Skewness in Expected Macro Fundamentals and the Predictability of Equity Returns: Evidence and Theory

Ric Colacito, Eric Ghysels, Jinghan Meng, and Wasin Siwasarit

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Introduction

- Long-Run Risks Model: time-varying expected growth rate
  - $\rightarrow$ This paper: we look at the cross-section of analysts' forecasts

Introduction

- Long-Run Risks Model: time-varying expected growth rate
  $\rightarrow$ This paper: we look at the cross-section of analysts' forecasts
- At each point in time we look at:
  - Mean of all forecasts
  - Volatility of all forecasts
  - Skewness of all forecasts

Introduction

- Long-Run Risks Model: time-varying expected growth rate

  $\rightarrow$ This paper: we look at the cross-section of analysts' forecasts

- At each point in time we look at:
  - Mean of all forecasts
  - Volatility of all forecasts
  - Skewness of all forecasts

- We find:
  1. Evidence of persistence for all the moments
  2. Skewness predicts future Mean

Introduction

- Long-Run Risks Model: time-varying expected growth rate

  $\rightarrow$ This paper: we look at the cross-section of analysts' forecasts

- At each point in time we look at:
  - Mean of all forecasts
  - Volatility of all forecasts
  - Skewness of all forecasts

- We find:
  1. Evidence of persistence for all the moments
  2. Skewness predicts future Mean

- Questions

Introduction

- Long-Run Risks Model: time-varying expected growth rate
  → This paper: we look at the cross-section of analysts' forecasts
- At each point in time we look at:
  - Mean of all forecasts
  - Volatility of all forecasts
  - Skewness of all forecasts
- We find:
  1. Evidence of persistence for all the moments
  2. Skewness predicts future Mean
- Questions
  1. How much larger is the premium to compensate for the risk of time-varying moments of the distribution of expected GDP forecasts?
     → Bansal and Yaron (2004), Bansal, Kiku, Shaliastovich, and Yaron (2012) look at time varying means and variances

Introduction

- Long-Run Risks Model: time-varying expected growth rate
  → This paper: we look at the cross-section of analysts' forecasts
- At each point in time we look at:
  - Mean of all forecasts
  - Volatility of all forecasts
  - Skewness of all forecasts
- We find:
  1. Evidence of persistence for all the moments
  2. Skewness predicts future Mean
- Questions
  1. How much larger is the premium to compensate for the risk of time-varying moments of the distribution of expected GDP forecasts?
     → Bansal and Yaron (2004), Bansal, Kiku, Shaliastovich, and Yaron (2012) look at time varying means and variances
  2. What is the use of this information for forecasting stock market returns?
     → Campbell and Diebold (2009) look at first two moments

Battle plan

1. A look at the data

Battle plan

1. A look at the data
2. An endowment economy featuring
   - time varying distribution of expected consumption growth (mean, variance, skewness)
   - recursive preferences

Battle plan

1. A look at the data
2. An endowment economy featuring
   - time varying distribution of expected consumption growth (mean, variance, skewness)
   - recursive preferences
3. How large is the skewness premium?
   - Properties of the stochastic discount factor (bounds)
   - Equity risk premium from a calibrated economy

Battle plan

1. A look at the data

2. An endowment economy featuring
   - time varying distribution of expected consumption growth (mean, variance, skewness)
   - recursive preferences

3. How large is the skewness premium?
   - Properties of the stochastic discount factor (bounds)
   - Equity risk premium from a calibrated economy

4. Testing empirical predictions: can the distribution of expected growth rates forecast equity returns and the realized variance of equity returns?

Data on Expected Real GDP/GNP growth rates

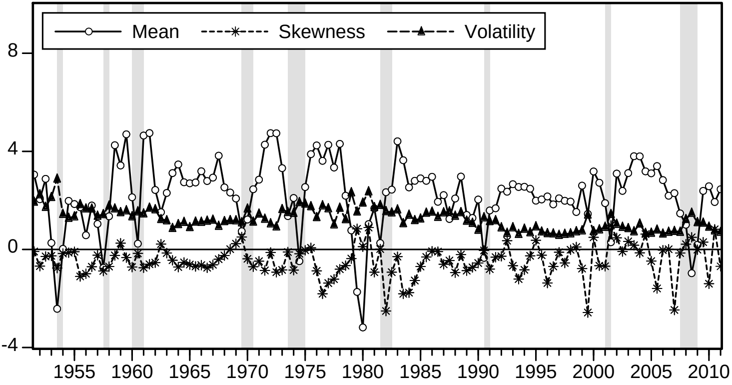
Data on Expected Real GDP/GNP growth rates

1. Livingston Survey:
   - Time series size: forecasts from 06/1946 to 06/2011, twice per year;
   - Forecast horizon: 6 months and 12 months from now;
   - Cross-sectional size: 19-50+ economists in each period, from 11 sectors (e.g., industry, government, banking, academia, etc).

Data on Expected Real GDP/GNP growth rates

1. Livingston Survey:
    - Time series size: forecasts from 06/1946 to 06/2011, twice per year;
    - Forecast horizon: 6 months and 12 months from now;
    - Cross-sectional size: 19-50+ economists in each period, from 11 sectors (e.g., industry, government, banking, academia, etc).
2. Blue Chips Economic Indicators:
    - Time series size: forecasts from 09/1984 to 06/2011, every month;
    - Forecast horizon: 1, 2, up to 6 quarters ahead;
    - Cross-sectional size: 40-50 economists in each period.

Moments of Expected GDP Forecasts



Transition dynamics of conditional moments

	Mean	Volatility	Third Moment$^{1/3}$
Lagged Mean	0.496 [0.070]	–	–
Lagged Volatility	–	0.886 [0.058]	–
Lagged Third Moment$^{1/3}$	–	–	0.329 [0.077]

Transition dynamics of conditional moments

	Mean	Volatility	Third Moment$^{1/3}$
Lagged Mean	0.480 [0.056]	−0.038 [0.019]	−0.094 [0.055]
Lagged Volatility	0.183 [0.785]	0.818 [0.052]	−0.258 [−0.164]
Lagged Third Moment$^{1/3}$	0.302 [0.093]	−0.085 [0.026]	0.275 [0.068]

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t = (1-\delta)\log C_t + \delta\theta \log E_t \exp\left\{\frac{U_{t+1}}{\theta}\right\}$$

where $\theta = 1/(1-\gamma)$.

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t \quad = \quad (1-\delta)\log C_t + \delta E_t\left[U_{t+1}\right]$$

where $\theta = 1/(1-\gamma)$. If $\theta \to -\infty$: time additive case.

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t = (1-\delta)\log C_t + \delta\theta \log E_t \exp\left\{\frac{U_{t+1}}{\theta}\right\}$$

where $\theta = 1/(1-\gamma)$.

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t \approx (1-\delta)\log C_t + \delta E_t[U_{t+1}] + \frac{\delta}{2\theta} V_t[U_{t+1}] + \frac{\delta}{6\theta^2} E_t(U_{t+1} - E_t U_{t+1})^3 + \dots$$

where $\theta = 1/(1-\gamma)$.

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t \quad \approx \quad (1-\delta)\log C_t + \delta E_t[U_{t+1}] + \frac{\delta}{2\theta} V_t[U_{t+1}] + \frac{\delta}{6\theta^2} E_t(U_{t+1} - E_t U_{t+1})^3 + \dots$$

where $\theta = 1/(1-\gamma)$.

- Standard Expected Utility term

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t \approx (1-\delta)\log C_t + \delta E_t[U_{t+1}] + \frac{\delta}{2\theta} V_t[U_{t+1}] + \frac{\delta}{6\theta^2} E_t (U_{t+1} - E_t U_{t+1})^3 + \ldots$$

where $\theta = 1/(1-\gamma)$.

- Standard Expected Utility term
- Utility variance matters ($\gamma > 1 \Rightarrow \theta < 0$: agents dislike variance)

Preferences

Agents have recursive risk-sensitive preferences:

$$U_t \quad \approx \quad (1-\delta)\log C_t + \delta E_t[U_{t+1}] + \frac{\delta}{2\theta} V_t\left[U_{t+1}\right] + \frac{\delta}{6\theta^2} E_t\left(U_{t+1} - E_t U_{t+1}\right)^3 + \dots$$

where $\theta = 1/(1-\gamma)$.

- Standard Expected Utility term
- Utility variance matters ($\gamma > 1 \Rightarrow \theta < 0$: agents dislike variance)
- Conditional Skewness matters
- Higher order conditional moments are potentially important...

Preliminaries and Notation

- At each date t, observe the cross-section $\left\{E_t^i\left(\Delta c_{t+1}\right)\right\}_{i=1}^n$

Preliminaries and Notation

- At each date t, observe the cross-section $\left\{E_t^i\left(\Delta c_{t+1}\right)\right\}_{i=1}^n$
- Assume that $E_t^i\left(\Delta c_{t+1}\right)=E_t\left(\Delta c_{t+1}\right)+\xi_t^i, \quad \forall i=\{1,\ldots,n\}$

Preliminaries and Notation

- At each date t, observe the cross-section $\left\{E_t^i\left(\Delta c_{t+1}\right)\right\}_{i=1}^{n}$
- Assume that $E_t^i\left(\Delta c_{t+1}\right) = E_t\left(\Delta c_{t+1}\right) + \xi_t^i, \quad \forall i = \{1, \ldots, n\}$
- Denote the **c**ross **s**ectional moments as:

Preliminaries and Notation

- At each date t, observe the cross-section $\left\{E_t^i\left(\Delta c_{t+1}\right)\right\}_{i=1}^{n}$
- Assume that $E_t^i\left(\Delta c_{t+1}\right) = E_t\left(\Delta c_{t+1}\right) + \xi_t^i, \quad \forall i = \{1, \ldots, n\}$
- Denote the **c**ross **s**ectional moments as:
  - $\widehat{E}_t^{cs}\left(\Delta c_{t+1}\right) = \frac{1}{n}\sum_{i=1}^{n} E_t^i\left(\Delta c_{t+1}\right)$

Preliminaries and Notation

- At each date t, observe the cross-section $\left\{E_t^i\left(\Delta c_{t+1}\right)\right\}_{i=1}^n$
- Assume that $E_t^i\left(\Delta c_{t+1}\right)=E_t\left(\Delta c_{t+1}\right)+\xi_t^i, \quad \forall i=\{1,\ldots,n\}$
- Denote the **c**ross **s**ectional moments as:
  - $\widehat{E}_t^{cs}\left(\Delta c_{t+1}\right)=\frac{1}{n}\sum_{i=1}^n E_t^i\left(\Delta c_{t+1}\right)$
  - $\widehat{V}_t^{cs}\left(\Delta c_{t+1}\right)=\frac{1}{n}\sum_{i=1}^n\left[E_t^i\left(\Delta c_{t+1}\right)-\widehat{E}_t^{cs}\left(\Delta c_{t+1}\right)\right]^2$

Preliminaries and Notation

- At each date t, observe the cross-section $\left\{E_t^i\left(\Delta c_{t+1}\right)\right\}_{i=1}^n$
- Assume that $E_t^i\left(\Delta c_{t+1}\right)=E_t\left(\Delta c_{t+1}\right)+\xi_t^i, \quad \forall i=\{1,\ldots,n\}$
- Denote the **c**ross **s**ectional moments as:
    - $\widehat{E}_t^{cs}\left(\Delta c_{t+1}\right)=\frac{1}{n}\sum_{i=1}^n E_t^i\left(\Delta c_{t+1}\right)$
    - $\widehat{V}_t^{cs}\left(\Delta c_{t+1}\right)=\frac{1}{n}\sum_{i=1}^n\left[E_t^i\left(\Delta c_{t+1}\right)-\widehat{E}_t^{cs}\left(\Delta c_{t+1}\right)\right]^2$
    - $\widehat{S}_t^{cs}\left(\Delta c_{t+1}\right)=\frac{\frac{1}{n}\sum_{i=1}^n\left[E_t^i(\Delta c_{t+1})-\widehat{E}_t^{cs}(\Delta c_{t+1})\right]^3}{\left(\widehat{V}_t^{cs}(\Delta c_{t+1})\right)^{3/2}}$

Dynamics of consumption growth

$$\Delta c_{t+1} = \underbrace{\mu_c + x_t}_{E_t[\Delta c_{t+1}]} + \sqrt{\sigma_t^c}\varepsilon_{t+1}^c$$

where

$$\begin{aligned} x_{t+1} &= \rho x_t + \varphi_e \sqrt{\sigma_t^x}\varepsilon_{t+1}^x \\ \varepsilon_{t+1}^x &\sim Skew - Normal(0, 1, \nu_{t+1}) \end{aligned}$$

Dynamics of consumption growth

$$\Delta c_{t+1} = \underbrace{\mu_c + x_t}_{E_t[\Delta c_{t+1}]} + \sqrt{\sigma_t^c}\varepsilon_{t+1}^c$$

where

$$\begin{aligned} x_{t+1} &= \rho x_t + \varphi_e \sqrt{\sigma_t^x}\varepsilon_{t+1}^x \\ \varepsilon_{t+1}^x &\sim Skew - Normal(0, 1, \nu_{t+1}) \end{aligned}$$

- Variance is time-varying: $\sigma_{t+1}^c = (1-\rho_\sigma)\overline{\sigma}_c + \rho_\sigma \sigma_t + \sqrt{\sigma_\sigma}\xi_{t+1}^\sigma$

Dynamics of consumption growth

$$\Delta c_{t+1} = \underbrace{\mu_c + x_t}_{E_t[\Delta c_{t+1}]} + \sqrt{\sigma_t^c}\varepsilon_{t+1}^c$$

where

$$x_{t+1} = \rho x_t + \varphi_e \sqrt{\sigma_t^x}\varepsilon_{t+1}^x$$
$$\varepsilon_{t+1}^x \sim Skew - Normal(0, 1, \nu_{t+1})$$

- Variance is time-varying: $\sigma_{t+1}^c = (1 - \rho_\sigma)\overline{\sigma}_c + \rho_\sigma \sigma_t + \sqrt{\sigma_\sigma}\xi_{t+1}^\sigma$
- Skewness is time-varying: $\nu_{t+1} = \rho_\nu \nu_t + \sqrt{\sigma_\nu}\xi_{t+1}$

Dynamics of consumption growth

$$\Delta c_{t+1} = \underbrace{\mu_c + x_t}_{E_t[\Delta c_{t+1}]} + \sqrt{\sigma_t^c}\varepsilon_{t+1}^c$$

where

$$\begin{aligned} x_{t+1} &= \rho x_t + \varphi_e \sqrt{\sigma_t^x}\varepsilon_{t+1}^x \\ \varepsilon_{t+1}^x &\sim Skew - Normal(0, 1, \nu_{t+1}) \end{aligned}$$

- Variance is time-varying: $\sigma_{t+1}^c = (1 - \rho_\sigma)\overline{\sigma}_c + \rho_\sigma \sigma_t + \sqrt{\sigma_\sigma}\xi_{t+1}^\sigma$
- Skewness is time-varying: $\nu_{t+1} = \rho_\nu \nu_t + \sqrt{\sigma_\nu}\xi_{t+1}$
- Variance of x_t is proportional to variance of Δc_t

$$\sigma_t^x = \sigma_t^c / \underbrace{\left(1 - \frac{2}{\pi} E_t\left[\frac{\nu_{t+1}}{\sqrt{1+\nu_{t+1}^2}}\right]^2\right)}_{Var_t[\varepsilon_{t+1}^x]}$$

Conditional moments

Conditional moments

- Conditional mean depends on all three lagged moments

$$E_t(x_{t+1}) = \rho_x x_t + \left(\frac{2}{4-\pi}\right)^{1/3} V_t(x_{t+1})^{1/2} S_t(x_{t+1})^{1/3}$$

Conditional moments

- Conditional mean depends on all three lagged moments

$$E_t(x_{t+1}) = \rho_x x_t + \left(\frac{2}{4-\pi}\right)^{1/3} V_t(x_{t+1})^{1/2} S_t(x_{t+1})^{1/3}$$

- Conditional variance is AR(1)

$$V_t(x_{t+1}) = \varphi_e^2 \sigma_t^c$$

Conditional moments

- Conditional mean depends on all three lagged moments

$$E_t(x_{t+1}) = \rho_x x_t + \left(\frac{2}{4-\pi}\right)^{1/3} V_t(x_{t+1})^{1/2} S_t(x_{t+1})^{1/3}$$

- Conditional variance is AR(1)

$$V_t(x_{t+1}) = \varphi_e^2 \sigma_t^c$$

- Conditional skewness is AR(1)

$$S_t\left(x_{t+1}\right)^{1/3} \approx \frac{4-\pi}{2}\sqrt{\frac{2}{\pi}}\rho_\nu \nu_t$$

Calibration

γ	Risk aversion	10
δ	Subjective discount factor	0.998
μ_c	Average consumption growth	0.001
ρ_x	Autoregressive coefficient of the expected consumption growth rate x_t	0.9619
ϕ_e	Ratio of long-run shock and short-run shock volatilities	0.05
μ_x	Location parameter of skew normal distribution of the innovations to x_t	0
$\sqrt{\sigma_\sigma}$	Conditional volatility of the variance of the short-run shock to consumption growth	3.80×10^{-6}
ρ_σ	Persistence of the variance of the short-run shock to consumption growth	0.93
$\sqrt{\sigma_\nu}$	Conditional volatility of the scale parameter ν of the skew normally distributed innovations to x_t	0.4696
ρ_ν	Persistence of the scale parameter ν of skew normally distributed innovations to x_t	0.8
λ	Leverage	3

Calibration

γ	Risk aversion	10
δ	Subjective discount factor	0.998
μ_c	Average consumption growth	0.001
ρ_x	Autoregressive coefficient of the expected consumption growth rate x_t	0.9619
ϕ_e	Ratio of long-run shock and short-run shock volatilities	0.05
μ_x	Location parameter of skew normal distribution of the innovations to x_t	0
$\sqrt{\sigma_\sigma}$	Conditional volatility of the variance of the short-run shock to consumption growth	3.80×10^{-6}
ρ_σ	Persistence of the variance of the short-run shock to consumption growth	0.93
$\sqrt{\sigma_\nu}$	Conditional volatility of the scale parameter ν of the skew normally distributed innovations to x_t	0.4696
ρ_ν	Persistence of the scale parameter ν of skew normally distributed innovations to x_t	0.8
λ	Leverage	3

Calibration

γ	Risk aversion	10
δ	Subjective discount factor	0.998
μ_c	Average consumption growth	0.001
ρ_x	Autoregressive coefficient of the expected consumption growth rate x_t	0.9619
ϕ_e	Ratio of long-run shock and short-run shock volatilities	0.05
μ_x	Location parameter of skew normal distribution of the innovations to x_t	0
$\sqrt{\sigma_\sigma}$	Conditional volatility of the variance of the short-run shock to consumption growth	3.80×10^{-6}
ρ_σ	Persistence of the variance of the short-run shock to consumption growth	0.93
$\sqrt{\sigma_\nu}$	Conditional volatility of the scale parameter ν of the skew normally distributed innovations to x_t	0.4696
ρ_ν	Persistence of the scale parameter ν of skew normally distributed innovations to x_t	0.8
λ	Leverage	3

Stochastic Discount Factor

- The SDF is

$$\log M_{t+1} = \log \frac{\partial U_t / \partial C_{t+1}}{\partial U_t / \partial C_t}$$
$$= \log \delta - \Delta c_{t+1} + \frac{U_{t+1}}{\theta} - \log E_t \exp \left\{ \frac{U_{t+1}}{\theta} \right\}$$

Stochastic Discount Factor

- The SDF is

$$\log M_{t+1} = \log \frac{\partial U_t / \partial C_{t+1}}{\partial U_t / \partial C_t}$$
$$= \log \delta - \Delta c_{t+1} + \frac{U_{t+1}}{\theta} - \log E_t \exp\left\{ \frac{U_{t+1}}{\theta} \right\}$$

- Assess the performance of the model using the HJ volatility bound

$$\sigma(M) \geq \frac{E\left[R^m - R^f\right]}{\sigma(R^m - R^f)} \frac{1}{R^f}$$

Stochastic Discount Factor

- The SDF is

$$\begin{aligned}\log M_{t+1} &= \log \frac{\partial U_t / \partial C_{t+1}}{\partial U_t / \partial C_t} \\ &= \log \delta - \Delta c_{t+1} + \frac{U_{t+1}}{\theta} - \log E_t \exp\left\{ \frac{U_{t+1}}{\theta} \right\}\end{aligned}$$

- Assess the performance of the model using the HJ volatility bound

$$\sigma(M) \geq \frac{E\left[R^m - R^f\right]}{\sigma\left(R^m - R^f\right)} \frac{1}{R^f}$$

Stochastic Discount Factor

- The SDF is

$$\begin{aligned} \log M_{t+1} &= \log \frac{\partial U_t / \partial C_{t+1}}{\partial U_t / \partial C_t} \\ &= \log \delta - \Delta c_{t+1} + \frac{U_{t+1}}{\theta} - \log E_t \exp \left\{ \frac{U_{t+1}}{\theta} \right\} \end{aligned}$$

- Assess the performance of the model using the HJ volatility bound

$$\sigma(M) \geq \frac{E\left[R^m - R^f\right]}{\sigma(R^m - R^f)} \frac{1}{R^f}$$

- Volatile Utility $\Rightarrow$ Volatile SDF!

Stochastic Discount Factor

- The SDF is

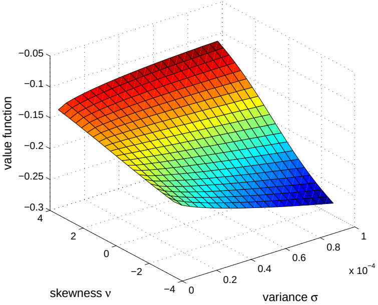
$$\begin{aligned}\log M_{t+1} &= \log \frac{\partial U_t / \partial C_{t+1}}{\partial U_t / \partial C_t} \\ &= \log \delta - \Delta c_{t+1} + \frac{U_{t+1}}{\theta} - \log E_t \exp \left\{ \frac{U_{t+1}}{\theta} \right\}\end{aligned}$$

- Assess the performance of the model using the HJ volatility bound

$$\sigma(M) \geq \frac{E\left[R^m - R^f\right]}{\sigma(R^m - R^f)} \frac{1}{R^f}$$

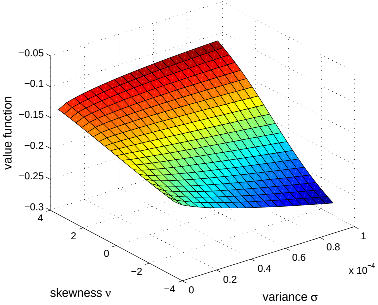
- Volatile Utility $\Rightarrow$ Volatile SDF!
- How much do time-varying volatility and skewness matter?

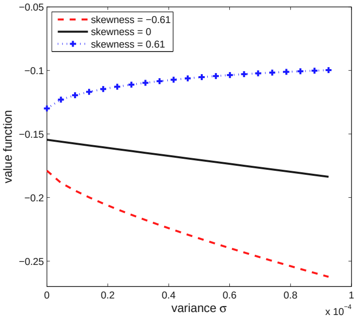
Utility Function



- Time-varying skewness amplifies the uncertainty of lifetime utility

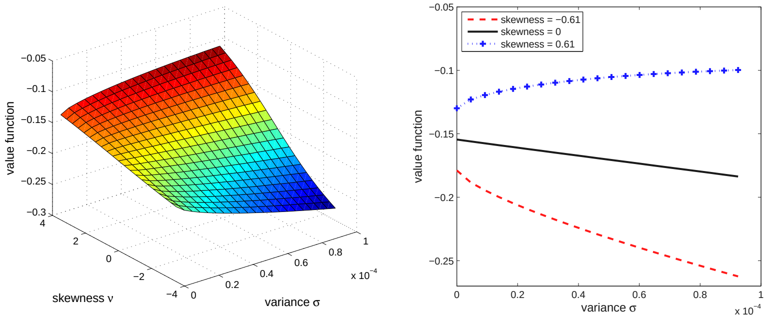
Utility Function





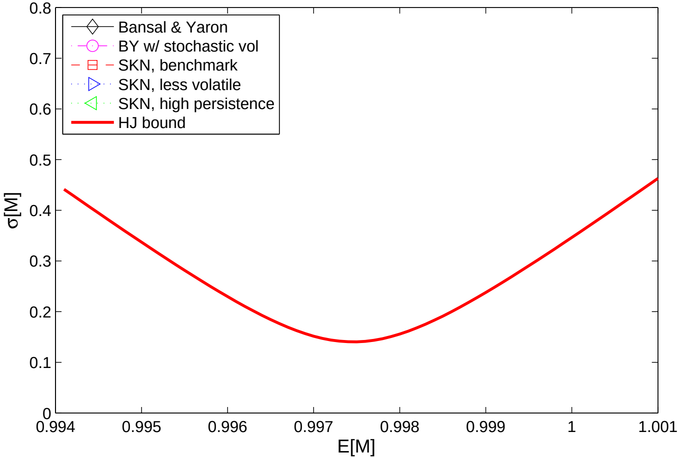
- Time-varying skewness amplifies the uncertainty of lifetime utility
- Skewness interacts with variance:
  $\rightarrow$ high variance is welfare increasing with positive skewness
  $\rightarrow$ high variance is welfare decreasing with negative skewness

Utility Function

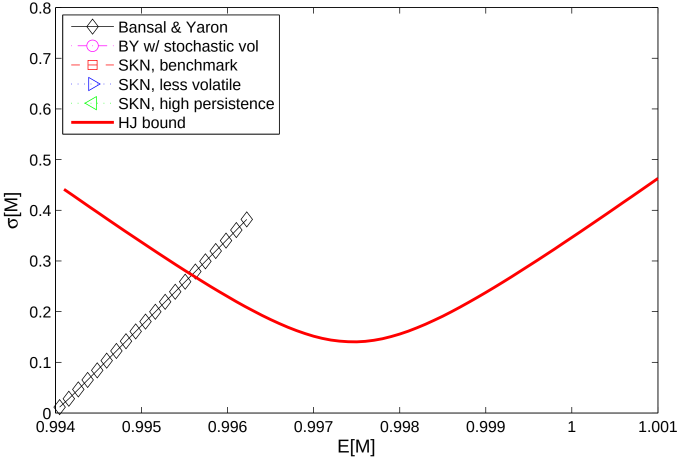


- Time-varying skewness amplifies the uncertainty of lifetime utility
- Skewness interacts with variance:
  $\rightarrow$ high variance is welfare increasing with positive skewness
  $\rightarrow$ high variance is welfare decreasing with negative skewness
- Black line is (roughly) the case of an economy with zero skewness

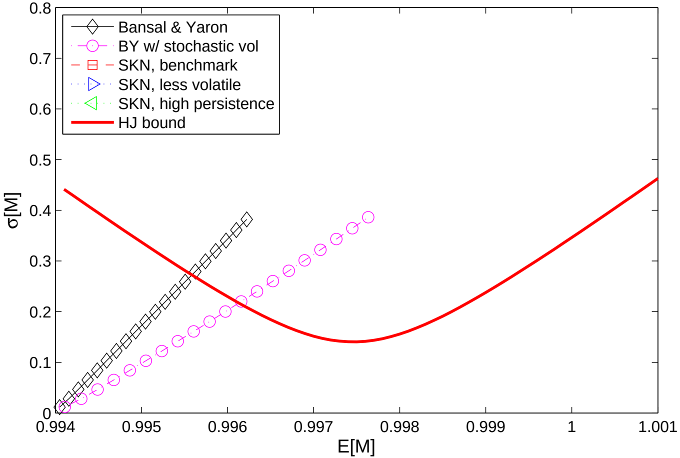
Hansen-Jagannathan Bounds



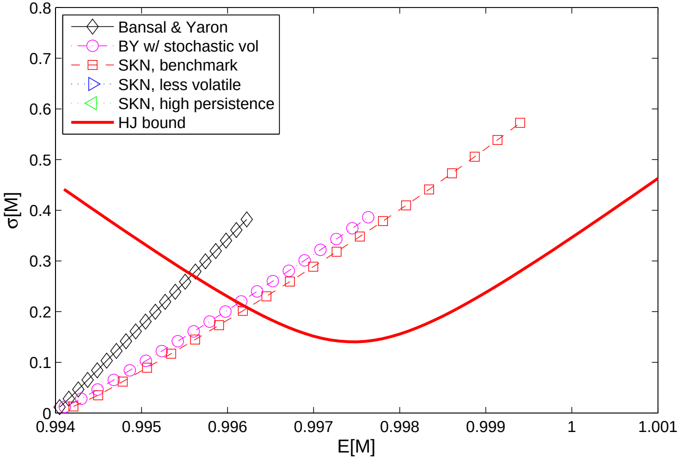
Hansen-Jagannathan Bounds



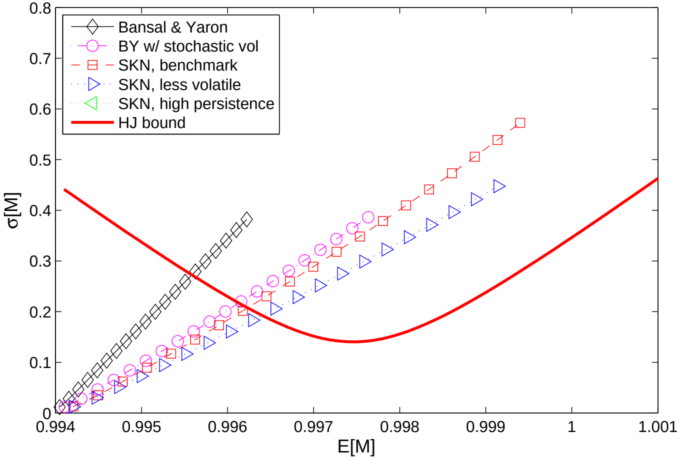
Hansen-Jagannathan Bounds



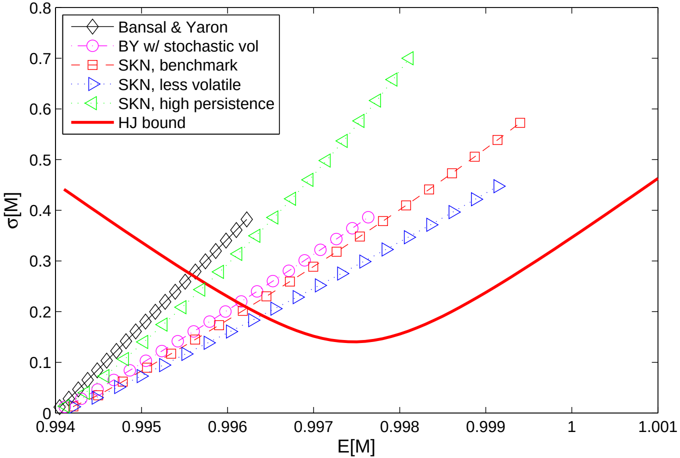
Hansen-Jagannathan Bounds



Hansen-Jagannathan Bounds



Hansen-Jagannathan Bounds



Entropy bound

- Backus, Chernov, and Zin (2012) define the conditional entropy of the pricing kernel as:

$$L_t\left(M_{t+1}\right) = logE_t M_{t+1} - E_t \log M_{t+1}$$

- A measure of dispersion: if M is log-normal, then it boils down to the variance

Entropy bound

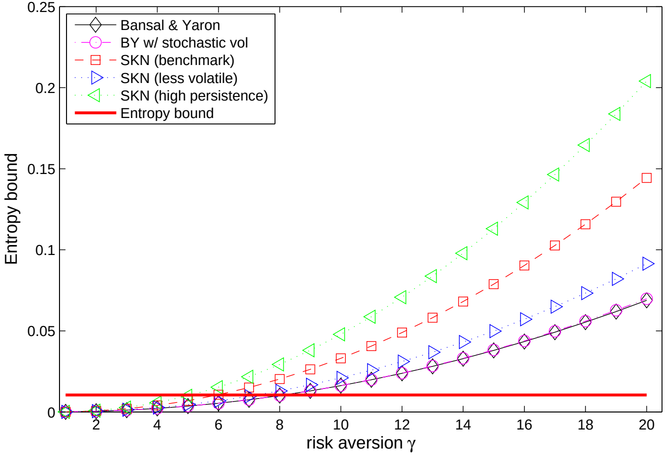
- Backus, Chernov, and Zin (2012) define the conditional entropy of the pricing kernel as:

$$L_t\left(M_{t+1}\right) = logE_t M_{t+1} - E_t \log M_{t+1}$$

- A measure of dispersion: if M is log-normal, then it boils down to the variance
- They show that, together with the Euler equation, it leads to the entropy bound:

$$EL\left(M_{t+1}\right) \quad \geq \quad E\left(\log R_{t+1} - r_{f,t}\right)$$

Entropy bound (cont'd)



Equity returns

→ Look at a claim to levered consumption: $\Delta d_{t+1} = \lambda \Delta c_{t+1}$

Equity returns

→ Look at a claim to levered consumption: $\Delta d_{t+1} = \lambda \Delta c_{t+1}$

	Data	No Skew	Benchmark	Volatile Skew
$E[r_t^d - r_t^f]$	6.33			
$\sigma[r_t^d - r_t^f]$	19.4			
$E[r_t^f]$	1.16			
$\sigma[r_t^f]$	1.89			
$E[p/d]$	3.30			
$\sigma[p/d]$	0.31			
$AC_1[p/d]$	0.87			

Equity returns

→ Look at a claim to levered consumption: $\Delta d_{t+1} = \lambda \Delta c_{t+1}$

	Data	No Skew	Benchmark	Volatile Skew
$E[r_t^d - r_t^f]$	6.33	2.89		
$\sigma[r_t^d - r_t^f]$	19.4	9.30		
$E[r_t^f]$	1.16	1.89		
$\sigma[r_t^f]$	1.89	1.37		
$E[p/d]$	3.30	4.47		
$\sigma[p/d]$	0.31	0.09		
$AC_1[p/d]$	0.87	0.521		

Equity returns

$\rightarrow$ Look at a claim to levered consumption: $\Delta d_{t+1} = \lambda \Delta c_{t+1}$

	Data	No Skew	Benchmark	Volatile Skew
$E[r_t^d - r_t^f]$	6.33	2.89	7.80	
$\sigma[r_t^d - r_t^f]$	19.4	9.30	16.0	
$E[r_t^f]$	1.16	1.89	1.89	
$\sigma[r_t^f]$	1.89	1.37	2.22	
$E[p/d]$	3.30	4.47	2.82	
$\sigma[p/d]$	0.31	0.09	0.17	
$AC_1[p/d]$	0.87	0.521	0.52	

Equity returns

→ Look at a claim to levered consumption: $\Delta d_{t+1} = \lambda \Delta c_{t+1}$

	Data	No Skew	Benchmark	Volatile Skew
$E[r_t^d - r_t^f]$	6.33	2.89	7.80	8.83
$\sigma[r_t^d - r_t^f]$	19.4	9.30	16.0	18.2
$E[r_t^f]$	1.16	1.89	1.89	1.89
$\sigma[r_t^f]$	1.89	1.37	2.22	2.44
$E[p/d]$	3.30	4.47	2.82	2.66
$\sigma[p/d]$	0.31	0.09	0.17	0.19
$AC_1[p/d]$	0.87	0.521	0.52	0.50

Sensitivity Analysis

	Sharpe Ratios	Consumption Volatility	Consumption AC(1)

Sensitivity Analysis

Sharpe Ratios			Consumption Volatility			Consumption AC(1)		
ρ_ν			ρ_ν			ρ_ν		
0.80	0.82	0.86	0.80	0.82	0.86	0.80	0.82	0.86

Sensitivity Analysis

		Sharpe Ratios			Consumption Volatility			Consumption AC(1)		
		ρ_ν			ρ_ν			ρ_ν		
		0.80	0.82	0.86	0.80	0.82	0.86	0.80	0.82	0.86
	0.20									
$\sqrt{\sigma_\nu}$	0.47									
	0.60									
No Skew			36.00			2.32			0.40	

Sensitivity Analysis

		Sharpe Ratios			Consumption Volatility			Consumption AC(1)		
		ρ_ν			ρ_ν			ρ_ν		
		0.80	0.82	0.86	0.80	0.82	0.86	0.80	0.82	0.86
	0.20	41.00	42.19	45.50	2.48 [2.03, 2.94]	2.53 [2.03, 2.94]	2.65 [2.03, 2.94]	0.45 [0.28, 0.63]	0.47 [0.28, 0.65]	0.49 [0.32, 0.67]
$\sqrt{\sigma_\nu}$	0.47	51.62	54.40	62.27	2.88 [2.31, 3.45]	3.00 [2.39, 3.61]	3.28 [2.58, 3.98]	0.54 [0.38, 0.71]	0.56 [0.39, 0.73]	0.61 [0.45, 0.78]
	0.60	55.79	59.07	68.15	3.05 [2.44, 3.67]	3.19 [2.51, 3.86]	3.50 [2.75, 4.26]	0.57 [0.41, 0.73]	0.59 [0.43, 0.75]	0.64 [0.49, 0.79]
No Skew			36.00			2.32			0.40	

- Sharpe Ratios increase between 15% and 90%

Sensitivity Analysis

		Sharpe Ratios			Consumption Volatility			Consumption AC(1)		
		ρ_ν			ρ_ν			ρ_ν		
		0.80	0.82	0.86	0.80	0.82	0.86	0.80	0.82	0.86
$\sqrt{\sigma_\nu}$	0.20	41.00	42.19	45.50	2.48 [2.03, 2.94]	2.53 [2.03, 2.94]	2.65 [2.03, 2.94]	0.45 [0.28, 0.63]	0.47 [0.28, 0.65]	0.49 [0.32, 0.67]
	0.47	51.62	54.40	62.27	2.88 [2.31, 3.45]	3.00 [2.39, 3.61]	3.28 [2.58, 3.98]	0.54 [0.38, 0.71]	0.56 [0.39, 0.73]	0.61 [0.45, 0.78]
	0.60	55.79	59.07	68.15	3.05 [2.44, 3.67]	3.19 [2.51, 3.86]	3.50 [2.75, 4.26]	0.57 [0.41, 0.73]	0.59 [0.43, 0.75]	0.64 [0.49, 0.79]
No Skew			36.00			2.32			0.40	

- Sharpe Ratios increase between 15% and 90%
- Consumption dynamics impose discipline on the model

Predicting returns

E[growth]
V[growth]
S[growth]
cay
default
term pr.
DP

Predicting returns

	Model
E[growth]	-0.051 [0.003]
V[growth]	0.009 [0.003]
S[growth]	-0.067 [0.003]
cay	-
default	-
term pr.	-
DP	-

Predicting returns

	Model	[1]	[2]	[3]	[4]	[5]	[6]
E[growth]	-0.051 [0.003]	-0.182 [0.079]	-	-	-0.170 [0.083]	-0.178 [0.085]	-0.172 [0.086]
V[growth]	0.009 [0.003]	-	0.093 [0.085]	-	- -	0.039 [0.081]	0.034 [0.091]
S[growth]	-0.067 [0.003]	-	-	-0.104 [0.062]	-0.115 [0.061]	-0.114 [0.060]	-0.115 [0.058]
cay	-	-	-	-	-	-	0.094 [0.088]
default	-	-	-	-	-	-	-0.008 [0.069]
term pr.	-	-	-	-	-	-	0.193 [0.097]
DP	-	-	-	-	-	-	0.136 [0.129]

Predicting returns

Livingston Data Only

	[1]	[2]	[3]	[4]	[5]	[6]
E[growth]	-0.164 [0.082]	-	-	-0.168 [0.082]	-0.155 [0.086]	-0.156 [0.089]
V[growth]	-	0.102 [0.088]	-	-	0.062 [0.086]	0.082 [0.104]
S[growth]	-	-	-0.047 [0.101]	-0.059 [0.102]	-0.052 [0.103]	-0.067 [0.089]
cay	-	-	-	-	-	0.196 [0.103]
default	-	-	-	-	-	-0.007 [0.078]
term pr.	-	-	-	-	-	0.202 [0.103]
DP	-	-	-	-	-	0.125 [0.125]

Predicting returns

Livingston (cross-sectional size > 20) + Blue Chips

	[1]	[2]	[3]	[4]	[5]	[6]
E[growth]	-0.152 [0.083]	-	-	-0.175 [0.082]	-0.164 [0.093]	-0.166 [0.098]
V[growth]	-	0.102 [0.089]	-	-	0.032 [0.089]	0.025 [0.109]
S[growth]	-	-	-0.123 [0.062]	-0.151 [0.060]	-0.148 [0.061]	-0.145 [0.060]
cay	-	-	-	-	-	0.201 [0.100]
default	-	-	-	-	-	0.001 [0.085]
term pr.	-	-	-	-	-	0.181 [0.108]
DP	-	-	-	-	-	0.136 [0.126]

Predicting returns

Livingston + Blue Chips (with dummy for returns beyond 2% CI)

	[1]	[2]	[3]	[4]	[5]	[6]
E[growth]	-0.166 [0.091]	-	-	-0.194 [0.091]	-0.160 [0.091]	-0.161 [0.083]
V[growth]	-	0.171 [0.095]	-	-	0.100 [0.091]	0.113 [0.089]
S[growth]	-	-	-0.161 [0.058]	-0.191 [0.057]	-0.180 [0.057]	-0.176 [0.060]
cay	-	-	-	-	-	0.162 [0.083]
default	-	-	-	-	-	0.032 [0.071]
term pr.	-	-	-	-	-	0.173 [0.098]
DP	-	-	-	-	-	0.079 [0.117]

Predicting returns

Livingston + Blue Chips (with dummy for returns beyond 10% CI)

	[1]	[2]	[3]	[4]	[5]	[6]
E[growth]	-0.212 [0.082]	-	-	-0.229 [0.083]	-0.194 [0.082]	-0.173 [0.080]
V[growth]	-	0.186 [0.091]	-	-	0.107 [0.087]	0.056 [0.098]
S[growth]	-	-	-0.090 [0.062]	-0.123 [0.065]	-0.109 [0.064]	-0.104 [0.067]
cay	-	-	-	-	-	0.146 [0.091]
default	-	-	-	-	-	0.068 [0.067]
term pr.	-	-	-	-	-	0.126 [0.102]
DP	-	-	-	-	-	0.164 [0.127]

Predicting volatility

E[growth]
V[growth]
S[growth]
RV_{t-1}

Predicting volatility

	Model
E[growth]	0.021
	[0.003]
V[growth]	0.069
	[0.003]
S[growth]	0.030
	[0.003]
RV_{t-1}	-

Predicting volatility

	Model	[1]	[2]	[3]	[4]	[5]
E[growth]	0.021	-0.132	-0.190	-	-0.140	-0.140
	[0.003]	[0.093]	[0.103]		[0.106]	[0.106]
V[growth]	0.069	0.118	-	0.160	0.085	0.085
	[0.003]	[0.094]		[0.086]	[0.081]	[0.081]
S[growth]	0.030	-	-0.125	-0.084	-0.110	-0.110
	[0.003]		[0.105]	[0.090]	[0.106]	[0.106]
RV_{t-1}	-	-	-	-	-	0.080
						[0.122]

Concluding Remarks

- The **entire distribution** of expected GDP growth rates matters for equity returns

Concluding Remarks

- The **entire distribution** of expected GDP growth rates matters for equity returns
- There is a sizeable skewness premium

Concluding Remarks

- The **entire distribution** of expected GDP growth rates matters for equity returns
- There is a sizeable skewness premium
- Extensions
  - Average skewness is negative: results are almost unaffected, because what matters is the volatility of the skewness and its predictive power for the mean

Concluding Remarks

- The **entire distribution** of expected GDP growth rates matters for equity returns
- There is a sizeable skewness premium
- Extensions
  - Average skewness is negative: results are almost unaffected, because what matters is the volatility of the skewness and its predictive power for the mean
  - Cross-sectional implications: assets whose skewness of expected cash flows' forecasts is more volatile should command larger risk premia
    $\rightarrow$ Cross-section of US equities
    $\rightarrow$ Cross-section of int'l equities