \\
& +[\pi_\eta - \gamma + k_{1,m}A_{3,m}\varphi_\eta + (\theta - 1)k_1 A_3\varphi_\eta]\sigma_{g,t}\eta_{t+1}.
\end{aligned}
$$

Using the Euler equation $\mathbb{E}_t[M_{t+1}R_{m,t+1}] = 1$ and the fact that $\ln(\mathbb{E}[X]) = \mathbb{E}[\ln(X)] -$

$\frac{1}{2}\text{Var}[\ln(X)]$ for log normal distributed variable X, we have

$$\begin{aligned}
A_3(\theta-1)(\rho k_1-1)-\gamma+k_{1,m}A_{3,m}\rho-A_{3,m}+\phi &= 0,\\
(\theta-1)(k_1 v_g-1)A_1+(k_{1,m}v_g-1)A_{1,m}+\frac{1}{2}[\pi_\eta-\gamma+k_{1,m}A_{3,m}\varphi_\eta+(\theta-1)k_1A_3\varphi_\eta]^2 &= 0,\\
(\theta-1)(k_1 v_x-1)A_2+(k_{1,m}v_x-1)A_{2,m}+\frac{1}{2}((\theta-1)k_1A_3\varphi_e+\gamma\psi_x+k_{1,m}A_{3,m}\varphi_e+\pi_e)^2 &= 0,\\
c_2+c_3+\frac{1}{2}[k_1(\theta-1)(A_1\sigma_1+A_2\sigma_2)+k_{1,m}(A_{1,m}\sigma_1+A_{2,m}\sigma_2)]^2 & \\
+\frac{1}{2}[(\theta-1)k_1A_2+k_{1,m}A_{2,m}]^2\sigma_3^2 &= 0,
\end{aligned}$$

from which we have

$$\begin{aligned}
A_{0,m} &= \frac{1}{1-k_{1,m}}\Big[c_2+k_{0,m}+k_{1,m}A_{1,m}\sigma_g^2(1-v_g)+k_{1,m}A_{2,m}\sigma_x^2(1-v_x)+\mu_d+\\
&\qquad +\frac{1}{2}[k_1(\theta-1)(A_1\sigma_1+A_2\sigma_2)+k_{1,m}(A_{1,m}\sigma_1+A_{2,m}\sigma_2)]^2\\
&\qquad +\frac{1}{2}[(\theta-1)k_1A_2+k_{1,m}A_{2,m}]^2\sigma_3^2\Big],\\
A_{1,m} &= \frac{(\theta-1)(k_1v_g-1)A_1+\frac{1}{2}[\pi_\eta-\gamma+k_{1,m}A_{3,m}\varphi_\eta+(\theta-1)k_1A_3\varphi_\eta]^2}{1-k_{1,m}v_g},\\
A_{2,m} &= \frac{1}{1-k_{1,m}v_x}\Big[(\theta-1)(k_1v_x-1)A_2+\frac{1}{2}((\theta-1)k_1A_3\varphi_e+\gamma\psi_x+k_{1,m}A_{3,m}\varphi_e+\pi_e)^2\Big],\\
A_{3,m} &= \frac{\phi-\frac{1}{\psi}}{1-k_{1,m}\rho}.
\end{aligned}$$

From equation (10), we can derive the conditional stock market variance

(11) $$\sigma_{m,t}^2=c_4+(k_{1,m}A_{3,m}\varphi_e+\pi_e)^2\sigma_{x,t}^2+(\pi_\eta+k_{1,m}A_{3,m}\varphi_\eta)^2\sigma_{g,t}^2,$$

where $c_4=k_{1,m}^2(A_{1,m}\sigma_1+A_{2,m}\sigma_2)^2+k_{1,m}^2A_{2,m}^2\sigma_3^2$. Using equation (11), we can substitute $\sigma_{g,t}^2$ out from equation (9) by $\sigma_{m,t}^2$:

(12) $$\begin{aligned}
z_{m,t} &= A_{0,m}+A_{1,m}\sigma_{g,t}^2+A_{2,m}\sigma_{x,t}^2+A_{3,m}x_t\\
&= A_{0,m}-\frac{A_{1,m}}{(\pi_\eta+k_{1,m}A_{3,m}\varphi_\eta)^2}c_4+a\sigma_{m,t}^2+b\sigma_{x,t}^2+A_{3,m}x_t,
\end{aligned}$$

where $a = \frac{A_{1,m}}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}$ and $b = A_{2,m} - \frac{A_{1,m}}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}(k_{1,m}A_{3,m}\varphi_e + \pi_e)^2$.

Using equations (6) and (10), we have

$$\begin{aligned} Cov_t[m_{t+1}, r_{m,t+1}] &= c_5 - [\gamma - (\theta-1)k_1A_3\varphi_\eta](\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)\sigma^2_{g,t} \\ &\quad +[(\theta-1)k_1A_3\varphi_e + \gamma\psi_x](k_{1,m}A_{3,m}\varphi_e + \pi_e)\sigma^2_{x,t}, \end{aligned}$$

where $c_5 = k_1k_{1,m}(\theta-1)(A_1\sigma_1 + A_2\sigma_2)(A_{1,m}\sigma_1 + A_{2,m}\sigma_2) + (\theta-1)k_1k_{1,m}A_{2,m}A_2\sigma_3^2$. By the Euler equations $\mathbb{E}_t[M_{t+1}R_{m,t+1}] = 1$ and $\mathbb{E}_t[M_{t+1}R_t^f] = 1$ we have

$$\begin{aligned} \mathbb{E}_t[r_{m,t+1} - r_t^f] &= -\frac{1}{2}\sigma^2_{m,t} - Cov_t[m_{t+1}, r_{m,t+1}] \\ &= -c_5 - \frac{1}{2}\sigma^2_{m,t} + [\gamma - (\theta-1)k_1A_3\varphi_\eta](\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)\sigma^2_{g,t} \\ &\quad -[(\theta-1)k_1A_3\varphi_e + \gamma\psi_x](k_{1,m}A_{3,m}\varphi_e + \pi_e)\sigma^2_{x,t}. \end{aligned} \tag{13}$$

From (11) and (13) we have

$$\mathbb{E}_t[r_{m,t+1} - r_t^f] = c_6 + \alpha\sigma^2_{m,t} + \beta\sigma^2_{x,t},$$

where

$$\begin{aligned} c_6 &= -c_5 - \frac{\gamma - (\theta-1)k_1A_3\varphi_\eta}{\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta}c_4, \\ \alpha &= -\frac{1}{2} + \frac{\gamma - (\theta-1)k_1A_3\varphi_\eta}{\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta}, \\ \beta &= -[(\theta-1)k_1A_3\varphi_e + \gamma\psi_x](k_{1,m}A_{3,m}\varphi_e + \pi_e) - \frac{\gamma - (\theta-1)k_1A_3\varphi_\eta}{\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta}(k_{1,m}A_{3,m}\varphi_e + \pi_e)^2. \end{aligned}$$

By the Euler equation $\mathbb{E}_t[M_{t+1}R_t^f] = 1$ we have

$$\begin{aligned}
r_t^f &= -\mathbb{E}_t[m_{t+1}] - \frac{1}{2}\mathrm{Var}_t[m_{t+1}] \\
&= c_7 - [A_3(\theta-1)(\rho k_1 - 1) - \gamma]x_t + c\sigma_{g,t}^2 + d\sigma_{x,t}^2 \\
&= c_7 - \frac{cc_4}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2} + \frac{1}{\psi}x_t + \frac{c}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}\sigma_{m,t}^2 \\
&\quad + [d - \frac{c}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}(k_{1,m}A_{3,m}\varphi_e + \pi_e)^2]\sigma_{x,t}^2,
\end{aligned}$$

where

$$\begin{aligned}
c_7 &= -c_2 - \frac{1}{2}k_1^2(\theta-1)^2[(A_1\sigma_1 + A_2\sigma_2)^2 + A_2^2\sigma_3^2], \\
c &= -[(\theta-1)(k_1 v_g - 1)A_1 + \frac{1}{2}[\gamma - (\theta-1)k_1 A_3\varphi_\eta]^2], \\
d &= -[(\theta-1)(k_1 v_x - 1)A_2 + \frac{1}{2}((\theta-1)k_1 A_3\varphi_e + \gamma\psi_x)^2].
\end{aligned}$$

D. Stock Portfolio Returns

Using the log linear approximation for the return on portfolio p, we have

$$r_{p,t+1} = \ln\frac{P_{p,t+1} + D_{p,t+1}}{P_{p,t}} = k_{0,p} + k_{1,p}z_{p,t+1} - z_{p,t} + \Delta d_{p,t+1}, \tag{14}$$

where $z_{p,t} = \ln\frac{P_{p,t}}{D_{p,t}}$, $\bar{z}_p = \mathbb{E}[z_{p,t}]$, $k_{1,p} = \dfrac{e^{\bar{z}_p}}{e^{\bar{z}_p}+1} < 1$, and $k_{0,p} = \ln(e^{\bar{z}_p}+1) - \dfrac{\bar{z}_p e^{\bar{z}_p}}{e^{\bar{z}_p}+1}$.

The portfolio's dividend growth process is

$$\Delta d_{p,t+1} = \mu_d + \phi_p x_t + \pi_{\eta,p}\sigma_{g,t}\eta_{t+1} + \pi_{e,p}\sigma_{x,t}e_{t+1} + \pi_p z_{p,t+1}.$$

We suppose that the log price-dividend ratio has the following form

$$z_{p,t} = A_{0,p} + A_{1,p}\sigma_{g,t}^2 + A_{2,p}\sigma_{x,t}^2 + A_{3,p}x_t, \tag{15}$$

where $A_{0,p}, A_{1,p}, A_{2,p}, A_{3,p}$ are constants to be determined below.

Combining equations (14) and (15), we have

$$\begin{aligned} r_{p,t+1} &= c_{3,p} + (k_{1,p}v_g - 1)A_{1,p}\sigma_{g,t}^2 + (k_{1,p}v_x - 1)A_{2,p}\sigma_{x,t}^2 \\ &\quad +(k_{1,p}A_{3,p}\rho - A_{3,p} + \phi_p)x_t + k_{1,p}(A_{1,p}\sigma_1 + A_{2,p}\sigma_2)z_{1,t+1} \\ &\quad +k_{1,p}A_{2,p}\sigma_3 z_{2,t+1} + \pi_p z_{p,t+1} + (k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})\sigma_{x,t}e_{t+1} \\ &\quad +(\pi_{\eta,p} + k_{1,p}A_{3,p}\varphi_\eta)\sigma_{g,t}\eta_{t+1}, \end{aligned} \tag{16}$$

where $c_{3,p} = k_{0,p} + (k_{1,p} - 1)A_{0,p} + k_{1,p}A_{1,p}\sigma_g^2(1 - v_g) + k_{1,p}A_{2,p}\sigma_x^2(1 - v_x) + \mu_d$. The conditional variance of the portfolio return is

$$\sigma_{p,t}^2 = c_{4,p} + (k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})^2\sigma_{x,t}^2 + (\pi_{\eta,p} + k_{1,p}A_{3,p}\varphi_\eta)^2\sigma_{g,t}^2,$$

where $c_{4,p} = k_{1,p}^2(A_{1,p}\sigma_1 + A_{2,p}\sigma_2)^2 + k_{1,p}^2 A_{2,p}^2\sigma_3^2 + \pi_p^2$.

The covariance of the portfolio return with the log pricing kernel is

$$\begin{aligned} Cov_t[m_{t+1}, r_{p,t+1}] &= c_{5,p} - [\gamma - (\theta - 1)k_1A_3\varphi_\eta](\pi_{\eta,p} + k_{1,p}A_{3,p}\varphi_\eta)\sigma_{g,t}^2 \\ &\quad +[(\theta - 1)k_1A_3\varphi_e + \gamma\psi_x](k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})\sigma_{x,t}^2, \end{aligned}$$

where $c_{5,p} = k_1k_{1,p}(\theta - 1)(A_1\sigma_1 + A_2\sigma_2)(A_{1,p}\sigma_1 + A_{2,p}\sigma_2) + (\theta - 1)k_1k_{1,p}A_{2,p}A_2\sigma_3^2$.

By the Euler equations $\mathbb{E}_t[M_{t+1}R_{p,t+1}] = 1$ and $\mathbb{E}_t[M_{t+1}R_t^f] = 1$ we have

$$\begin{aligned} \mathbb{E}_t[r_{p,t+1} - r_t^f] &= -\frac{1}{2}\sigma_{p,t}^2 - Cov_t[m_{t+1}, r_{p,t+1}] \\ &= -c_{5,p} - \frac{1}{2}c_{4,p} - \frac{1}{2}(k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})^2\sigma_{x,t}^2 \\ &\quad +\Big[[\gamma - (\theta - 1)k_1A_3\varphi_\eta](\pi_{\eta,p} + k_{1,p}A_{3,p}\varphi_\eta) - \frac{1}{2}(k_{1,p}A_{3,p}\varphi_\eta + \pi_{\eta,p})^2\Big]\sigma_{g,t}^2 \\ &\quad -[(\theta - 1)k_1A_3\varphi_e + \gamma\psi_x](k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})\sigma_{x,t}^2. \end{aligned} \tag{17}$$

Substituting equation (11) into equation (17), we have

$$\mathbb{E}_t[r_{p,t+1} - r_t^f] = c_{6,p} + \alpha_p \sigma_{m,t}^2 + \beta_p \sigma_{x,t}^2,$$

where

$$\begin{aligned}
c_{6,p} &= -c_{5,p} - \frac{1}{2}c_{4,p} - \frac{a_p}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}c_4, \\
\alpha_p &= \frac{a_p}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}, \\
\beta_p &= -[(\theta-1)k_1 A_3 \varphi_e + \gamma\psi_x](k_{1,p}A_{3,p}\varphi_e + \pi_{e,p}) - \frac{a_p}{(\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2}(k_{1,m}A_{3,m}\varphi_e + \pi_e)^2 \\
&\quad -\frac{1}{2}(k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})^2.
\end{aligned}$$

Combining equations (6) and (16), we have

$$\begin{aligned}
m_{t+1} + r_{p,t+1} &= \theta \ln\delta - \frac{\theta}{\psi}\Delta c_{t+1} + (\theta-1)r_{a,t+1} + r_{p,t+1} \\
&= c_2 + c_{3,p} + [A_3(\theta-1)(\rho k_1 - 1) - \gamma + k_{1,p}A_{3,p}\rho - A_{3,p} + \phi_p]x_t \\
&\quad +[(\theta-1)(k_1 v_g - 1)A_1 + (k_{1,p}v_g - 1)A_{1,p}]\sigma_{g,t}^2 \\
&\quad +[(\theta-1)(k_1 v_x - 1)A_2 + (k_{1,p}v_x - 1)A_{2,p}]\sigma_{x,t}^2 \\
&\quad +[k_1(\theta-1)(A_1\sigma_1 + A_2\sigma_2) + k_{1,p}(A_{1,p}\sigma_1 + A_{2,p}\sigma_2)]z_{1,t+1} \\
&\quad +[(\theta-1)k_1 A_2 + k_{1,p}A_{2,p}]\sigma_3 z_{2,t+1} \\
&\quad +[(\theta-1)k_1 A_3\varphi_e + \gamma\psi_x + k_{1,p}A_{3,p}\varphi_e + \pi_{e,p}]\sigma_{x,t}e_{t+1} \\
&\quad +[\pi_{\eta,p} - \gamma + (\theta-1)k_1 A_3\varphi_\eta + k_{1,p}A_{3,p}\varphi_\eta]\sigma_{g,t}\eta_{t+1} + \pi_p z_{p,t+1}.
\end{aligned}$$

Using the Euler equation $\mathbb{E}_t[M_{t+1}R_{p,t+1}] = 1$ and the fact that $\ln(\mathbb{E}[X]) = \mathbb{E}[\ln(X)] -$

$\frac{1}{2}\text{Var}[\ln(X)]$ for log normal distributed variable X, we have

$$\begin{aligned}
A_3(\theta-1)(\rho k_1 - 1) - \gamma + k_{1,p}A_{3,p}\rho - A_{3,p} + \phi_p &= 0,\\
(\theta-1)(k_1 v_g - 1)A_1 + (k_{1,p}v_g - 1)A_{1,p} + \frac{1}{2}[\pi_{\eta,p} - \gamma + (\theta-1)k_1 A_3\varphi_\eta + k_{1,p}A_{3,p}\varphi_\eta]^2 &= 0,\\
(\theta-1)(k_1 v_x - 1)A_2 + (k_{1,p}v_x - 1)A_{2,p} &\\
+\frac{1}{2}((\theta-1)k_1 A_3\varphi_e + \gamma\psi_x + k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})^2 &= 0,\\
c_2 + c_{3,p} + \frac{1}{2}[k_1(\theta-1)(A_1\sigma_1 + A_2\sigma_2) + k_{1,p}(A_{1,p}\sigma_1 + A_{2,p}\sigma_2)]^2 &\\
+\frac{1}{2}[(\theta-1)k_1 A_2 + k_{1,p}A_{2,p}]^2\sigma_3^2 + \frac{1}{2}\pi_p^2 &= 0,
\end{aligned}$$

from which we get

$$\begin{aligned}
A_{0,p} &= \frac{1}{1-k_{1,p}}\Big[c_2 + k_{0,p} + k_{1,p}A_{1,p}\sigma_g^2(1-v_g) + k_{1,p}A_{2,p}\sigma_x^2(1-v_x) + \mu_d + \\
&\qquad +\frac{1}{2}[k_1(\theta-1)(A_1\sigma_1 + A_2\sigma_2) + k_{1,p}(A_{1,p}\sigma_1 + A_{2,p}\sigma_2)]^2\\
&\qquad +\frac{1}{2}[(\theta-1)k_1 A_2 + k_{1,p}A_{2,p}]^2\sigma_3^2 + \frac{1}{2}\pi_p^2\Big],\\
A_{1,p} &= \frac{(\theta-1)(k_1 v_g - 1)A_1 + \frac{1}{2}[\pi_{\eta,p} - \gamma + (\theta-1)k_1 A_3\varphi_\eta + k_{1,p}A_{3,p}\varphi_\eta]^2}{1 - k_{1,p}v_g},\\
A_{2,p} &= \frac{1}{1-k_{1,p}v_x}\big[(\theta-1)(k_1 v_x - 1)A_2 + \frac{1}{2}((\theta-1)k_1 A_3\varphi_e + \gamma\psi_x + k_{1,p}A_{3,p}\varphi_e + \pi_{e,p})^2\big],\\
A_{3,p} &= \frac{\phi_p - \frac{1}{\psi}}{1-k_{1,p}\rho}.
\end{aligned}$$

E. Negative Correlation Condition

$$\begin{aligned}
&cov_t(M_{t+1}R_{m,t+1}, R_{m,t+1})\\
=\;& \mathbb{E}_t[M_{t+1}R_{m,t+1}^2] - \mathbb{E}_t[M_{t+1}R_{m,t+1}]\mathbb{E}_t[R_{m,t+1}]\\
=\;& \mathbb{E}_t[M_{t+1}R_{m,t+1}^2] - \mathbb{E}_t[R_{m,t+1}] = \mathbb{E}_t[\exp(m_{t+1} + 2r_{m,t+1})] - \mathbb{E}_t[\exp(r_{m,t+1})]\\
=\;& \exp\big(\mathbb{E}_t[m_{t+1}] + 2\mathbb{E}_t[r_{m,t+1}] + 2Var_t[r_{m,t+1}] + \frac{1}{2}Var_t[m_{t+1}] + 2cov_t(m_{t+1}, r_{m,t+1})\big)\\
&-\exp\big(\mathbb{E}_t[r_{m,t+1}] + \frac{1}{2}Var_t[r_{m,t+1}]\big). \qquad (18)
\end{aligned}$$

The assumption that M_{t+1} and $R_{m,t+1}$ are jointly log-normal distributed is used in equation (18). The no-arbitrage condition $\mathbb{E}_t[M_{t+1}R_{m,t+1}] = 1$ implies

$$\exp\big(\mathbb{E}_t[m_{t+1}] + \mathbb{E}_t[r_{m,t+1}] + \frac{1}{2}Var_t[r_{m,t+1}] + \frac{1}{2}Var_t[m_{t+1}] + cov_t(m_{t+1}, r_{m,t+1})\big) = 1.$$

Substituting the log-linearized no-arbitrage condition into equation (18), we have

$$\begin{aligned} & cov_t(M_{t+1}R_{m,t+1}, R_{m,t+1}) \\ = \; & \exp\big(\mathbb{E}_t[r_{m,t+1}] + 1.5Var_t[r_{m,t+1}] + cov_t(m_{t+1}, r_{m,t+1})\big) - \exp\big(\mathbb{E}_t[r_{m,t+1}] + \frac{1}{2}Var_t[r_{m,t+1}]\big) \\ = \; & \exp\big(\mathbb{E}_t[r_{m,t+1}] + \frac{1}{2}Var_t[r_{m,t+1}]\big)[\exp\big(Var_t[r_{m,t+1}] + cov_t(m_{t+1}, r_{m,t+1})\big) - 1]. \end{aligned} \tag{19}$$

Note that

$$\begin{aligned} Var_t[r_{m,t+1}] &= c_4 + (\pi_e + k_{1,m}A_{3,m}\varphi_e)^2\sigma^2_{x,t} + (\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2\sigma^2_{g,t}, \\ Cov_t[m_{t+1}, r_{m,t+1}] &= c_5 + [\gamma\psi_x + k_1\varphi_e\frac{\frac{1}{\psi} - \gamma}{1 - k_1\rho}](\pi_e + k_{1,m}A_{3,m}\varphi_e)\sigma^2_{x,t} \\ & \quad -[\gamma - k_1\varphi_\eta\frac{\frac{1}{\psi} - \gamma}{1 - k_1\rho}](\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)\sigma^2_{g,t}. \end{aligned}$$

Therefore,

$$Var_t[r_{m,t+1}] + Cov_t[m_{t+1}, r_{m,t+1}] = a_0 + a_1\sigma^2_{x,t} + a_2\sigma^2_{g,t},$$

where

$$\begin{aligned} a_0 &= c_4 + c_5, \\ a_1 &= (\pi_e + k_{1,m}A_{3,m}\varphi_e)^2 + [\gamma\psi_x + k_1\varphi_e\frac{\frac{1}{\psi} - \gamma}{1 - k_1\rho}](\pi_e + k_{1,m}A_{3,m}\varphi_e) > 0, \\ a_2 &= (\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta)^2 - [\gamma - k_1\varphi_\eta\frac{\frac{1}{\psi} - \gamma}{1 - k_1\rho}](\pi_\eta + k_{1,m}A_{3,m}\varphi_\eta) < 0. \end{aligned}$$

B. Additional Simulation Results

A. Long-Horizon Forecast Regressions

In Table A1, we report the OLS estimation results of forecasting long-horizon excess stock market returns using quarterly predictor variables. In Panel A, we use price-dividend ratio (PD) as the predictor variable. For example, we use quarter t PD to forecast excess stock market returns over the period from quarter $t + 1$ to quarter $t + 4$ for the 1-year forecast horizon. In parentheses, we report the Newey-West t-value; the number of lags equals the number of quarters in the forecast horizon. We find that consistent with the actual data, PD correlates negatively with future excess stock market returns and R^2 increases monotonically with forecast horizons from 1 year to 5 years.

Panels B and C of Table A1 report long-horizon forecast regression results using stock market variance (VMKT) and euphoria variance (VE) as the predictor variables, respectively. We use both market and euphoria variances as the predictor variables in Panel D. The two variances jointly have stronger market return predictive power than they do individually. R^2 in Panel D is higher than its counterpart in Panel A. This is because the market return predictive power of the price-dividend ratio reflects its correlations with stock market variance and euphoria variance.

B. Alternative IST Calibration

Justiniano, Primiceri, and Tambalotti (2010) estimate impulse responses of consumption to IST shocks and report the findings in their Figure 3 for only the first 16 quarters. IST shocks are transitory in their model. We assume that consumption peaks at the 16th quarter and then reverse to the steady state value gradually with a symmetric path. The break-even discount rate is 35.75%, which is used to choose the parameter values for IST shocks reported in Table A2.

Figure 1 plots the Justiniano et al. (2010) estimated (solid line) and model (dashed line) impulse responses of consumption to one standard deviation increase in the IST shock. For comparison, we scale the model impulse responses so that the impact effect is the same as that of the Justiniano et al. (2010) estimated impulse responses.

The risk price is negative for IST shocks under the alternative calibration. Figure 2 shows that stock market variance is a V-shaped function of the price-dividend ratio. Figure 2 shows that the conditional equity premium decreases monotonically with the price-dividend ratio. Table A3 shows that key statistics of consumption, dividends, market returns, the price-dividend ratio, and the risk-free rate are within the 95% interval of simulated samples. The only exception is that the consumption volatility (2.16%) is slightly higher than the 97.5 percentile of simulated samples (2.31%).

We assume that the correlation between good and bad variances is zero. As a robustness check, we calibrate the model allowing for nonzero σ_2 and the other model parameters have the same value as those used in the benchmark calibration. We assume a positive correlation in Figure 3, ranging from 0.2 to 0.8. For comparison, we also include the benchmark case of zero correlation. Our main theoretical implication of a V-shaped stock market variance-price relation holds when DT and IST variances are positively correlated. Figure 3 shows similar results for negative correlations. In addition, Tables A4 to A7 show that our model's other asset pricing implications remain qualitatively similar for both positive and negative correlations between DT and IST variances.

C. DT Shocks, IST Shocks, and Consumption Growth

Panel A of Table A8 shows that in the multiple regression, consumption growth correlates negatively with IST shocks and positively with excess stock market returns in simulated data from the benchmark calibration. Interestingly, the effect of IST shocks on consumption growth is weak in the simple regression. These theoretical results quantitatively match their empirical counterparts reported in Panel C. Excess market returns are a proxy for DT shocks when together with IST shocks in our model. Consistent with this prediction, Panel B shows that excess market returns correlate positively and significantly with both IST shocks and ΔTFP, a proxy for DT shocks. Moreover, results reported in Panel A remain qualitatively similar when we use ΔTFP as an instrumental variable for excess market returns in Panel D.

C. Data Appendix

A. Main Variables

We use quarterly data spanning the 1963Q1 to 2016Q4 period unless otherwise indicated. Daily and monthly stock return data are from the Center of Research in Security Prices (CRSP), annual accounting data are from Compustat, and analysts earnings forecast data are from I/B/E/S. We obtain the Fama-French 5 factor portfolio return data from Kenneth French at Dartmouth College, the aggregate earnings-price ratio data from Robert Shiller at Yale University, and industry classification data from Dimitris Papanikolaou at Northwestern University. We follow Boudoukh, Michaely, Richardson, and Roberts (2007) to construct the dividend-price ratio and the net (equity) payout-price ratio using CRSP dividend payments and assuming zero-reinvestment.[1]

As a robustness check, we follow Pastor, Sinha, and Swaminathan (2008) to use the implied cost of capital (ICC) as a proxy for the conditional equity premium. For robustness, we consider five commonly used ICC measures proposed by Pastor et al. (2008), Gebhardt, Lee, and Swaminathan (2001), Easton (2004), Ohlson and Juettner-Nauroth (2005), and Gordon and Gordon (1997). We also obtain the Li, Ng, and Swaminathan (2013) ICC measure from David Ng at Cornell University. I/B/E/S publishes monthly consensus forecasts on the third Thursday of each month. We impose a minimum reporting lag of three months to make sure that earnings forecasts are made based on publicly available accounting information.

Papanikolaou (2011) shows that the spread in equity returns between investment-goods pro-

[1]We employ two methods to calculate corporate dividend payments: (1) the CRSP stock market indices with and without the dividend distribution and (2) the CRSP dividend payments (CRSP item DIVAMT). The corporate net payout is the difference between dividend payments and equity issuance that we compute using the monthly change in the number of shares outstanding. We use several dividend reinvestment assumptions, including no reinvestment, the risk-free rate, and the market rate at the end of each month. Results are similar for all alternative methods. For brevity, we use CRSP dividend payments data and assume zero-reinvestment to construct the dividend-price ratio and the net payout-price ratio.

ducers and consumption-goods producers (IMC) correlates closely with the IST shock measure constructed using the relative price of new equipment. We follow Papanikolaou (2011) to measure IST shocks using the return difference between high and low IMC beta stocks. Because the equity return-based IST proxy is available at a higher (daily) frequency, we can measure IST variance more precisely using realized variance.

Kogan and Papanikolaou (2013,0) argue that stocks with higher investment-capital ratios, Tobin's Q, price-earnings ratios, market-to-book equity ratios, market betas, and idiosyncratic volatilities are more sensitive to IST shocks. The high-minus-low spreads in returns on portfolios sorted by these characteristics are also proxies for IST shocks. Kogan and Papanikolaou (2013) find strong commonality among the IST proxies. We use the average and first principle component of the eight IST proxies as two additional IST measures.

To construct the daily IMC spread, we use industry classification data to sort stocks into two portfolios, investment-goods producers and consumption-goods producers. We calculate the daily value-weighted portfolio returns, and IMC is the difference in returns between the two portfolios. To construct daily high-minus-low portfolio spreads, we first sort stocks into two portfolios using the median NYSE market cap as the breaking point. Within each size portfolio, we sort stocks equally into three portfolios by each of the aforementioned seven characteristics. If the characteristic uses accounting data that have release delays, we form the portfolios at the end of June of year $t+1$ and hold the portfolios for a year. Otherwise, we form the portfolios at the end of December of year t and hold the portfolios for a year.[2] We construct daily portfolio returns using the value weight. We then construct a high-minus-low hedging portfolio for each characteristic. For example, we construct the return differences between high and low Tobin's Q portfolios for both small and big stocks and use their simple average as a proxy for IST shocks.

We construct quarterly realized variance of each IST measure using the formula:

$$RV_t = \sum_{i=1}^{N_t} r_{i,t}^2 + 2\sum_{i=1}^{N_t} r_{i,t} r_{i+1,t}, \tag{20}$$

[2]Results are similar for monthly rebalanced portfolios or independently sorted portfolios.

where $r_{i,t}$ is the ith day excess return, N_t is the number of daily returns in quarter t, and the second term is the correction of serial correlation in daily returns. For the first principle component of the eight IST proxies, we do not include the second term because it generates negative realized variance in some quarters.

Consistent with the conjecture that euphoria variance is a systematic risk, we document a strong commonality among the ten IST-based euphoria variance measures. To highlight this point, we also use the average and first principle component of the ten standardized IST-based euphoria variance measures as additional proxies for euphoria variance.

To construct VWASV, we first calculate quarterly realized variance of individual stocks and then aggregate them using the value weight. Because options-implied variance is a better measure of conditional variance than is realized variance, we use options-implied variance to construct VWASV after 1996. Consistent with the model implication, we document a strong relation between VWASV and IST-based euphoria variance measures. The correlation of VWASV with the 12 IST-based euphoria variance measures ranges from 59% to 79% over the 1963Q1 to 2016Q4 period, with an average of 69%.

Similar to simulated data, we also use the squared market-book (MB) equity ratio and price-earnings (PE) ratio as the weights to construct two alternative average stock variance measures, MB2ASV and PE2ASV, respectively. The price-dividend ratio is not used because many high-tech stocks pay no dividends. We assume that idiosyncratic volatility is constant across stocks in simulation. Campbell, Lettau, Malkiel, and Xu (2001) and many others, however, show that small stocks have much higher idiosyncratic volatility than big stocks. To address this issue, we construct BM2ASV and PE2ASV using the 500 largest stocks. We also winsorize the MB and PE ratios at the 5 and 95 percentiles to mitigate measurement errors. The correlations of BM2ASV and PE2ASV with VWASV (the average IST-based euphoria variance) are 0.67 and 0.80 (0.72 and 0.82), respectively.

Last, we use the realized market variance as a proxy for the conditional market variance up to 1985 and use options-implied market variance obtained from CBOE afterward.

B. SPF and Tealbook Forecasts

We assume in the model that both IST and DT shocks correlate positively with expected consumption and dividend growth. We investigate these assumptions using SPF (Survey of Professional Forecasters) and Tealbook forecasts as measures of expected consumption and profits growth. We obtained both forecasts from Philadelphia Fed.[3]

Croushore and Stark (2019) provide a comprehensive overview of SPF studies and conclude that "no forecasting model has consistently outperformed the SPF (page 7)" with an important caveat. Romer and Romer (2000) find that the Tealbook forecasts outperform the SPF forecasts, while Capistrán (2008) shows that SPF contains additional information not incorporated in the Tealbook.

The Bureau of Economic Analysis (BEA) usually releases quarter q National Income and Products Accounts (NIPA) data in the first month of the following quarter $q+1$. The SPF survey questions are sent to forecasters in quarter $q+1$ immediately after the previous quarter q NIPA data become available; and the forecasters usually have only one week to submit their forecasts. We use Table 3 from Croushore and Stark (2019) (reproduced in Figure 4) to illustrate the structure of the SPF forecasts. In the example, NGDP is the nominal gross domestic product. NGDP1 is the historical NGDP of the previous quarter. NGDP2-NGDP6 are the NGDP forecasts over the following 1-5 quarters, respectively. NGDPA and NGDPB are the forecasts for the current and following year NGDP, respectively.

We construct the forecasts of the real PCE (SPF variable RCONSUM) growth rates over the next 1 to 5 quarters and two years using the first-quarter survey of each year, which provides the longest-term (2-year-ahead) PCE growth forecast, $\frac{RCONSUMB}{RCONSUM1} - 1$. Our annual sample spans the 1982 to 2016 period. We regress the SPF forecast of the PCE growth rate over the next i period on

[3]The SPF forecasts are available from https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/survey-of-professional-forecasters. The Tealbook forecasts are available from https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/greenbook.

its own lag and the concurrent IST and DT shocks:

$$\Delta PCE_{t+1}^{F,i} = a^i + b^i \Delta PCE_t^{F,i} + c^i IST_{t+1} + d^i ERET_{t+1}, \tag{21}$$

where we use the excess market return, ERET, as a proxy for the DT shock.

We use the SPF variable CPROF to construct the 2-year-ahead corporate profit growth forecast. Because the measure of CPROF is inconsistent before 2006Q1, we use the sample spanning the 2006 to 2016 period.[4] Starting from 1992, the first-quarter SPF includes the 10-year-ahead GDP and productivity growth forecasts, which are a proxy for x_t in long-run risk models.

In the first FOMC meeting every year, staff economists at the Fed provide their forecasts of PCE and GDP growth rates over the each of following seven quarters in the Tealbook. We construct the growth rates over the next seven quarters over the 1988 to 2016 period.

C. Daily and Monthly IST Factors

Accounting data are from Compustat Annual Fundamental files. Stock prices, stock returns, and shares outstanding of common stocks traded on NYSE, AMEX, and Nasdaq are from CRSP. Daily excess stock market returns and daily risk-free rates are from Ken French at Dartmouth College. We exclude Utility firms (SIC 4900-4949), financial firms (SIC 6000-6799), and firms

[4]The SPF Document indicates in page 23: "Prior to the survey of 2006Q1, it is corporate profits after tax excluding IVA and CCAdj. The historical values of this particular measure are subject to large discrete jumps when there is a change in tax law affecting depreciation provisions. The time series of projections for this series in the Survey of Professional Forecasters may or may not capture the jumps in historical values, depending on whether the forecasters anticipated the corresponding changes in tax law. Beginning with the survey of 2006:Q1, we switched to the after-tax measure that includes IVA and CCAdj." The document is available at `https://www.philadelphiafed.org/-/media/frbp/assets/surveys-and-data/survey-of-professional-forecasters/spf-documentation.pdf?la=en&hash=F2D73A2CE0C3EA90E71A363719588D25`.

that have negative or missing book values of equities. We follow Hou, Xue, and Zhang (2015) to construct book values of equities using Compustat annual data files. It equals (a) stockholders' book equities, plus (b) balance sheet deferred taxes and investment tax credit, and minus (c) book values of preferred stocks. We use the Compustat item *SEQ* as a measure of stockholders' book equities. If *SEQ* is not available, we use the sum of the book value of common equities *CEQ* and the par value of preferred stocks *PSTK*. If the sum of *CEQ* and *PSTK* is not available, we use the difference between the book value of total assets *AT* and the book value of total liabilities *LT*. Balance sheet deferred taxes and investment tax credit are measured by *TXDITC*. The book value of preferred stocks is redemption value *PSTKRV*, liquidation value *PSTKL*, or par value *PSTK* of preferred stocks, depending on the availability.

Papanikolaou (2011) argues that HML is closely related to IST shocks, and we obtain daily and monthly HML from Kenneth French at Dartmouth College. Following Papanikolaou (2011), we construct the daily investment-minus-consumption factor, IMC, as the difference in daily returns between the value-weighted portfolio of investment-goods producers and the value-weighted portfolio of consumption-goods producers. We thank Dimitris Papanikolaou at Kellogg School of Management of Northwestern University for providing the classification of investment-goods producers and consumption-goods producers used in Papanikolaou (2011).

Following Kogan and Papanikolaou (2013), we construct six additional proxies of IST shocks using portfolios formed by Tobin's Q, the investment-capital ratio (IK) the price-earnings ratio (PE), loadings on excess stock market returns (β_{MKT}), idiosyncratic volatility (IMCIV), and loadings on IMC (β_{IMC}). As in Kogan and Papanikolaou (2013), we exclude investment-goods producers from our sample. For portfolios that require accounting data, i.e., Tobin's Q, IK, and PE, we rank stocks using year t annual accounting data, and rebalance portfolios at the end of June, year $t + 1$. For portfolios that require only stock return data, i.e., β_{MKT}, IMCIV, and β_{IMC}, we rank stocks using data available at the end of year t, and rebalance portfolios at the end of year t. We construct daily and monthly IST shock proxies using double sorts. We first sort stocks into two groups using the median NYSE market capitalization as the breakpoint. Within each size portfolio, we sort stocks into three portfolios by a firm characteristic, e.g., IK, using the NYSE $30th$ and $70th$ IK percentiles as the breakpoints. We construct the daily or monthly value-weighted portfolio returns and calculate the return difference between low and high IK, for example, portfolios. The IK factor is the average of the long-short portfolio returns of small and big stocks. We construct the other factors in the same way. Table A9 provides more details of IST factors.

We also construct five-by-five portfolios using each of the aforementioned six firm characteristics. We first sort all stocks into five size portfolios using the NYSE $20th$, $40th$, $60th$, and $80th$ market capitalization percentiles as the breakpoints. Within each size portfolio, we sort stocks into five portfolios by a firm characteristic, e.g., IK, using the NYSE $20th$, $40th$, $60th$, and $80th$ IK percentiles as breakpoints. We calculate monthly both equal-weighted and value-weighted returns for each portfolio. Monthly equal-weighed and value-weighted returns on the five-by-five portfolios formed on BM are obtained from Kenneth French at Dartmouth College.

D. Implied Cost of Capital

We construct five ICC measures. Analyst consensus (mean) earnings forecast data are from the I/B/E/S unadjusted summary file. Accounting data are from Compustat. The end-of-month stock price and shares outstanding data are from CRSP. The 10-year treasury yield and GDP growth rate are from the Federal Reserve Bank of St. Louis. We use WRDS's iclink to link I/B/E/S data and CRSP data and then merge them with Compustat data using the CRSP/Compustat Merged linking table. We impose the following data requirements. First, firms must have common stocks traded on NYSE, AMEX, or NASDAQ. Second, a stock must have a valid SIC code that can be used to classify the stock into one of Fama-French 48 industries. The requirement allows us to construct the median payout ratio for each industry-size group. We use the historical SIC code from Compustat (Compustat item *SICH*). If *SICH* is unavailable, we use the SIC code from CRSP (CRSP item **SICCD**). Third, stocks must have valid CRSP price (CRSP item **PRC**) and shares outstanding (CRSP item **SHROUT**) that are used to calculate market capitalization. Fourth, we exclude observations with negative or missing I/B/E/S earnings forecast for the current fiscal year FE_{t+1}

(I/B/E/S FPI=1). Fifth, I/B/E/S publishes monthly consensus forecasts on the third Thursday of each month. To ensure that earnings forecasts are made based on publicly available accounting information, we impose a minimum reporting lag of three months. Last, because of the low coverage in I/B/E/S data files in early years, our sample begins from January 1981.

E. Pastor, Sinha, and Swaminathan (2008) Measure

Pastor et al. (2008) define ICC as:

$$\mathrm{P}_t = \sum_{k=1}^{15} \frac{\mathrm{FE}_{t+k}(1-\mathrm{b}_{t+k})}{(1+\mathrm{r}_e)^k} + \frac{\mathrm{FE}_{t+16}}{\mathrm{r}_e(1+\mathrm{r}_e)^{15}},$$

where r_e is the implied cost of capital, b_{t+k} is the expected year $t+k$ plowback rate, FE_{t+k} is the analyst forecast of the $t+k$ year earnings per share, and P_t is the current month price per share. We calculate the implied cost of capital from the finite-horizon free cash flow valuation model using a three-stage procedure.

Stage 1: Earnings growth rate

We define earnings growth rate as

$$\mathrm{g}_{t+i} = \mathrm{g}_{t+i-1} \times \exp\left[\frac{\log(\frac{\mathrm{g}}{\mathrm{g}_{LT}})}{T-1}\right], \quad \text{for i = 4 to 16.}$$

We use I/B/E/S (FPI=0) item LTG as a measure of analyst long-term growth rate forecasts, g_{LT}. If LTG is missing, we use $(\mathrm{FE}_{t+2}/\mathrm{FE}_{t+1}) - 1$ instead. If consensus forecast for year t+2 is also missing, we use $(\mathrm{FE}_{t+1}/\mathrm{FE}_{t+0}) - 1$ as an alternative measure. If the analyst long-term growth rate forecast measure has a value below 2% (above 100%), we replace it with 2% (100%). We then measure earnings growth rate between year $t+4$ and year $t+16$ by assuming that firm earnings growth rates mean-revert to the steady-state growth rate by year $t+17$. We assume that the steady-state growth rate, g, equals the long-run nominal GDP growth rate, which is the expanding rolling average of the sum of annual real GDP growth rate and implicit price deflator growth rate. Our GDP data begins in 1930. The real GDP growth rate and implicit price deflator data are from the Federal Reserve Bank of St. Louis.

Stage 2: Expected Earnings Per Share

We calculate the expected earnings per share using the formula:

$$\text{FE}_{t+i} = \text{FE}_{t+i-1} \times (1 + g_{t+k}) \text{ , for i = 4 to 16.}$$

We obtain FE_{t+2} from I/B/E/S. If it is missing, we assume that it equals $\text{FE}_{t+1} \times (1 + g_{LT})$. After obtaining FE_{t+2}, we remove firms with missing or negative FE_{t+1} and FE_{t+2}. The forecast of three-year-ahead earnings is FE_{t+3}=$\text{FE}_{t+2} \times (1 + g_{LT})$. We then use FE_{t+3} and the corresponding growth rate obtained from stage 1 to measure FE_{t+i} recursively.

Stage 3: Plowback rate

The plowback rate forecast for year $t + 1$ and $t + 2$ can be constructed using the most recent accounting data. We construct the forecast in the years after $t + 2$ recursively using the formula:

$$b_{t+k} = b_{t+k-1} - \frac{b_{t+2} - b}{14} = b_{t+k-1} - \frac{b_{t+2} - \frac{g}{r_e}}{14}, \text{ for k = 3 to 15.}$$

Plowback rate (PB_t) equals one minus net payout ratio NP_t. We measure NP_t in three ways. First, we define $\text{NP}_t = \frac{\text{D}_t + \text{REP}_t - \text{NE}_t}{\text{NI}_t}$, where D_t is the common dividend (Compustat item *DVC*), REP_t is the share repurchase (Compustat item *PRSTKC*), NE_t is the net equity issuance (Compustat item *SSTK*), and NI_t is net income (Compustat item *IB*). Second, if IB is missing or has a negative value, we use the one-year ahead consensus earnings forecast made at the end of previous calendar year, FE_{t-1}, to measure NI_t or $\text{NP}_t = \frac{\text{D}_t + \text{REP}_t - \text{NE}_t}{\text{FE}_{t-1}}$. Last, if NP_t is still unavailable or if the NP_t from the first two steps has a value above 1 or below -0.5, we use the median NP_t of the corresponding industry-size portfolio instead. To compute the median NP_t, we first sort firms into Fama-French 48 industries. Within each industry, we use firm market capitalization at the end of previous calendar year to sort firms equally into three portfolios. If the resulting NP_t from each industry-size portfolio has a value above 1 or below -0.5, we replace it with 1 or -0.5, respectively. Hence, the minimum (maximum) plowback rate is 0 (1.5). If a firm still does not have valid plowback rate after these procedures, we remove it from the sample.

We estimate the plowback rates for year $t+3$ to year $t+16$ recursively by assuming that the plowback rate mean-reverts linearly to a steady-state value at year t+17. The steady-state plowback rate is $b = g/r_e$, where the steady state growth rate g is obtained from stage 1 and r_e is the implied cost of capital that we are interested in. Therefore, the expanded free cash flow valuation model is

$$\begin{aligned} P_t &= \frac{\text{FE}_{t+1}(1-\text{PB}_t)}{(1+r_e)^1} + \frac{\text{FE}_{t+2}(1-\text{PB}_t)}{(1+r_e)^2} \\ &+ \sum_{k=3}^{15} \frac{\text{FE}_{t+k}\left(1-\left(b_{t+k-1} - \dfrac{\text{PB}_t - \frac{g}{r_e}}{14}\right)\right)}{(1+r_e)^k} + \frac{\text{FE}_{t+16}}{r_e(1+r_e)^{15}}, \end{aligned}$$

and we can solve for r_e numerically.

F. Gebhardt et al. (2001) Measure

Gebhardt et al. (2001) use the following equation to solve for ICC:

$$\text{P}_t = \text{B}_t + \sum_{k=1}^{11} \frac{(\text{FROE}_{t+k} - r_e)B_{t+k-1}}{(1+r_e)^k} + \frac{(\text{FROE}_{t+12} - r_e)B_{t+11}}{r_e(1+r_e)^{11}}.$$

P_t is the stock price from CRSP monthly files. We use shares outstanding data from I/B/E/S to calculate the book equity value per share, B_t. If the shares outstanding value from I/B/E/S is missing, we construct an interpolated value using CRSP data: $d{*}\textbf{SHROUT}_{m-1}+(1-d){*}\textbf{SHROUT}_m$, where d is the ratio of the number of days between previous month-end and current I/B/E/S statistical period to the total number of trading days in month m, and **SHROUT** is the number of monthly-end shares outstanding from CRSP. r_e is the implied cost of capital. FROE is the expected return on equity (ROE).

For years $t+1$ to $t+2$, $\text{FROE}_{t+k} = \frac{\text{FE}_{t+k}}{\text{B}_{t+k-1}}$. We obtain FE_{t+1} and FE_{t+2} from I/B/E/S. For year $t+3$, we use the analyst long-term earnings growth rate forecast (LTG) from I/B/E/S (FPI=0) to calculate $\text{FE}_{t+3} = \text{FE}_{t+2} \times (1 + \text{LTG})$. If LTG is missing, we replace it with $(\text{FE}_{t+2}/\text{FE}_{t+1}) - 1$. If consensus forecasts in year $t+2$ is also missing, we use $(\text{FE}_{t+1}/\text{FE}_{t+0}) - 1$. We require non-negative and non-missing I/B/E/S consensus earnings forecasts. After year $t+3$, we estimate FROE by assuming that it linearly mean-reverts to the industry median ROE by year $t+11$. $\text{ROE}_t = \frac{\text{E}_t}{\text{B}_t}$, where E_t is the actual EPS obtained from I/B/E/S unadjusted summary files. As in Gebhardt et al. (2001), we exclude firms with negative EPS when estimating the industry median ROE because profitable firms provide more accurate estimation over the industry's long-term equilibrium rate of return on equity than do unprofitable firms. We require a minimum of five years and a maximum of ten years rolling window to compute the industry median ROE, ROE_{int}. Hence, $\text{FROE}_{t+3+j} = \text{FROE}_{t+3} \times (1 + g_{int})^j$ where $g_{int} = (\frac{\text{ROE}_{int}}{\text{FROE}_{t+3}})^{\frac{1}{9}} - 1$.

The book equity value per share is obtained from clean surplus accounting $\text{B}_{t+j} = \text{B}_{t+j-1} + \text{FE}_{t+j} - \text{D}_{t+j}$, for j = 1 to 11. B_t is the book equity value per share measured as the ratio of most recent book equity value to the number of shares outstanding. FE_{t+k} is the year t forecast of EPS in year $t+k$. D_{t+k} is the year t forecast of dividend per shares in year $t+k$; it is the product of the most recent dividend payout ratio with FE_{t+k}. We use Compustat data to construct the dividend payout ratio as $\frac{DVC}{IB}$. For firms with negative or missing *IB*, we use $\frac{DVC}{(0.06*AT)}$ as an alternative dividend payout ratio. Note that the historical average return on assets is 0.06 in the US data. We require firms to have a valid payout ratio. For firms with a payout ratio below zero or above one, we replace it with zero or one, respectively.

Following Gebhardt et al. (2001), we impose following data requirements. First, firms must have non-missing book value of equity. The definition of book equity is the same as the one used to construct IST factors in the preceding subsection. We remove firms with a negative book value of equity. Second, firms must have non-missing net income (*IB*). For firms with negative *IB*, we replace it with $0.06 \times$ *AT* if possible. Third, firms must have non-missing dividends (*DVC*) and long-term debt (*DLTT*). Last, we exclude firms with missing or negative earnings forecasts for the following fiscal year (I/B/E/S FPI=2).

G. Easton (2004) Measure

Easton (2004) uses the following equation to estimate the implied cost of capital:

$$\mathrm{P}_t = \frac{\mathrm{FE}_{t+2} + r_e \times \mathrm{D}_{t+1} - \mathrm{FE}_{t+1}}{r_e^2}.$$

P_t is the stock price. r_e is the implied cost of capital. FE_{t+1} and FE_{t+2} are consensus analyst earnings forecasts for the current and next fiscal years. D_{t+1} is the expected dividend per share, and is calculated as the product of FE_{t+1} with the most recent payout ratio. The definition and criteria of the payout ratio is the same as that used in Gebhardt et al. (2001). We require firms with non-missing book value of equity, net income (*IB*), and dividends (*DVC*). Firms with a negative book value of equity are excluded. We also exclude firms with missing or negative earnings forecasts for the next fiscal year (I/B/E/S FPI=2).

H. Ohlson and Juettner-Nauroth (2005) Measure

Ohlson and Juettner-Nauroth (2005) construct the implied cost of capital using the following equation:

$$r_e = A + \sqrt{A^2 + \frac{\mathrm{FE}_{t+1}}{\mathrm{P}_t} \times (g - (\gamma - 1))}.$$

r_e is the implied cost of capital. $A = 0.5\Big[(\gamma - 1) + \frac{\mathrm{D}_{t+1}}{\mathrm{P}_t}\Big]$. D_{t+1} is the expected dividend per share, and is calculated as the product of FE_{t+1} with the most recent payout ratio. FE_{t+1} and FE_{t+2} are consensus analyst earnings forecasts for the current and next fiscal years. P_t is the stock price. $\gamma - 1$ is set to 10-year Treasury yield minus 3%. $g = 0.5\Big[\Big(\frac{\mathrm{FE}_{t+2} - \mathrm{FE}_{t+1}}{\mathrm{FE}_{t+1}}\Big) + \mathrm{LTG}_t\Big]$. As in Gode and Mohanram (2003), we use the average of near-term and long-term growth rates to estimate g. The definition and criteria of the payout ratio is the same as that used in Gebhardt et al. (2001). We require firms with non-missing book value of equity, net income (*IB*), and dividends (*DVC*). Firms with negative book value of equity are excluded. We also exclude firms with missing or negative earnings forecasts for the next fiscal year (I/B/E/S FPI=2).

I. Gordon and Gordon (1997) Measure

The Gordon and Gordon (1997) measure is a special case of the finite-horizon Gordon growth model. They use the following equation to calculate the implied cost of capital:

$$\mathrm{P}_t = \frac{\mathrm{FE}_{t+1}}{r_e}.$$

r_e is the implied cost of capital. FE_{t+1} is consensus analysts earnings forecasts for the current fiscal year. Firms with missing or negative earnings forecasts for the next fiscal year (I/B/E/S FPI=2) are excluded.

D. Supplemental Empirical Results

A. IST Shocks, Consumption, and Cash Flows

In Table A11, we report the OLS estimation results of regressing the change in long-run analyst earnings growth forecast on its own lag (DV_LAG), IST shocks (IST), lagged IST shocks (IST_LAG), excess stock market returns (ERET), and lagged excess stock market returns (ERET_LAG). We construct long-run analyst earnings growth forecast using I/B/E/S long-term earnings growth forecast data and include only firms with the December fiscal year end.

We construct daily stock return difference between investment-goods producers and consumption-goods producers, IMC, and then form portfolios on IMC betas. We use the return difference between high IMC-beta stocks and low IMC-beta stocks as a proxy for IST shocks. The annual sample spans the 1983 to 2015 period. In parentheses we report t-statistics constructed using Newey-West standard errors with two lags. We find that both IST and IST_LAG correlate positively and significantly with the change in long-run analyst earnings growth forecast even when controlling for ERET and ERET_LAG.

B. Summary Statistics

Table A12 provides summary statistics of main variables used in the empirical analysis. Panel A reports log price ratios. PD is the price-dividend ratio. PPO is the price-payout ratio. PE is the price-earnings ratio. Panel B reports the implied cost of capital measures. PSS, GLS, Easton, OJ, GG are ICC measures proposed by Pastor et al. (2008), Gebhardt et al. (2001), Easton (2004), Ohlson and Juettner-Nauroth (2005), and Gordon and Gordon (1997), respectively. AICC is the average of these five ICC measures. LNS is the ICC measure used in Li et al. (2013). Panel C reports empirical measures of euphoria variance and stock market variance. We have eight proxies for IST shocks. VIMC is quarterly realized variance of IMC. VIK, VTobinQ, VPE, VIMCIV, Vβ_{IMC}, VIMC, Vβ_{MKT}, and VHML are quarterly realized variances of hedging portfolios formed by characteristics IK, Tobin's Q, PE ratio, IMC idiosyncratic volatilities, IMC beta, Market Beta, and book-to-market equity ratio, respectively. We also calculate first principle component and the average of the eight IST measures, and VFPC and VAVE are their realized variances, respectively. FPCV and AVEV are the first principle component and the average of these (standardized) IST-based euphoria variance measures. VWASV is the value-weighted average stock variance. EWASV is the equity-weighted average stock variance. TYVIX is the options-implied bond variance. VMKT is stock market variance. Panel D reports asset returns. IK, TobinQ, PE, IMCIV, β_{IMC}, β_{MKT}, and HML are quarterly returns on hedging portfolios formed by characteristics IK, Tobin's Q, PE ratio, IMC idiosyncratic volatilities, IMC beta, Market Beta, and book-to-market equity ratio, respectively. AVE is the average of returns on the seven hedging portfolio returns. CMA, RMW, and SMB are the conservative-minus-aggressive, robust-minus-weak, and small-minus-big factors, respectively. ERET is the excess stock market return, and RF is the real risk-free rate.

C. Forecasting Excess Stock Market Returns Using Variances

Panel A of Table A13 reports the univariate regression results of forecasting one-quarter-ahead excess stock market returns with stock market variance and various measures of euphoria variance. Over the 1963Q1 to 2016Q4 period, stock market variance, VMKT, correlates positively and significantly with future excess stock market returns at the 5% level. By contrast, the correlation is negative for the IST-based euphoria variance measures except for Vβ_{MKT}, although it is statistically insignificant in most cases. The correlation is negative albeit statistically insignificant for the value-weighted average stock variance (VWASV) and bond variance (TYVIX).

In Panel B of Table A13, we include both stock market variance and a euphoria variance measure as forecasting variables. Consistent with our model's prediction, we find that the two variances have much stronger forecasting power for excess stock market returns in bivariate regressions than in univariate regressions. The coefficient on VMKT is always significantly positive, and the coefficient on euphoria variance is always significantly negative. More importantly, the coefficients and t-values are substantially larger in magnitude than their univariate counterparts reported in Panel A for both stock market variance and euphoria variance. In addition, the R^2 is much higher in bivariate regressions than in corresponding univariate regressions. The difference reflects the omitted variables problem. The coefficient of correlation between VMKT and euphoria variance measures is positive, ranging between 30% to 70%, while VMKT and euphoria variance have opposite effects on conditional equity premium. If we omit euphoria variance (VMKT) in the forecast regression, the coefficient on VMKT (euphoria variance) is downward (upward) biased toward zero.[5]

For comparison, we include the equal-weighted average stock variance, EWASV, as a predictor in Table A13. Its predictive power for excess stock market returns is much weaker than that of

[5]The multicollinearity problem cannot explain our findings because it inflates standard errors and does not increases R^2. As a further robustness check, we orthogonalize market variance by euphoria variance and vice versa, and find that the orthogonalized market variance or euphoria variance has significant predictive power for excess market returns (untabulated).

VWASV. Specifically, the effect of EWASV on the conditional equity premium is statistically insignificant at the 10% level in both univariate and bivariate regressions. By contrast, VWASV is statistically significant at the 1% level in the bivariate regression. These results are consistent with the model's prediction that VWASV has closer correlation with euphoria variance than does EWASV.

As a robustness check, we also investigate the out-of-sample predictive power of stock market variance and euphoria variance in Panel C of Table A13. For TYVIX, we use the 2003Q1 to 2009Q4 period for the initial in-sample estimation and make the out-of-sample forecast for the 2010Q1 to 2016Q4 period using an expanding sample. For the other euphoria variance measures, we use the 1963Q1 to 1989Q4 period for initial in-sample estimation and make the out-of-sample forecast for the 1990Q1 to 2016Q4 period using an expanding sample. We use two standard measures to gauge the out-of-sample performance. MSER is the mean squared forecasting errors ratio of the forecasting model to a benchmark model in which conditional equity premium equals average equity premium in historical data. ENC_NEW is the encompassing test proposed by Clark and McCracken (2001). 8 out of 12 IST-based euphoria variance measures have smaller mean squared forecasting errors than does the benchmark model. The encompassing test shows that the out-of-sample predictive power is statistically significant at the 5% level for all IST-based euphoria variance measures. Results are similar for VWASV and TYVIX.

As expected, VWASV has market return predictive power similar to that of IST-based euphoria variance measures. For example, it drives out IST-based euphoria variance measures except for VHML in the multivariate regressions of forecasting excess stock market returns. In addition, the predictive power of TYVIX is similar to that of VWASV: TYVIX becomes statistically insignificant when we control for VWASV in the forecasting regression. These results are not reported here but are available upon request. Because IST-based euphoria variance measures have similar predictive for excess stock market returns, for brevity, in the remainder of the appendix we use their first principle component, FPCV, and their average, AVEV as IST-based proxies for euphoria variance. Because TYVIX is available only for a short sample period, we use VWASV as the alternative euphoria variance measure in the remainder of the appendix.

D. Forecasting Excess Stock Market Returns Using ICC and Scaled Stock Market Prices

If ICC is a measure of the conditional equity premium, it may forecast excess stock market returns. Consistent with this conjecture, Li et al. (2013) show that their ICC measure does have significant predictive power for excess stock market returns. We replicate their main finding in Panel A of Table A14 that LNS correlates positively and significantly with the one-quarter-ahead excess stock market return at the 5% level. The other ICC measures also correlate positively with future excess stock market returns; however, the relation is statistically insignificant at the 5% level.

To investigate whether the forecasting power of ICC for excess stock market returns reflects its correlation with stock market variance and euphoria variance, we decompose ICC into two components by regressing it on stock market variance and euphoria variance. We use FPCV as the euphoria variance measure in Panel A of Table A14. The fitted component of ICC measures correlates positively and significantly with future stock market returns, while the residual component has negligible predictive power. Results are similar when we use AVEV and VWASV as euphoria variance measures in Panels B and C, respectively.

In our model, the price-dividend ratio correlates with stock market variance and euphoria variance because these variances are the determinants of conditional equity premium. To investigate this implication, we decompose the scaled stock market price into two components by regressing it on stock market variance and euphoria variance. In Panel A of Table A14, we use FPCV as the proxy for euphoria variance. For all three stock market price measures, the fitted component correlates negatively and significantly with one-quarter-ahead excess stock market returns at the 1% level, while the predictive power is negligible for the residual component. Panels B and C show that results are similar when we use AVEV and VWASV, respectively, as proxies for euphoria variance.

E. Forecasting Anomalies

In our model, stocks that are more sensitive to IST shocks have more negative loadings on euphoria variance and thus lower expected returns. Similarly, stocks that are more sensitive to DT shocks have more positive loadings on fear variance and thus higher expected returns. To investigate this implication, we form portfolios on the investment-capital ratio, Tobin's Q, the price-earnings ratio, idiosyncratic volatility, IMC beta, and market beta. We construct hedging portfolios that have a long (short) position in stocks that are least (most) sensitive to IST shocks. For example, we buy stocks with a low investment-capital ratio, sell stocks with a high investment-capital ratio, and take the return spread as the return on the zero-cost hedging portfolio formed by the investment-capital ratio. Because extant studies, e.g., Kogan and Papanikolaou (2013,0), have shown that these hedging portfolios have significant loadings on IST shocks, we expect that these long-short portfolios have positive loadings on euphoria variance.

In addition, Kogan and Papanikolaou (2013,0) argue that the strong comovement among portfolios formed on the investment-capital ratio, Tobin's Q, the price-earnings ratio, idiosyncratic volatility, IMC beta, market beta, and the book-to-market equity ratio reflects their strong sensitivity to IST shocks. To investigate this conjecture, we calculate the average of returns on the long-short portfolios formed on these characteristics, AVE, as a measure of the commonality.

We also consider the four hedging risk factors in the Fama and French (2015) five-factor model, HML, CMA, RMW, and SMB. HML longs (shorts) stocks with high (low) book-to-market equity ratios; CMA longs (shorts) stocks with low (high) total asset growth; RMW longs (shorts) stocks with high (low) profitability; and SMB longs (shorts) stocks with small (big) market capitalization.

In Table A15, we report the OLS regression results of forecasting long-short portfolio returns using stock market variance and euphoria variance. We use FPCV as a proxy for euphoria variance in Panel A. As expected, the coefficient on euphoria variance is positive in all cases; and it is statistically significant at least at the 10% in most cases. The coefficient on stock market variance is negative in all cases except for SMB, and is statistically significant at least at the 10% level except for CMA and SMB. Again, we find similar results using AVEV and VWASV as proxies for euphoria variance in Panels B and C, respectively. To summarize, stocks with different sensitivity to DT and IST shocks have different loadings on stock market variance and euphoria variance, and these differences in their loadings are related to their different expected excess returns.

F. Cross-Section of Expected Stock Returns

In Panel A of Table A16, we report the Fama and MacBeth (1973) regression results for the 32 triple-sorted portfolios formed on market capitalization, operation profit, and total asset growth. The risk price is significantly positive at the 1% level for loadings on euphoria variance and at the 10% level for loadings on stock market variance. Panel D reports that results are qualitatively similar for the 32 triple-sorted portfolios formed on market capitalization, book-to-market equity ratios, and total asset growth.

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FIGURE 1

Justiniano et al. (2010) Impulse Responses

Solid line is the impulse responses of consumption to IST shocks estimated by Justiniano et al. (2010). Dashed line is the model impulse responses. For comparison, scaled the model impulse responses that the impact effect is the same as that of the estimated impulse responses.

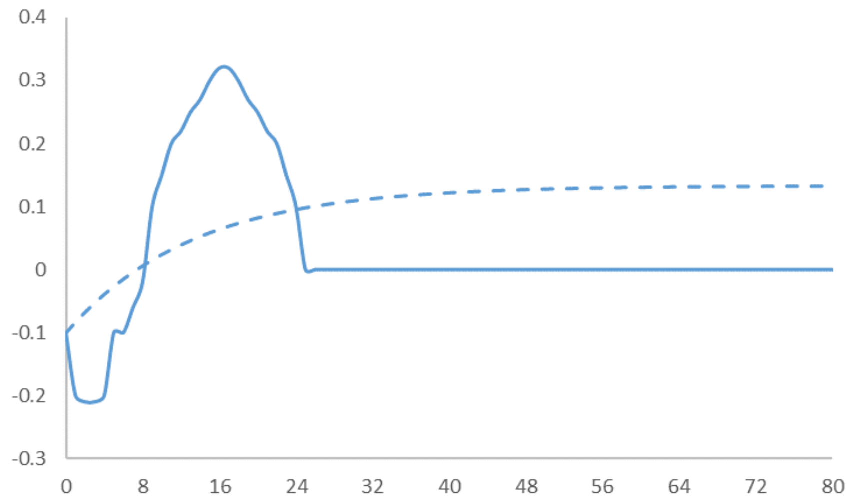
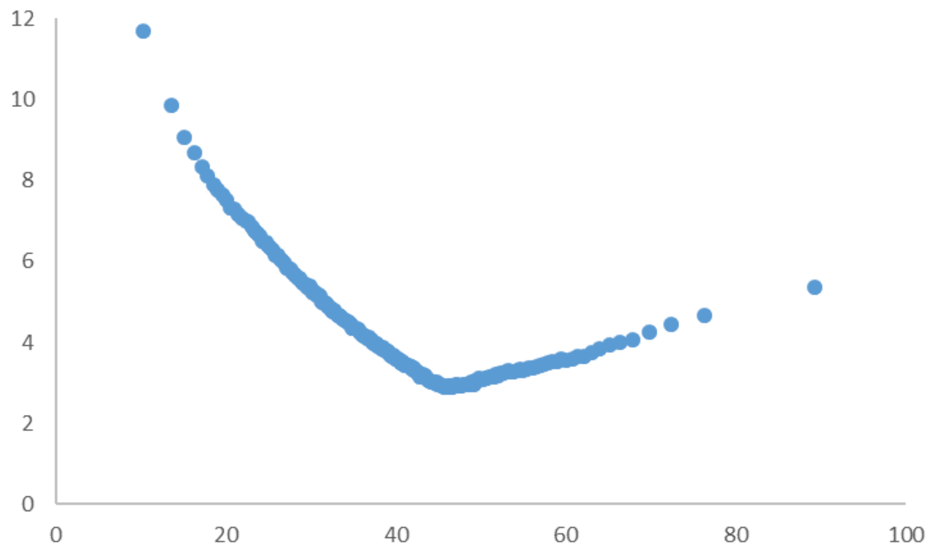


FIGURE 2

Market Variance and Equity Premium

The figure plots the relation between the price-dividend ratio (horizontal axis) and the conditional market variance or the conditional equity premium (in percentage, vertical axis) in simulated data

(a) Conditional Market Variance



(b) Conditional Equity Premium

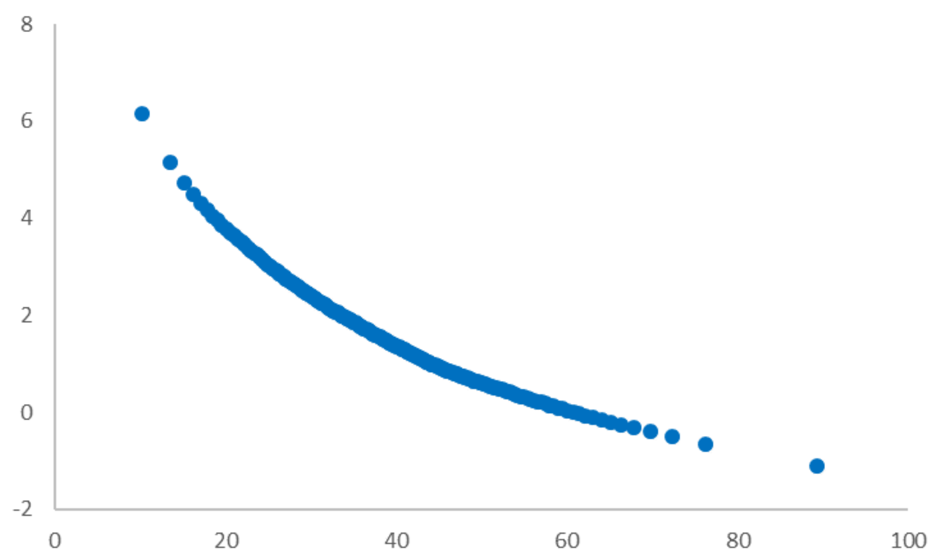
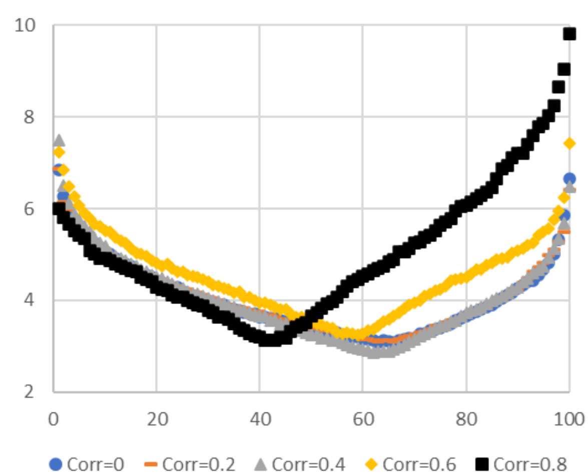


FIGURE 3

Stock Market Variance-Price Relation in Our Model for Nonzero correlation

This figure shows stock Market Variance-Price Relation in Our Model for Nonzero correlation between DT and IST Variances. The vertical axis denotes stock market variance in percentage point. The horizon axis denotes the range of the price dividend ratio from lowest (1) to highest(100).

(a) Positive Correlation



(b) Negative Correlation

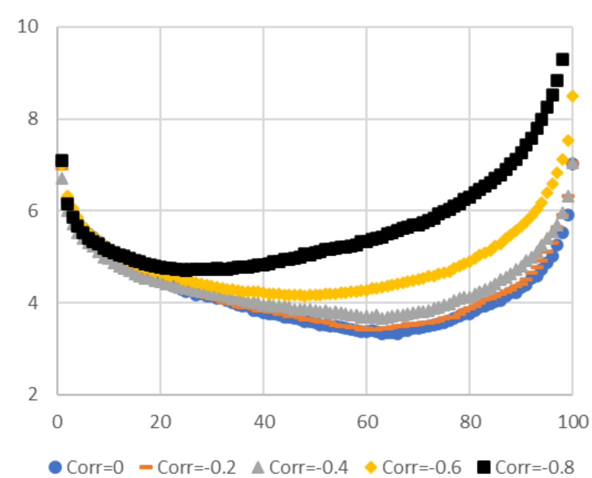


FIGURE 4

SPF Variable Description

Table 3. Example: Forecast Horizons for Nominal GDP at Three Survey Dates

Survey Date (Year, Quarter)		Quarterly Historical Value	Quarterly Projections: Quarter Forecast					Annual-Average Projections: Year Forecast	
(1) Year	(2) Quarter	(3) NGDP1	(4) NGDP2	(5) NGDP3	(6) NGDP4	(7) NGDP5	(8) NGDP6	(9) NGDPA	(10) NGDPB
2005	3	2005:Q2	2005:Q3	2005:Q4	2006:Q1	2006:Q2	2006:Q3	2005	2006
2005	4	2005:Q3	2005:Q4	2006:Q1	2006:Q2	2006:Q3	2006:Q4	2005	2006
2006	1	2005:Q4	2006:Q1	2006:Q2	2006:Q3	2006:Q4	2007:Q1	2006	2007

Table notes. The table shows how we organize the survey's median (or mean) responses for three survey dates: 2005:Q3, 2005:Q4, and 2006:Q1. The entries in columns (1)–(2) show the year and quarter when we conducted the survey. The entry in column (3) shows the observation date for the last known historical quarter at the time we sent the questionnaire to the panelists. The entries in columns (4)–(8) show the quarterly observation dates forecast. The entries in columns (9)–(10) show the annual observation dates forecast: Notice how the annual-average forecast horizons are fixed within a calendar year and change in each first-quarter survey. Moody's now views the historical values for the Aaa and Baa corporate bond yields (BOND and BAABOND) as proprietary. Accordingly, the Philadelphia Fed is not permitted to release these historical values to the public.

TABLE A1

Forecasting Excess Stock Market Returns over Long Horizons

The table reports the OLS estimation results of regressing long-horizon excess stock market returns on quarterly predictor variables for simulated data. We use overlapping quarterly returns. Parentheses report the Newey-West t-value; the number of lags equals to the number of quarters in the forecast horizon. We generate 10,000 simulated samples and report their distributions. The column "Pop" reports the results obtained from 100,000 simulated quarterly observations. PD is the price-dividend ratio. VMKT is stock market variance. VE is euphoria variance. R^2 is reported in percentage.

	1 year			3 years			5 years		
	Median	70%	Pop	Median	70%	Pop	Median	70%	Pop
Panel A: Price-Dividend Ratio									
PD	-0.059	-0.086	-0.040	-0.175	-0.248	-0.118	-0.279	-0.399	-0.913
	(-1.341)	(-1.866)	(-71.916)	(-1.504)	(-2.133)	(-73.884)	(-1.621)	(-2.325)	(-73.430)
R^2	0.851	1.580	0.665	2.425	4.558	1.916	3.888	7.252	3.062
Panel B: Stock Market Variance									
VMKT	0.559	1.127	0.313	1.614	3.271	0.908	2.629	5.328	1.467
	(0.606)	(1.183)	(26.898)	(0.663)	(1.311)	(27.130)	(0.704)	(1.408)	(26.490)
R^2	0.318	0.752	0.001	0.931	2.156	0.252	1.527	3.540	0.395
Panel C: Euphoria Variance									
VE	-9.608	-20.397	-6.296	-28.079	-59.647	-18.634	-46.064	-99.256	-30.659
	(-0.521)	(-1.086)	(-30.496)	(-0.587)	(-1.229)	(-31.505)	(-0.630)	(-1.316)	(-31.389)
R^2	0.290	0.669	0.117	0.846	1.967	0.342	1.425	3.195	0.557
Panel D: Stock Market Variance and Euphoria Variance									
VMKT	1.713	2.510	1.149	4.920	7.257	3.363	7.953	11.698	5.480
	(1.267)	(1.846)	(69.637)	(1.426)	(2.106)	(71.791)	(1.536)	(2.286)	(71.636)
VE	-31.188	-48.903	-20.700	-94.147	-140.834	-60.804	-150.880	-227.018	-99.364
	(-1.205)	(-1.767)	(-70.337)	(-1.367)	(-2.025)	(-72.397)	(-1.468)	(-2.209)	(-71.980)
R^2	1.383	2.255	0.714	3.987	6.410	2.052	6.379	10.093	3.281

TABLE A2

Alternative Configuration of Model Parameters

The table reports the parameter values used in the model. We calibrate the IST shock using the impulse responses estimated by Justiniano et al. (2010).

Preferences	δ	γ	ψ			
	0.9997	2.5	0.7			
Consumption	μ_c	ρ	φ_η	φ_e	ψ_x	σ_g
	0.0015	0.975	0.1	0.0022	0.0389	0.002
	σ_x	v_g	v_x	σ_1	σ_2	σ_3
	0.002	0.999	0.9995	0.000003	0	0.000004
Dividends	μ_d	ϕ	π_e	π_η		
	0.0015	2.2	3	3.5		

TABLE A3

Consumption, Dividend, and Asset Returns

The table reports summary statistics of the consumption growth rate, Δc; the dividend growth rate, Δd; the stock market return, R; the log price-dividend ratio, $p - d$; and the risk-free rate, R^f. E is the mean; σ is the standard deviation; ACi is the ith-order autocorrelation coefficient; $VR6$ is the variance ratio of six-year growth rate to six times one-year growth rate; and $Corr$ is the correlation coefficient. The column under the name "Data" reproduces annual estimates from the 1930 to 2008 period reported in Bansal, Kiku, and Yaron (2012) and Beeler and Campbell (2012). The column under the name "Model" reports the distribution of annual estimates from 10,000 simulated samples of 79 years each. "Pop" reports annual estimates from a long simulated sample of 100,000 years. We use the parameter values reported in Table A2 to generate simulated data.

	Data	Model					
Moment	Estimate	Median	2.5%	5%	95%	97.5%	Pop
$E[\Delta c]$	1.93	1.82	-0.91	-0.42	4.03	4.62	1.78
$\sigma(\Delta c)$	2.16	4.28	2.31	2.51	7.20	7.93	4.97
$AC1(\Delta c)$	0.45	0.72	0.53	0.56	0.84	0.85	0.76
$E[\Delta d]$	1.15	1.80	-5.35	-4.03	7.55	8.98	1.76
$\sigma(\Delta d)$	11.05	13.99	8.57	9.23	20.87	22.63	15.69
$AC1(\Delta d)$	0.21	0.51	0.24	0.29	0.70	0.73	0.55
$Corr(\Delta c, \Delta d)$	0.55	0.83	0.49	0.56	0.95	0.96	0.82
$E[R]$	7.66	7.16	0.37	1.39	14.69	16.82	7.53
$\sigma(R)$	20.28	22.77	14.82	15.79	34.86	37.80	25.26
$AC1(R)$	0.02	0.11	-0.14	-0.10	0.34	0.38	0.15
$Corr(R, e)$	0.44	0.42	0.10	0.14	0.69	0.73	0.42
$E[p - d]$	3.36	3.65	3.07	3.19	3.94	4.00	3.64
$\sigma(p - d)$	0.45	0.20	0.11	0.12	0.34	0.38	0.34
$AC1(p - d)$	0.87	0.86	0.66	0.70	0.94	0.95	0.96
$E[R^f]$	0.57	3.33	0.15	0.73	5.96	6.63	3.30
$\sigma(R^f)$	2.86	4.77	2.55	2.79	8.11	8.97	5.59
$AC1(R^f)$	0.65	0.79	0.63	0.66	0.88	0.89	0.82

TABLE A4

Consumption, Dividend, and Asset Returns: $Corr(\sigma_g^2, \sigma_x^2) = 0.8$

The table reports summary statistics of the consumption growth rate, Δc; the dividend growth rate, Δd; the stock market return, R; the log price-dividend ratio, $p - d$; and the risk-free rate, R^f. E is the mean; σ is the standard deviation; $AC1$ to $AC5$ are the first to fifth-order autocorrelation coefficients; and $Corr$ is the correlation coefficient. The column under the name "Data Estimate" reproduces annual estimates from the 1930 to 2008 period reported in Bansal et al. (2012) and Beeler and Campbell (2012). $Corr(R, e)$ is the correlation between the market return and IST shocks estimated using the sample spanning the 1964 to 2016 period. The column under the name "Model" reports the distribution of annual estimates from 10,000 simulated samples of 79 years each. "Pop" reports annual estimates from a long simulated sample of 100,000 years.

	Data	Model					
Moment	Estimate	Median	2.5%	5%	95%	97.5%	Pop
$E[\Delta c]$	1.93	1.81	0.09	0.41	3.20	3.58	1.79
$\sigma(\Delta c)$	2.16	3.06	1.65	1.80	4.97	5.41	3.49
$AC1(\Delta c)$	0.45	0.59	0.36	0.39	0.74	0.76	0.63
$AC2(\Delta c)$	0.16	0.34	0.01	0.06	0.57	0.61	0.40
$AC3(\Delta c)$	-0.10	0.22	-0.11	-0.05	0.48	0.52	0.29
$AC4(\Delta c)$	-0.24	0.14	-0.19	-0.13	0.42	0.46	0.21
$AC5(\Delta c)$	-0.02	0.08	-0.23	-0.19	0.36	0.41	0.16
$E[\Delta d]$	1.15	1.79	-4.23	-2.95	6.66	7.76	1.75
$\sigma(\Delta d)$	11.05	14.93	8.08	8.79	23.83	25.63	17.23
$AC1(\Delta d)$	0.21	0.33	0.09	0.13	0.53	0.56	0.35
$Corr(\Delta c, \Delta d)$	0.55	0.51	0.20	0.26	0.71	0.74	0.48
$E[R]$	7.66	5.46	-0.10	0.70	12.59	14.38	5.94
$\sigma(R)$	20.28	24.06	14.42	15.40	38.85	42.46	27.75
$AC1(R)$	0.02	0.02	-0.22	-0.18	0.22	0.26	0.04
$Corr(R, e)$	0.44	0.65	0.41	0.45	0.79	0.81	0.65
$E[p - d]$	3.36	4.63	4.05	4.17	5.23	5.39	4.76
$\sigma(p - d)$	0.45	0.23	0.12	0.13	0.41	0.46	0.49
$AC1(p - d)$	0.87	0.87	0.68	0.71	0.95	0.96	0.98
$E[R^f]$	0.57	1.49	-0.05	0.24	2.35	2.51	1.39
$\sigma(R^f)$	2.86	1.70	0.90	0.98	2.85	3.11	2.02
$AC1(R^f)$	0.65	0.80	0.64	0.67	0.88	0.89	0.83

TABLE A5

Consumption, Dividend, and Asset Returns: $Corr(\sigma_g^2, \sigma_x^2) = -0.8$

The table reports summary statistics of the consumption growth rate, Δc; the dividend growth rate, Δd; the stock market return, R; the log price-dividend ratio, $p - d$; and the risk-free rate, R^f. E is the mean; σ is the standard deviation; $AC1$ to $AC5$ are the first to fifth-order autocorrelation coefficients; and $Corr$ is the correlation coefficient. The column under the name "Data Estimate" reproduces annual estimates from the 1930 to 2008 period reported in Bansal et al. (2012) and Beeler and Campbell (2012). $Corr(R, e)$ is the correlation between the market return and IST shocks estimated using the sample spanning the 1964 to 2016 period. The column under the name "Model" reports the distribution of annual estimates from 10,000 simulated samples of 79 years each. "Pop" reports annual estimates from a long simulated sample of 100,000 years.

	Data	Model					
Moment	Estimate	Median	2.5%	5%	95%	97.5%	Pop
$E[\Delta c]$	1.93	1.81	0.10	0.41	3.20	3.58	1.79
$\sigma(\Delta c)$	2.16	3.06	1.66	1.80	4.97	5.40	3.49
$AC1(\Delta c)$	0.45	0.59	0.35	0.39	0.74	0.76	0.63
$AC2(\Delta c)$	0.16	0.34	0.01	0.06	0.57	0.61	0.40
$AC3(\Delta c)$	-0.10	0.22	-0.11	-0.05	0.48	0.52	0.29
$AC4(\Delta c)$	-0.24	0.14	-0.19	-0.13	0.41	0.46	0.21
$AC5(\Delta c)$	-0.02	0.08	-0.24	-0.19	0.36	0.41	0.16
$E[\Delta d]$	1.15	1.84	-3.99	-3.07	6.60	7.66	1.81
$\sigma(\Delta d)$	11.05	15.17	10.41	11.07	21.61	23.21	17.12
$AC1(\Delta d)$	0.21	0.34	0.09	0.13	0.56	0.60	0.35
$Corr(\Delta c, \Delta d)$	0.55	0.61	0.20	0.26	0.86	0.89	0.59
$E[R]$	7.66	8.11	1.92	2.88	14.12	15.50	8.35
$\sigma(R)$	20.28	27.36	20.29	21.27	35.71	37.69	29.22
$AC1(R)$	0.02	0.02	-0.21	-0.18	0.21	0.25	0.03
$Corr(R, e)$	0.44	0.61	0.22	0.28	0.84	0.86	0.62
$E[p - d]$	3.36	3.56	2.77	2.90	4.27	4.41	3.62
$\sigma(p - d)$	0.45	0.31	0.18	0.19	0.53	0.59	0.57
$AC1(p - d)$	0.87	0.88	0.70	0.74	0.95	0.96	0.97
$E[R^f]$	0.57	1.49	-0.06	0.24	2.34	2.51	1.39
$\sigma(R^f)$	2.86	1.70	0.90	0.98	2.84	3.11	2.02
$AC1(R^f)$	0.65	0.80	0.64	0.67	0.88	0.89	0.83

TABLE A6

Consumption, Dividend, and Asset Returns: $Corr(\sigma_g^2, \sigma_x^2) = 0.6$

The table reports summary statistics of the consumption growth rate, Δc; the dividend growth rate, Δd; the stock market return, R; the log price-dividend ratio, $p - d$; and the risk-free rate, R^f. E is the mean; σ is the standard deviation; $AC1$ to $AC5$ are the first to fifth-order autocorrelation coefficients; and $Corr$ is the correlation coefficient. The column under the name "Data Estimate" reproduces annual estimates from the 1930 to 2008 period reported in Bansal et al. (2012) and Beeler and Campbell (2012). $Corr(R, e)$ is the correlation between the market return and IST shocks estimated using the sample spanning the 1964 to 2016 period. The column under the name "Model" reports the distribution of annual estimates from 10,000 simulated samples of 79 years each. "Pop" reports annual estimates from a long simulated sample of 100,000 years.

	Data	Model					
Moment	Estimate	Median	2.5%	5%	95%	97.5%	Pop
$E[\Delta c]$	1.93	1.81	0.10	0.41	3.20	3.58	1.79
$\sigma(\Delta c)$	2.16	3.06	1.65	1.80	4.97	5.41	3.49
$AC1(\Delta c)$	0.45	0.59	0.35	0.39	0.74	0.76	0.63
$AC2(\Delta c)$	0.16	0.34	0.01	0.06	0.57	0.61	0.40
$AC3(\Delta c)$	-0.10	0.22	-0.11	-0.05	0.48	0.52	0.29
$AC4(\Delta c)$	-0.24	0.14	-0.18	-0.13	0.42	0.47	0.21
$AC5(\Delta c)$	-0.02	0.08	-0.24	-0.19	0.36	0.41	0.16
$E[\Delta d]$	1.15	1.80	-3.88	-2.73	6.36	7.34	1.76
$\sigma(\Delta d)$	11.05	13.53	7.61	8.33	21.20	22.86	15.68
$AC1(\Delta d)$	0.21	0.35	0.11	0.14	0.55	0.59	0.37
$Corr(\Delta c, \Delta d)$	0.55	0.57	0.23	0.29	0.78	0.81	0.54
$E[R]$	7.66	6.27	0.99	1.78	12.69	14.28	6.68
$\sigma(R)$	20.28	22.75	14.05	14.97	35.31	38.26	25.75
$AC1(R)$	0.02	0.02	-0.21	-0.18	0.22	0.26	0.04
$Corr(R, e)$	0.44	0.61	0.32	0.37	0.79	0.81	0.61
$E[p - d]$	3.36	3.97	3.34	3.46	4.39	4.49	4.01
$\sigma(p - d)$	0.45	0.22	0.12	0.13	0.38	0.42	0.41
$AC1(p - d)$	0.87	0.87	0.68	0.72	0.94	0.95	0.97
$E[R^f]$	0.57	1.49	-0.06	0.24	2.34	2.51	1.39
$\sigma(R^f)$	2.86	1.70	0.90	0.98	2.84	3.11	2.02
$AC1(R^f)$	0.65	0.80	0.64	0.67	0.88	0.89	0.83

TABLE A7

Consumption, Dividend, and Asset Returns: $Corr(\sigma_g^2, \sigma_x^2) = -0.6$

The table reports summary statistics of the consumption growth rate, Δc; the dividend growth rate, Δd; the stock market return, R; the log price-dividend ratio, $p - d$; and the risk-free rate, R^f. E is the mean; σ is the standard deviation; $AC1$ to $AC5$ are the first to fifth-order autocorrelation coefficients; and $Corr$ is the correlation coefficient. The column under the name "Data Estimate" reproduces annual estimates from the 1930 to 2008 period reported in Bansal et al. (2012) and Beeler and Campbell (2012). $Corr(R, e)$ is the correlation between the market return and IST shocks estimated using the sample spanning the 1964 to 2016 period. The column under the name "Model" reports the distribution of annual estimates from 10,000 simulated samples of 79 years each. "Pop" reports annual estimates from a long simulated sample of 100,000 years.

	Data	Model					
Moment	Estimate	Median	2.5%	5%	95%	97.5%	Pop
$E[\Delta c]$	1.93	1.81	0.10	0.41	3.20	3.58	1.79
$\sigma(\Delta c)$	2.16	3.06	1.66	1.80	4.97	5.40	3.49
$AC1(\Delta c)$	0.45	0.59	0.35	0.39	0.74	0.76	0.63
$AC2(\Delta c)$	0.16	0.34	0.01	0.07	0.57	0.61	0.40
$AC3(\Delta c)$	-0.10	0.22	-0.11	-0.05	0.48	0.52	0.29
$AC4(\Delta c)$	-0.24	0.14	-0.19	-0.13	0.42	0.46	0.21
$AC5(\Delta c)$	-0.02	0.08	-0.24	-0.19	0.36	0.41	0.16
$E[\Delta d]$	1.15	1.84	-3.67	-2.78	6.35	7.31	1.80
$\sigma(\Delta d)$	11.05	13.95	9.26	9.88	19.51	20.71	15.57
$AC1(\Delta d)$	0.21	0.36	0.11	0.15	0.58	0.61	0.37
$Corr(\Delta c, \Delta d)$	0.55	0.57	0.11	0.17	0.87	0.90	0.55
$E[R]$	7.66	7.68	1.92	2.81	13.50	14.88	7.94
$\sigma(R)$	20.28	25.08	18.12	19.13	32.98	34.85	26.81
$AC1(R)$	0.02	0.01	-0.21	-0.17	0.21	0.25	0.04
$Corr(R, e)$	0.44	0.57	0.20	0.25	0.82	0.85	0.57
1 $E[p - d]$	3.36	3.57	2.80	2.93	4.15	4.27	3.59
$\sigma(p - d)$	0.45	0.28	0.16	0.17	0.48	0.53	0.52
$AC1(p - d)$	0.87	0.88	0.70	0.74	0.95	0.96	0.97
$E[R^f]$	0.57	1.49	-0.06	0.24	2.34	2.51	1.39
$\sigma(R^f)$	2.86	1.70	0.89	0.99	2.84	3.11	2.01
$AC1(R^f)$	0.65	0.80	0.64	0.67	0.88	0.89	0.83

TABLE A8

Consumption, IST shocks, and Excess Market Returns

The table reports the OLS estimation results of regressing the growth rate of aggregate consumption on IST shocks and excess market returns (ERET) using simulated (Panel A) and actual data (Panels C and D). We use the excess market return as a proxy for DT shocks in Panels A and D and use the TFP growth rate (ΔTFP) as an instrumental variable for the excess market return in Panel D. We examine the relation between the excess market return with IST shocks and ΔTFP in Panel D. We construct daily stock return difference between investment-goods producers and consumption-goods producers, IMC, and then form 5 by 5 monthly portfolios on the market cap and the IMC beta estimated using daily returns in a month. We use the average return difference between high and low IMC-beta stocks of the top three market cap quintiles as a proxy for IST shocks. We use real-time real personal consumption expenditures on nondurable goods and services from the Bureau of Economic Analysis to construct aggregate consumption growth. ΔTFP is constructed using quarterly utilization-adjusted TFP data obtained from the San Francisco Fed. The annual sample spans the 1967 to 2016 period. In parentheses we report t-statistics constructed using Newey-West standard errors with two lags. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

DV_LAG	IST	ERET	R^2	IST	ΔTFP		R^2
Panel A: Consumption in Model				Panel B: Excess Market Returns			
0.611	-0.0002		0.375	0.417***			0.192
(10.549)	(-0.386)			(4.479)			
0.615		0.047	0.470		0.494		0.016
(12.425)		(5.432)			(1.432)		
0.618	-0.003	0.075	0.532	0.429***	0.547*		0.221
(13.904)	(-4.788)	(7.609)		(4.278)	(1.846)		
Panel C: Consumption				Panel D: Consumption with IV			
DV_LAG	IST	ERET	R^2	DV_LAG	IST	ERET	R^2
0.408***	0.001		0.130	0.408***	0.001		0.130
(3.360)	(0.184)			(3.360)	(0.184)		
0.590***		0.032***	0.338	0.934		0.091*	0.272
(4.597)		(2.787)		(3.402)		(1.947)	
0.605***	-0.014**	0.039***	0.367	0.819***	-0.030*	0.081**	0.326
(5.075)	(-1.983)	(3.527)		(3.632)	(-1.834)	(2.374)	

TABLE A9

IST Factors

The table describes the variables that we use to construct the IST shock proxies. Unless otherwise indicated, variables in italic and bold are from Compustat and CRSP, respectively.

Variable	Definition
IK	IK is the investment-capital ratio. We measure investment as the difference between capital expenditure and PPE sales or *CAPX-SPPE*. We measure capital using lagged PPE, *PPEGT*. *SPPE* is set to zero when missing.
Tobin's Q	Tobin's Q is the market value of assets divided by their replacement costs. The market value is the difference between (*INVT+TXDITC*) and (MKCAP12+*DLTT+PSTKRV*). The replacement cost is the book value of PPE, *PPEGT*. We set *TXDITC* to zero when missing. MKCAP12 is the market capitalization, the product of the share price **PRC** with shares outstanding **SHROUT**, at the calendar year end.
PE	PE is the ratio of a firm's market value (MKCAP12+*DLTT+PSTKRV-TXDB*) to the sum of operating income, *IB*, and interest expenses, *XINT*. MKCAP12 is the market capitalization, the product of the share price **PRC** with shares outstanding **SHROUT**, at the end of the calendar year.
IMC	IMC is the return difference between the value-weighted portfolio of investment-goods producers and the value-weighted portfolio of consumption-goods producers. We use June-end market capitalization for weights.
β_{MKT}	We estimate market beta by regressing daily excess stock returns on a constant and concurrent daily excess stock market returns using a one-year rolling window. We include only stocks that have at least 200 valid daily returns in a calendar year.
β_{IMC}	We estimate IMC beta by regressing daily excess stock returns on a constant and concurrent daily IMC using a one-year rolling window. We include only stocks that have at least 200 valid daily returns in a calendar year.
IMCIV	IMCIV is the square root of the sum of squared residuals from the regression of daily excess stock returns on a constant, daily value-weighted IMC, and daily excess market returns. We include only stocks that have at least 200 valid daily returns in a calendar year.

TABLE A10

Summary Statistics for monthly ICCs

The table reports the summary statistics of ICC measures

ICC	PSS	GLS	Easton	OJ	Gordon
Mean	0.107	0.091	0.116	0.118	0.071
Std Dev	0.021	0.021	0.029	0.029	0.020
Kurtosis	3.310	1.715	3.914	1.424	2.227
Skew	1.654	1.301	1.914	1.407	1.346
PSS	1				
GLS	0.969	1			
Easton	0.957	0.955	1		
OJ	0.894	0.921	0.963	1	
Gordon	0.968	0.987	0.928	0.871	1

TABLE A11

IST Shocks and Long-Run Analyst Earnings Growth Forecast

The table reports the OLS estimation results of regressing the change in long-run analyst earnings growth forecast on its own lag (DV_LAG), IST shocks (IST), lagged IST shocks (IST_LAG), excess stock market returns (ERET), and lagged excess stock market returns (ERET_LAG). We construct long-run analyst earnings growth forecast using I/B/E/S long-term earnings growth forecast data and include only firms with the December fiscal year end. We construct daily stock return difference between investment-goods producers and consumption-goods producers, IMC, and then form portfolios on IMC betas. We use the return difference between high IMC-beta stocks and low IMC-beta stocks as a proxy for IST shocks. The annual sample spans the 1983 to 2015 period. In parentheses we report t-statistics constructed using Newey-West standard errors with two lags.

DV_LAG	IST	IST_LAG	ERET	ERET_LAG	R^2
0.226	0.011	0.043			0.520
(2.557)	(1.782)	(6.321)			
0.071			0.013	0.047	0.457
(0.856)			(2.075)	(5.279)	
0.184	0.012	0.032	0.011	0.033	0.726
(3.231)	(2.663)	(4.626)	(1.671)	(5.746)	

TABLE A12

Summary Statistics of Selected Variables

The table reports the quarterly summary statistics for the stock market price (Panel A), the implied cost of capital (Panel B), variances (Panel C), and asset returns (Panel D). In Panel A, PD, PPO, and PE are log dividend-price ratio, log net payout-price ratio, and log earning-price ratio, respectively. In Panel B, PSS, GLS, Easton, OJ, and GG are the implied cost of capital measures constructed following Pastor et al. (2008), Gebhardt et al. (2001), Easton (2004), Ohlson and Juettner-Nauroth (2005), and Gordon and Gordon (1997), respectively. AICC is the average of these five ICC measures. LNS is the ICC measure used in Li et al. (2013). In Panel C, VIK, VTobinQ, VPE, VIMCIV, Vβ_{IMC}, VIMC, Vβ_{MKT}, and VHML are realized variances of daily returns on portfolios formed on IK, Tobin' Q, PE ratio, idiosyncratic volatility, IMC beta, IMC spread, Market Beta, and book-to-market equity ratio, respectively. VFPC and VAVE are realized variances of the first principle component and average of these eight daily portfolio returns, respectively. FPCV and AVEV are the first principle component and average, respectively, of VIK, VTobinQ, VPE, VIMCIV, Vβ_{IMC}, VIMC, Vβ_{MKT}, VHML, VFPC, and VAVE. VWASV and EWASV are value-weighted and equal-weighted average stock variances, respectively. VMKT is stock market variance. In Panel D, IK, TobinQ, PE, IMCIV, β_{IMC}, β_{MKT}, and HML are returns on long-short portfolios formed by IK, Tobin's Q, PE ratio, idiosyncratic volatility, IMC beta, Market Beta, and book-to-market ratio, respectively. AVE is the average of these seven portfolio returns. CMA, RMW, and SMB are the Fama and French (2015) conservative-minus-aggressive, robust-minus-weak, and small-minus-big factors, respectively. ERET is the excess stock market return. RF is the risk-free rate. Mean and standard errors in Panel B, C and D are reported in percentage. VPC1 is scaled by 10^{-4}, and PC1V and AVEV are scaled by 10^{-2}.

Variable	Mean	Std Err	Kurt	Skew	AR(1)	Sampling Period
Panel A: Stock Market Price						
PD	3.704	0.030	-0.577	-0.345	0.979	1963Q1-2016Q4
PPO	2.203	0.016	18.615	-3.742	0.940	1963Q1-2016Q4
PE	1.697	0.029	-0.502	0.385	0.982	1963Q1-2016Q4
Panel B: Implied Costs of Capital						
PSS	1.602	0.053	-0.873	0.527	0.909	1981Q1-2016Q4
GLS	1.128	0.052	-0.965	0.342	0.923	1982Q1-2016Q4
Easton	1.830	0.046	-0.896	-0.015	0.895	1981Q1-2016Q4
OJ	1.881	0.040	-0.809	-0.168	0.891	1981Q1-2016Q4
GG	0.711	0.056	-0.799	0.412	0.904	1981Q1-2016Q4
AICC	1.444	0.048	-0.906	0.265	0.910	1982Q1-2016Q4
LNS	1.806	0.059	-0.751	-0.019	0.866	1981Q1-2011Q4

Variable	Mean	Std Err	Kurt	Skew	AR(1)	Sampling Period
Panel C: Stock Return Variances						
VIK	0.080	0.005	13.517	3.327	0.592	1963Q1-2016Q4
VTobinQ	0.136	0.009	8.730	2.711	0.630	1963Q1-2016Q4
VPE	0.095	0.005	3.634	1.895	0.545	1963Q1-2016Q4
Vβ_{MKT}	0.144	0.010	15.822	3.532	0.632	1963Q1-2016Q4
Vβ_{IMC}	0.192	0.017	17.898	3.952	0.559	1963Q1-2016Q4
VIMCIV	0.188	0.018	37.512	5.329	0.556	1963Q1-2016Q4
VIMC	0.128	0.015	50.097	6.107	0.693	1963Q1-2016Q4
VHML	0.109	0.010	43.494	5.847	0.633	1963Q1-2016Q4
VFPC	0.003	0.026	20.698	4.155	0.688	1963Q1-2016Q4
VAVE	0.042	0.004	30.959	5.009	0.559	1963Q1-2016Q4
FPCV	0.000	0.068	16.067	3.629	0.649	1963Q1-2016Q4
AVEV	0.000	0.058	15.388	3.556	0.652	1963Q1-2016Q4
VWASV	0.029	0.022	7.588	2.582	0.647	1963Q1-2016Q4
EWASV	0.082	0.051	12.780	2.959	0.745	1963Q1-2016Q4
TYVIX	0.001	0.008	8.090	2.511	0.696	2003Q1-2016Q4
VMKT	0.653	0.042	6.960	2.466	0.503	1963Q1-2016Q4
Panel D: Asset Returns						
IK	0.714	0.299	2.110	0.356	0.057	1963Q1-2016Q4
TobinQ	0.888	0.413	1.869	-0.208	0.124	1963Q1-2016Q4
PE	0.879	0.306	1.327	-0.235	0.134	1963Q1-2016Q4
IMCIV	0.249	0.554	1.901	0.552	0.048	1963Q1-2016Q4
β_{MKT}	0.177	0.475	2.391	0.338	-0.006	1963Q1-2016Q4
β_{IMC}	0.177	0.475	2.391	0.338	-0.006	1963Q1-2016Q4
HML	1.108	0.390	1.703	0.439	0.121	1963Q1-2016Q4
AVE	0.587	0.341	3.125	-0.050	0.085	1963Q1-2016Q4
CMA	0.922	0.274	1.911	0.907	0.048	1963Q1-2016Q4
RMW	0.735	0.283	7.035	0.915	0.143	1963Q1-2016Q4
SMB	0.788	0.379	-0.080	0.142	-0.001	1963Q1-2016Q4
ERET	1.638	0.576	0.815	-0.505	0.062	1963Q1-2016Q4
RF	0.334	0.037	-0.364	0.268	0.865	1963Q1-2016Q4

TABLE A13

Forecasting Excess Stock Market Returns Using Variances

The table reports the OLS estimation results of forecasting one-quarter-ahead excess stock market returns using stock variances. VIK, VTobinQ, VPE, VIMCIV, Vβ_{IMC}, VIMC, Vβ_{MKT}, and VHML are realized variances of daily returns on portfolios formed on IK, Tobin's Q, PE ratio, idiosyncratic volatility, IMC beta, IMC spread, Market Beta, and book-to-market equity ratio, respectively. VFPC and VAVE are realized variances of the first principle component and average of these eight daily portfolio returns, respectively. FPCV and AVEV are the first principle component and average, respectively, of VIK, VTobinQ, VPE, VIMCIV, Vβ_{IMC}, VIMC, Vβ_{MKT}, VHML, VFPC, and VAVE. VWASV and EWASV are value-weighted and equal-weighted average stock variances, respectively. VMKT is stock market variance. TYVIX is the options-implied Treasury bond variance. TYVIX is available over the 2003Q1 to 2016Q4 period and the other variance measures are available over the 1963Q1 to 2016Q4 period. Panel A reports the univariate regression results. Panel B reports the bivariate regression results with stock market variance and a euphoria variance measure as the forecasting variables. Panel C reports the out-of-sample forecast results. For TYVIX, we use the 2003Q1 to 2009Q4 period for the initial in-sample estimation and make the out-of-sample forecast recursively for the 2010Q1 to 2016Q4 period using an expanding sample. For the other euphoria variance measures, we use the 1963Q1 to 1989Q4 period for initial in-sample estimation and make the out-of-sample forecast recursively for the 1990Q1 to 2016Q4 period using an expanding sample. We use two standard measures to gauge the out-of-sample performance. MSER is the mean squared forecasting errors ratio of the forecasting model to a benchmark model in which conditional equity premium equals average equity premium in historical data. ENC_NEW is the encompassing test proposed by Clark and McCracken (2001). t-values are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variable	Panel A		Panel B			Panel C		
	All Variance	R^2	Euphoria Variance	Market Variance	R^2	MSER	ENC_NEW Statistics	5% BSCV
VMKT	2.799**	3.707						
	(2.054)							
VIK	-11.408*	0.641	-26.902***	4.338***	8.192	0.957	11.699	2.381
	(-1.831)		(-5.060)	(2.851)				
VTobinQ	-3.993	-0.069	-11.062**	3.776***	5.833	0.997	10.846	2.370
	(-1.013)		(-2.043)	(2.997)				
VPE	-11.042	0.477	-29.331***	4.526***	8.368	0.927	15.510	2.331
	(-1.112)		(-2.927)	(3.543)				
VIMCIV	-1.535	-0.235	-4.807***	3.612***	5.208	1.171	2.667	2.525
	(-0.933)		(-3.467)	(2.614)				
$V\beta_{IMC}$	-4.414*	1.280	-9.446***	4.557***	9.650	0.931	12.380	2.379
	(-1.662)		(-2.725)	(4.904)				
VIMC	-3.020	0.136	-5.761**	3.381**	5.286	1.048	6.239	2.503
	(-1.583)		(-2.551)	(2.523)				
$V\beta_{MKT}$	0.773	-0.451	-8.748**	4.025***	4.877	1.006	5.426	2.379
	(0.220)		(-2.419)	(2.960)				
VHML	-8.357**	1.852	-19.934***	5.442***	12.781	0.823	31.010	2.484
	(-2.291)		(-6.038)	(6.088)				
VFPC	-1.634	0.076	-4.756***	4.165***	6.895	0.963	8.892	2.414
	(-1.233)		(-4.707)	(3.078)				
VAVE	-4.564	-0.377	-20.845***	3.586**	4.857	1.033	4.255	2.436
	(-0.523)		(-2.661)	(2.301)				
FPCV	-0.740	0.300	-2.247***	4.699***	8.448	0.917	12.985	2.380
	(-1.454)		(-4.389)	(4.295)				
AVEV	-0.898	0.347	-2.715***	4.765***	8.679	0.913	13.586	2.370
	(-1.481)		(-4.339)	(4.453)				
VWASV	-0.065	-0.440	-2.096***	8.979***	13.473	0.825	21.880	2.330
	(-0.168)		(-4.063)	(6.849)				
EWASV	0.078	-0.241	-0.211	3.897**	4.279	1.013	5.104	2.406
	(0.644)		(-1.515)	(2.474)				
TYVIX	-24.718	5.722	-53.546***	4.658***	17.143	0.771	8.849	2.629
	(-1.495)		(-2.798)	(5.699)				

TABLE A14

Forecasting One-Quarter-Ahead Excess Stock Market Returns

The table reports the OLS estimation results of forecasting excess stock market returns with implied cost of capital measures and scaled stock market prices. We de-trend the implied cost of capital by a linear time trend. PSS, GLS, Easton, OJ, and GG are the implied cost of capital measures constructed following Pastor et al. (2008), Gebhardt et al. (2001), Easton (2004), Ohlson and Juettner-Nauroth (2005), and Gordon and Gordon (1997), respectively. AICC is the average of these five ICC measures. LNS is the ICC measure used in Li et al. (2013). LNS is available over the 1981Q1 to 2011Q4 period, GLS and AICC are available over the 1982Q1 to 2016Q4 period, and the other ICC measures are available over the 1981Q1 to 2016Q4 period. PD is the price-dividend ratio. PPO is the price-payout ratio. PE is the price-earnings ratio. PD, PPO, and PE are available over the 1963Q1 to 2016Q4 period. In the column under the name"Original Value," we use the raw data of implied cost of capital measures and the scaled stock market prices as the predictor variables. We also decompose implied cost of capital measures and the scaled stock market prices by regressing them on a constant, stock market variance, and a euphoria variance measure. We use the fitted value as the forecasting variable in the column under the name "Fitted Value" and use the residual value as the forecasting variable in the column under the name "Residual Value." t-values are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Original Value	R^2	Fitted Value	R^2	Residual Value	R^2
Panel A: First Principle Component of Euphoria Variance Measures						
PSS	1.348	0.348	16.242***	9.461	0.287*	-0.690
	(1.173)		(4.504)		(1.803)	
GLS	1.563	0.593	14.954***	10.179	1.069	-0.427
	(1.416)		(5.150)		(0.584)	
Easton	1.540	0.296	18.967***	9.481	0.222	-0.693
	(1.230)		(4.976)		(0.146)	
OJ	2.531*	1.385	19.119***	9.767	0.942	-0.474
	(1.851)		(5.095)		(0.568)	
GG	1.809*	1.378	14.793***	9.762	1.266	-0.259
	(1.703)		(5.070)		(0.710)	
AICC	1.476	0.297	16.703***	10.167	0.672	-0.607
	(1.217)		(5.126)		(0.390)	
LNS	2.332**	2.212	13.075***	10.297	0.915	-0.408
	(1.957)		(4.407)		(0.653)	
PD	-0.018	0.479	-0.085***	3.984	0.001	-0.468
	(-1.315)		(-3.876)		(0.049)	
PPO	-0.050***	1.535	-0.118***	3.658	-0.009	-0.425
	(-2.740)		(-3.820)		(-0.196)	
PE	-0.016	0.144	-0.126***	6.305	0.007	-0.370
	(-1.057)		(-4.297)		(0.426)	

	Original Value	R^2	Fitted Value	R^2	Residual Value	R^2
Panel B: Average of Euphoria Variance Measures						
PSS	1.348	0.348	16.617***	9.685	0.288	-0.689
	(1.173)		(4.618)		(0.160)	
GLS	1.563	0.593	15.322***	10.483	1.056	-0.433
	(1.416)		(5.287)		(0.578)	
Easton	1.540	0.296	19.641***	9.824	0.224	-0.693
	(1.230)		(5.081)		(0.148)	
OJ	2.531*	1.385	19.591***	10.064	0.933	-0.478
	(1.851)		(5.230)		(0.563)	
GG	1.809*	1.378	15.177***	10.054	1.256	-0.264
	(1.703)		(5.205)		(0.704)	
AICC	1.476	0.297	17.145***	10.464	0.667	-0.608
	(1.217)		(5.262)		(0.387)	
LNS	2.332**	2.212	13.364***	10.577	0.907	-0.413
	(1.957)		(4.551)		(0.648)	
PD	-0.018	0.479	-0.088***	4.191	0.001	-0.466
	(-1.315)		(-4.945)		(0.073)	
PPO	-0.050***	1.535	-0.122***	3.848	-0.009	-0.432
	(-2.740)		(-3.876)		(-0.178)	
PE	-0.016	0.144	-0.129***	6.573	0.007	-0.360
	(-1.057)		(-4.367)		(0.447)	
Panel C: Value-Weighted Average Stock Variance						
PSS	1.348	0.348	16.684***	15.302	-1.212	-0.388
	(1.173)		(6.532)		(-0.704)	
GLS	1.563	0.593	13.819***	14.972	-0.533	-0.664
	(1.416)		(5.760)		(-0.309)	
Easton	1.540	0.296	17.934***	15.303	-0.938	-0.443
	(1.230)		(4.903)		(-0.649)	
OJ	2.531*	1.385	19.132***	15.631	-0.226	-0.697
	(1.851)		(5.845)		(-0.152)	
GG	1.809*	1.378	14.074***	15.632	-0.397	-0.670
	(1.703)		(5.768)		(-0.229)	
AICC	1.476	0.297	15.62***	14.968	-0.686	-0.614
	(1.217)		(5.845)		(-0.425)	
LNS	2.332**	2.212	14.304***	15.004	0.405	-0.741
	(1.957)		(6.358)		(0.302)	
PD	-0.018	0.479	-0.137***	8.562	0.007	-0.369
	(-1.315)		(-3.726)		(0.478)	
PPO	-0.050***	1.535	-0.158***	8.341	0.036	-0.116
	(-2.740)		(-3.706)		(0.651)	
PE	-0.016	0.144	-0.221***	12.322	0.008	-0.322
	(-1.057)		(-4.485)		(0.564)	

TABLE A15

Forecasting One-Quarter-ahead Anomaly Returns

The table reports the OLS estimation results of forecasting one-quarter-ahead anomaly returns. IK, TobinQ, PE, IMCIV, β_{IMC}, β_{MKT}, and HML are returns on long-short portfolios formed by investment-capital ratio, Tobin's Q, price-earnings ratio, idiosyncratic volatility, IMC beta, Market Beta, and book-to-market equity ratio, respectively. AVE is the average of these seven portfolio returns. CMA, RMW, and SMB are the Fama and French (2015) conservative-minus-aggressive, robust-minus-weak, and small-minus-big factors, respectively. We use three proxies for euphoria variance. We use the first principle component and the average of the 10 IST-based euphoria variance measures in Panels A and B, respectively. We use the value-weighted average sock variance in Panel C. Data span the 1963Q1 to 2016Q4 period. t-values are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Euphoria Variance	Market Variance	R^2
Panel A: The First Principle Component of Euphoria Variance Measures			
IK	0.442	-1.857**	4.193
	(1.098)	(-2.130)	
Tobin Q	0.794*	-1.975*	2.086
	(1.727)	(-1.833)	
PE	0.604*	-1.778***	3.423
	(1.757)	(-2.976)	
IMC IV	1.106*	-4.808***	9.099
	(1.681)	(-3.736)	
β_{IMC}	1.075	-3.643***	6.461
	(1.347)	(-2.837)	
β_{MKT}	0.826*	-4.490***	11.402
	(1.950)	(-4.638)	
HML	0.64	-2.271***	3.539
	(1.102)	(-3.101)	
AVE	0.786*	-2.965***	9.086
	(1.845)	(-3.874)	
CMA	0.674**	-0.715	1.202
	(2.272)	(-1.302)	
RMW	0.894**	-1.169**	2.896
	(2.272)	(-2.029)	
SMB	0.185	0.974	0.737
	(0.461)	(1.465)	
Panel B: The Average of Euphoria Variance Measures			
IK	0.551	-1.882**	4.276
	(1.164)	(-2.149)	
TobinQ	0.971*	-2.007*	2.175
	(1.768)	(-1.857)	
PE	0.734*	-1.799***	3.496
	(1.783)	(-2.996)	
IMC IV	1.332*	-4.837***	9.15
	(1.712)	(-3.741)	

	Euphoria Variance	Market Variance	R^2
Panel B: The Average of Euphoria Variance Measures			
AVE	0.952*	-2.990***	9.175
	(1.884)	(-3.875)	
CMA	0.810**	-0.731	1.271
	(2.109)	(-1.320)	
RMW	1.060**	-1.180**	2.914
	(2.252)	(-2.025)	
SMB	0.2	0.986	0.723
	(0.413)	(1.474)	
Panel C: Value-Weighted Average Stock Variance			
IK	0.489*	-2.926**	5.519
	(1.672)	(-2.402)	
TobinQ	0.824*	-3.734**	3.899
	(1.911)	(-2.291)	
PE	0.865**	-3.819***	8.249
	(2.560)	(-3.696)	
IMC IV	1.169**	-7.321***	11.178
	(2.445)	(-4.016)	
β_{IMC}	1.089**	-5.946***	8.701
	(2.100)	(-2.950)	
β_{MKT}	0.931**	-6.537***	13.334
	(2.539)	(-4.832)	
HML	0.835*	-4.189***	6.201
	(1.824)	(-2.963)	
AVE	0.890***	-4.922***	12.578
	(2.605)	(-4.019)	
CMA	0.672***	-2.124**	3.813
	(2.764)	(-2.292)	
RMW	0.776**	-2.701**	5.334
	(2.133)	(-2.303)	
SMB	0.301	0.245	1.148
	(1.152)	(0.286)	

TABLE A16

Cross-Section of Portfolio Returns and Variances

The table reports the Fama and MacBeth (1973) cross-sectional regression results. In Panel A, we use the 32 triple-sorted portfolios formed on market capitalization, operation profit, and total asset growth. In Panel B, we use the 32 triple-sorted portfolios formed on market capitalization, book-to-market equity ratios, and total asset growth. In the Fama and MacBeth regression, we first regress returns on each test portfolio on lagged stock market variance and lagged euphoria variance, and use the estimated loadings in the second-stage cross-sectional regressions. We include two lags of stock market variance and two lags of euphoria variance in the first-stage regression, and the loadings are the sum of the coefficients on two lags of stock market variance or two lags of euphoria variance. VMKT is stock market variance. We use three proxies of euphoria variance. FPCV is the first principle component of ten standardized IST-based euphoria variance measures. AVEV is the average of ten standardized IST-based euphoria variance measures. VWASV is the value-weighted average stock variance. The data span the 1963Q1 to 2016Q4 period. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Constant	Euphoria Variance	Market Variance	R^2
Panel A: 32 Portfolios Sorted by Size, Profitability, and Asset Growth				
FPCV	0.011**	1.164***	0.003*	57.279
	(2.142)	(4.221)	(1.858)	
AVEV	0.012**	0.996***	0.003*	57.600
	(2.206)	(4.221)	(1.877)	
VWASV	0.018***	0.022***	0.003*	61.867
	(3.390)	(3.384)	(1.946)	
Panel B: 32 Portfolios sorted by Size, BM, and Asset Growth				
FPCV	0.003	1.084***	0.005**	51.925
	(0.569)	(3.616)	(2.536)	
AVEV	0.003	0.925***	0.005**	51.967
	(0.617)	(3.618)	(2.543)	
VWASV	0.011*	0.023***	0.005**	59.010
	(1.797)	(3.275)	(2.475)	