Macroeconomic Crises since 1870 by R.J. Barro and J.F. Ursúa

F. Collard

Prepared for G. Meyer Conference, 1–2 September 2008

Basic Question

- Basic Question: Provide insight on the ability of rare economic disasters to help explain the equity premium puzzle
- Intuition: Taking the risk of catastrophic economic downturns explicitly into account should, for a given level of risk aversion, lead the agent to ask for a better return on risky assets.

Basic Question

- Basic Question: Provide insight on the ability of rare economic disasters to help explain the equity premium puzzle
- Intuition: Taking the risk of catastrophic economic downturns explicitly into account should, for a given level of risk aversion, lead the agent to ask for a better return on risky assets.

This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison's data to consumption $\Longrightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.

This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison's data to consumption $\Longrightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.

This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison's data to consumption $\Longrightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.

This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison's data to consumption $\Longrightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.

This paper

- Extend an earlier study by Barro to a longer time span
- Extend Maddison's data to consumption $\Longrightarrow$ 24 countries from 1870 up to 2006 (36 for GDP)
- Apply peak to trough analysis to identify disasters (both in C and GDP).
- Build on these figures to estimate the size and the probability of occurrence of a disaster.
- Use these estimates in a Lucas tree model with Epstein and Zin preferences to explain the equity premium.

Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920's, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations

Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920's, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations

Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920's, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations

Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920's, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations

Main results

- 95 crises for C, 152 for GDP in the World
- Main World crises: WWII, WWI, Great depression, influenza epidemic of the 1920's, Latin American and Asian financial crises.
- Proba of a disaster: around 3.5%, average size: 21–22%, Average duration: 3.5 years.
- When introduced in a Lucas tree model, these disasters help to account for the equity premium.
- Robust to most perturbations

The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for r^f), IES=0.5, RA=3.5

$$r^e - r^f = 0.05$$

- Disasters are needed for the result

The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for r^f), IES=0.5, RA=3.5

$$r^e - r^f = 0.05$$

- Disasters are needed for the result

The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for r^f), IES=0.5, RA=3.5

$$r^e - r^f = 0.05$$

- Disasters are needed for the result

Standard Model

$g_t = \overline{g} + u_t$ and

$$r^e - r^r = \gamma\sigma^2. \text{ for } \sigma = 0.02 \Longrightarrow \gamma = 125!$$

The role of Disasters

- Benchmark experiment: Epstein and Zin preferences (Just for r^f), IES=0.5, RA=3.5

$$r^e - r^f = 0.05$$

- Disasters are needed for the result

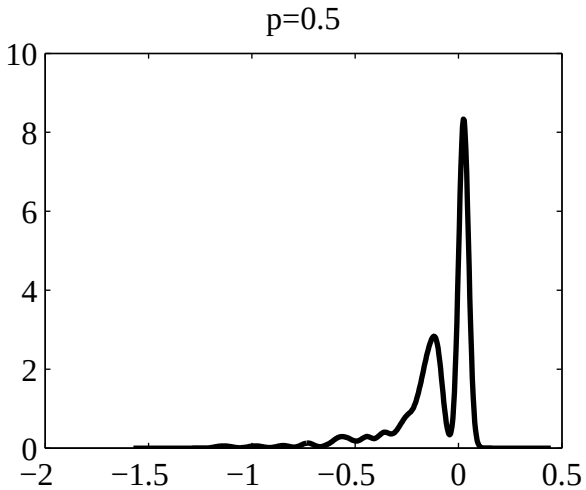
Current Model:

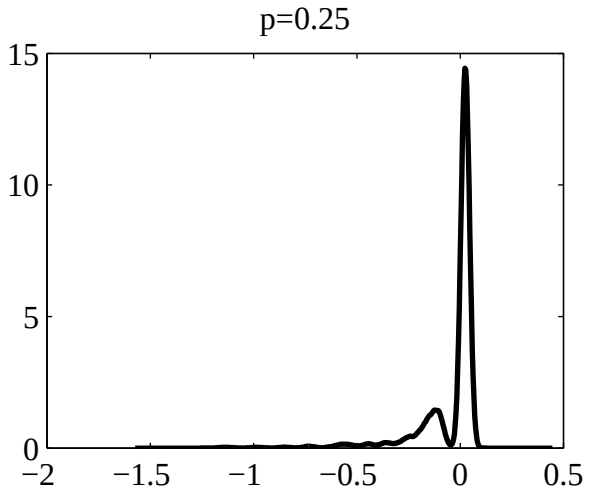
$$g_t = \overline{g} + u_t + v_t \text{ where } v_t = \begin{cases} 0 & \text{with proba } 1-p \\ \log(1-b) & \text{with proba } p \end{cases}$$

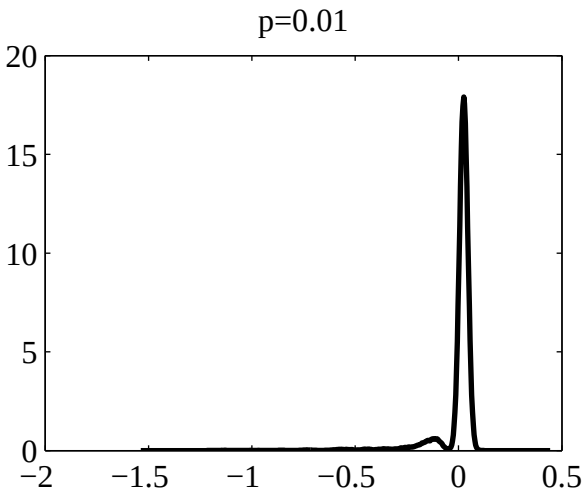
$$r^e - r^r = \underbrace{\gamma\sigma^2}_{\text{Standard Term}} + \underbrace{p\,E(b((1-b)^{-\gamma}-1))}_{\text{Disaster Effect}}$$

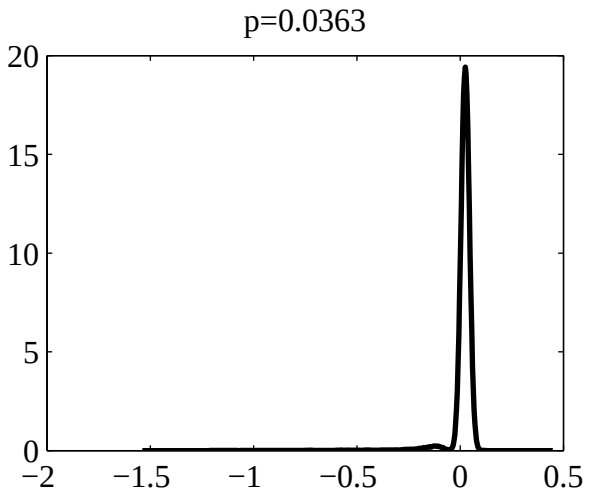
The role of Disasters

A Small Phenomenon?





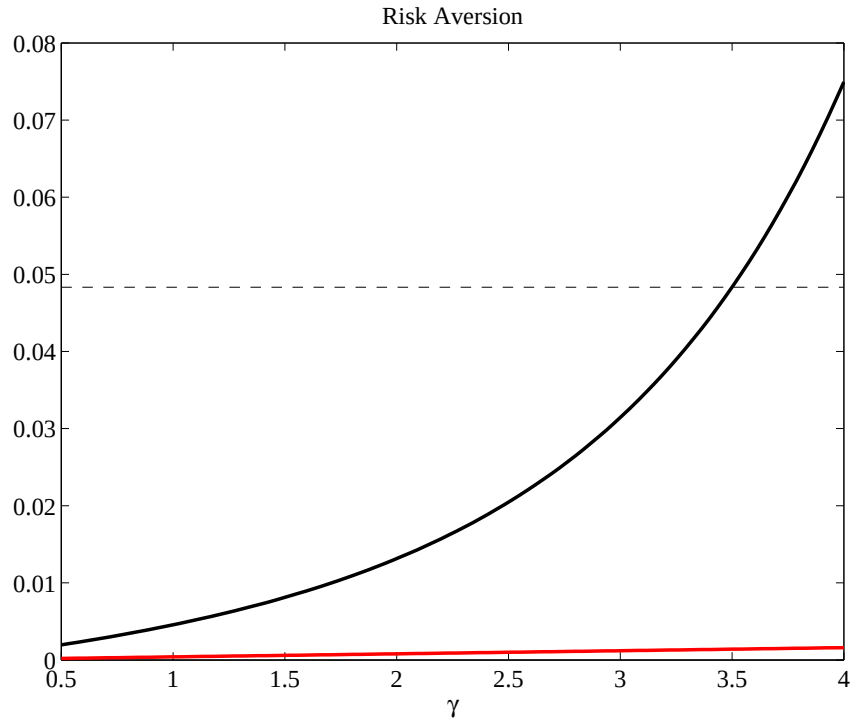




The role of Disasters

Risk Aversion

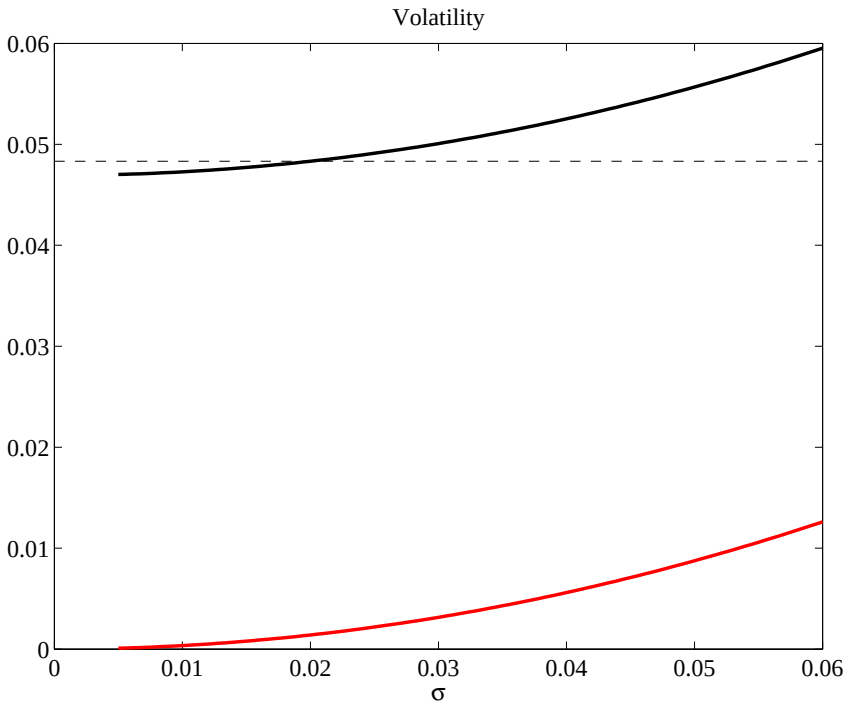
$$r^e - r^r = \gamma\sigma^2 + p\,E(b((1-b)^{-\gamma} - 1))$$



The role of Disasters

Volatility

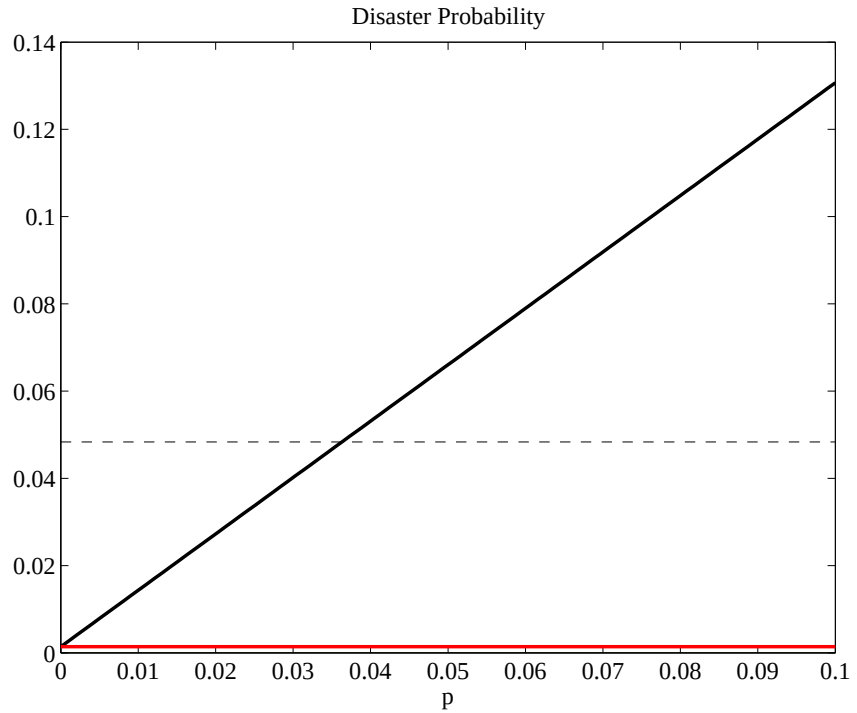
$$r^e - r^r = \gamma\sigma^2 + p\,E(b((1-b)^{-\gamma} - 1))$$



The role of Disasters

Disaster probability

$$r^e - r^r = \gamma\sigma^2 + p\,E(b((1-b)^{-\gamma} - 1))$$



What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%
- Rather "ad hoc"? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same "shock" for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!

What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%
- Rather "ad hoc"? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same "shock" for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!

What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%
- Rather "ad hoc"? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same "shock" for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!

What is a Disaster?

- In this paper a disaster is a contraction of either GDP or C larger than 10%
- Rather "ad hoc"? Why 10%?
- Assume homogeneity of crises across countries.
- Is a 10% contraction the same "shock" for all countries? For instance, the US and Iceland would probably not suffer from a 10% crisis the same way!

What is a Disaster?

- What is a crisis?
- A big negative event?
- or a shock I'm not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
- Should we consider GDP or C crises? Endowment vs production economies.

What is a Disaster?

- What is a crisis?
- A big negative event?
- or a shock I'm not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
- Should we consider GDP or C crises? Endowment vs production economies.

What is a Disaster?

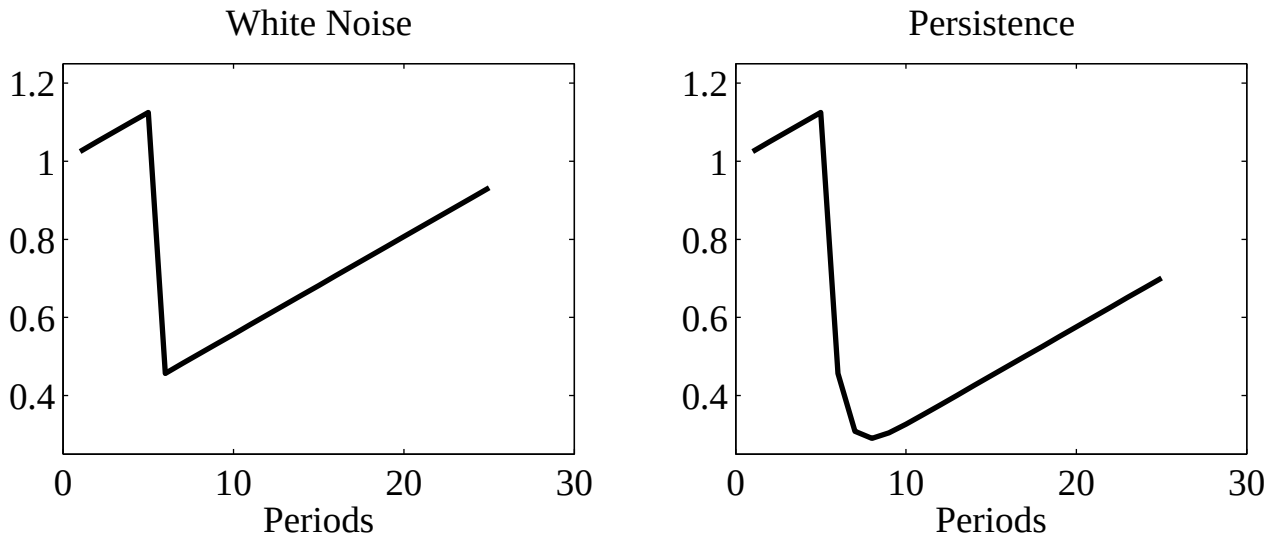
- What is a crisis?
- A big negative event?
- or a shock I'm not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
- Should we consider GDP or C crises? Endowment vs production economies.

What is a Disaster?

- What is a crisis?
- A big negative event?
- or a shock I'm not used to deal with and which therefore leaves me disarmed? In that case, I may be hurt very much by a small shock!
- Should we consider GDP or C crises? Endowment vs production economies.

Role of Persistence

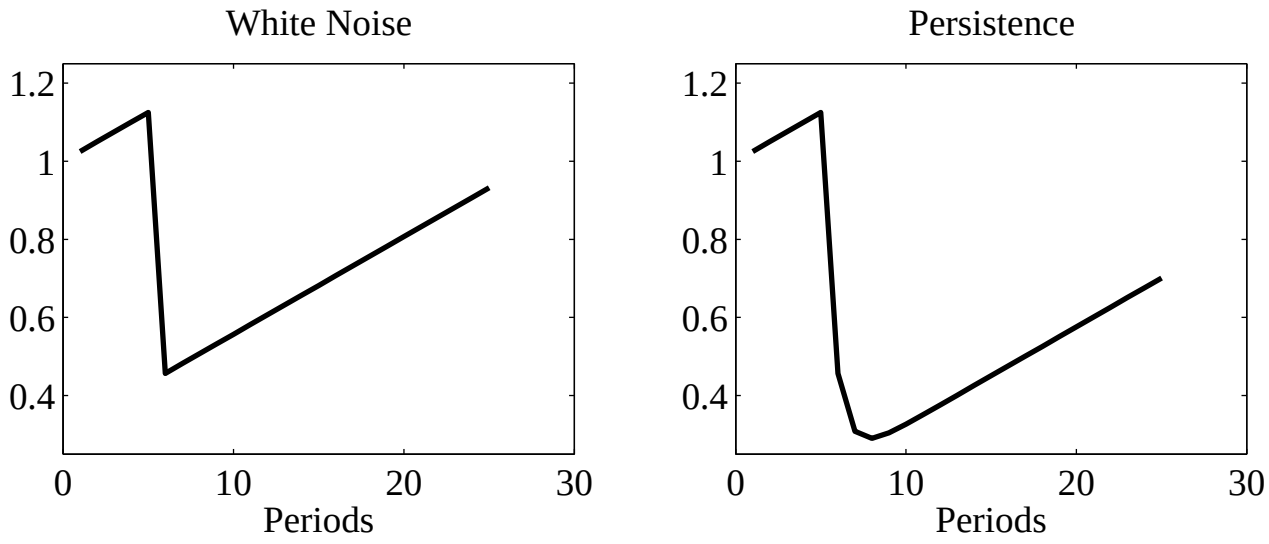
- An Issue raised in the paper



- Investigate this issue

Role of Persistence

- An Issue raised in the paper



- Investigate this issue

Role of Persistence

- A possibility: $g_t = (1-\rho_g)\overline{g} + \rho_g g_{t-1} + u_t + v_t$ where

$$v_t = \begin{cases} 0 & \text{with proba } 1-p \\ \log(1-b) & \text{with proba } p \end{cases}$$

- Deal with standard preferences (I will not look at the risk free rate)

$$E_t\left(\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}(R_{t+1} - R^f_{t+1})\right) = 0$$

- Solve it with minimum weighted residual method
- Simulate the model

Role of Persistence

- A possibility: $g_t = (1-\rho_g)\overline{g} + \rho_g g_{t-1} + u_t + v_t$ where

$$v_t = \begin{cases} 0 & \text{with proba } 1-p \\ \log(1-b) & \text{with proba } p \end{cases}$$

- Deal with standard preferences (I will not look at the risk free rate)

$$E_t\left(\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}(R_{t+1} - R^f_{t+1})\right) = 0$$

- Solve it with minimum weighted residual method
- Simulate the model

Role of Persistence

- A possibility: $g_t = (1-\rho_g)\overline{g} + \rho_g g_{t-1} + u_t + v_t$ where

$$v_t = \begin{cases} 0 & \text{with proba } 1-p \\ \log(1-b) & \text{with proba } p \end{cases}$$

- Deal with standard preferences (I will not look at the risk free rate)

$$E_t\left(\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}(R_{t+1} - R^f_{t+1})\right) = 0$$

- Solve it with minimum weighted residual method
- Simulate the model

Role of Persistence

- A possibility: $g_t = (1-\rho_g)\overline{g} + \rho_g g_{t-1} + u_t + v_t$ where

$$v_t = \begin{cases} 0 & \text{with proba } 1-p \\ \log(1-b) & \text{with proba } p \end{cases}$$

- Deal with standard preferences (I will not look at the risk free rate)

$$E_t\left(\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}(R_{t+1} - R^f_{t+1})\right) = 0$$

- Solve it with minimum weighted residual method
- Simulate the model

Role of Persistence

- Benchmark experiment: $\rho_g = 0.2$, γ is set such that the EP=0.05 ($\gamma = 2.6$);

p	EP
0	0.0028
0.0150	0.0232
0.0363	**0.0504**
0.1000	0.1215

Role of Persistence

- Change persistence (preserving volatility)

ρ_g	EP
0.075	0.0513
0.100	0.0507
0.150	0.0505
0.200	0.0504
0.300	0.0502

- Basically no action!

Role of Persistence

- Change persistence (preserving volatility)

ρ_g	EP
0.075	0.0513
0.100	0.0507
0.150	0.0505
0.200	0.0504
0.300	0.0502

- Basically no action!

Role of Persistence

- Only a numerical exercise
- May get analytical solution for the equity premium (Same as in CRRA):
  Tsionas, E.G., Exact solution of asset pricing models with arbitrary shock distributions, *Journal of Economic Dynamics and Control*, 27(5), 2003, 843-851.

Role of Persistence

- Only a numerical exercise
- May get analytical solution for the equity premium (Same as in CRRA):
  Tsionas, E.G., Exact solution of asset pricing models with arbitrary shock distributions, *Journal of Economic Dynamics and Control*, 27(5), 2003, 843-851.

End of this **Disastrous** Discussion!