Artur Anschukov, Harjoat Bhamra, and Lars-Alexander Kuehn

Leverage Dynamics and Learning about Economic Crises

Discussion by Jaroslav Borovička (NYU)

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Economic / financial crises are characterized by

- large drops in prices of risky assets, associated with increases in risk premia
- persistent effects and slow recoveries

Learning mechanisms alone often have transitory effects

- elevated risk premia when uncertainty about state of the economy is high
- this uncertainty is resolved relatively quickly (once we learn we are in adverse state)

This paper: combination of learning about disasters and leverage effects

Main idea

1) Unobserved Markov state determines intensity of disasters.

2) Investors observe an increased frequency of disasters.

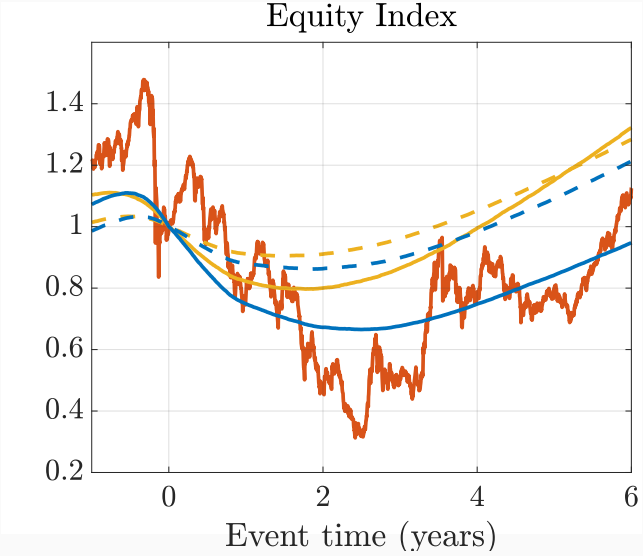
- increase the posterior probability of adverse (high-intensity) Markov state
- price of risk is high when uncertainty about the state is high

3) Disasters also depress firms' cash flows and increase their leverage.

- quantity of risk in the cash flows increases as distance-to-default shrinks

4) Elevated risk premia are driven

- initially driven by an increase in risk prices
- later by an increase in the quantity of cash-flow risk


Equity Index
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2
4
6
Event time (years)
Perfect info. - unlevered
Learning - unlevered
Perfect info. - levered
Learning - levered
Data

Consumption process

$$\frac{dC_t}{C_t} = \mu_c dt + \sigma_c dB_{c,t} + \left(e^{-Z_{c,t}} - 1\right) dN_t$$

- N has unobservable time-varying intensity λ_t, jump $Z_{c,t}$ exponentially distributed

Filtering: posterior probability of high-risk state

$$p_t = P\left(\lambda_t = \lambda_H | \mathcal{F}_t\right)$$

Recursive Duffie–Epstein–Zin preferences

$$J_t = \widetilde{\mathbb{E}}_t \left[\int_t^\infty f(C_s, J_s)\, ds \right]$$

- unitary IES and risk aversion γ

The SDF takes the form

$$\frac{d\pi_t}{\pi_{t-}} = -r(p_{t-})\,dt - \Theta_B dB_{c,t} + [\Theta_J(Z_{c,t}) + \Theta_L(p_{t-}, Z_{c,t})]\,dN_t - \left(\lambda^{\mathbb{Q}}(p_{t-}) - \widetilde{\lambda}(p_{t-})\right)dt$$

- price of Brownian risk $\Theta_B = \gamma\sigma_c$
- price of jump risk $\Theta_J(Z_{c,t}) \approx \gamma Z_{c,t}$
- price of belief uncertainty (requires non-separable preferences)

$$\Theta_L(p_{t-}, Z_{c,t}) \approx -(\gamma - 1)\,\sigma_P(p_{t-})\,V'(p_t)\,[1 + \Theta_J(Z_{c,t})]$$

Real earnings process for firm k

$$\frac{dX_{k,t}}{X_{k,t-}} = \mu_x dt + \sigma_x^{id} dB_{x,k,t} + \sigma_x^{sys} dB_{x,t} + \left(e^{-Z_{k,t}} - 1\right) dN_t - dN_{k,t}$$

- systematic cash flow jump arrivals perfectly correlated with consumption jumps
- Brownian shock B_x correlated with B_c but pricing implications are trivial
- additional idiosyncratic jumps and Brownian shocks to fit cross-sectional distributions

Given fixed perpetual coupon c_k, the value of levered equity is

$$S_{k,t} = (1-\eta) \sup_{\tau_{D,k} \geq t} \widetilde{\mathbb{E}}_t \left[\int_t^{\tau_{D,k}} \frac{\pi_u}{\pi_t} (X_{k,u} - c_k)\, du \right].$$

- optimal default stopping time $\tau_{D,k}$

Optimal coupon c_k determined at firm creation to maximize firm value net of debt issuance costs.

- optimal coupon decreasing in the probability of the high-risk state p_0 at firm creation
- optimal default threshold increasing in p_t

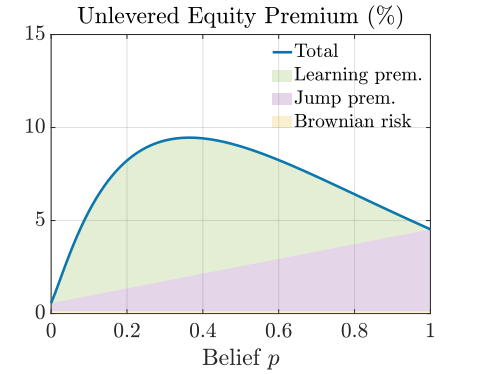
Exogenous firm destruction (and replacement) guarantees a stationary firm distribution.

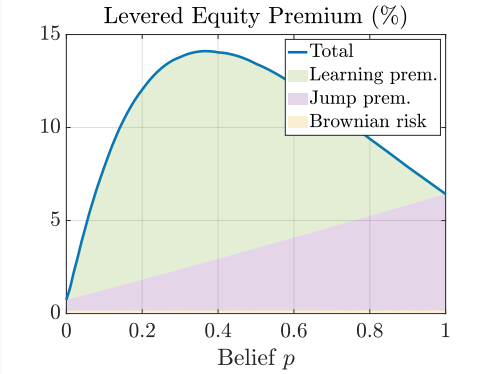
The modeling part is conceptually straightforward.

- exogenous SDF for the pricing of heterogeneous levered cash flows

Emphasis on empirical fit.

- consumption process fits frequency and magnitude of disasters
- cash flow processes fit excess returns, leverage, CDX rates
- particular attention to physical default risk and its pricing


Unlevered Equity Premium (%)
15
10
5
0
0
0.2
0.4
0.6
0.8
1
Belief p
Total
Learning prem.
Jump prem.
Brownian risk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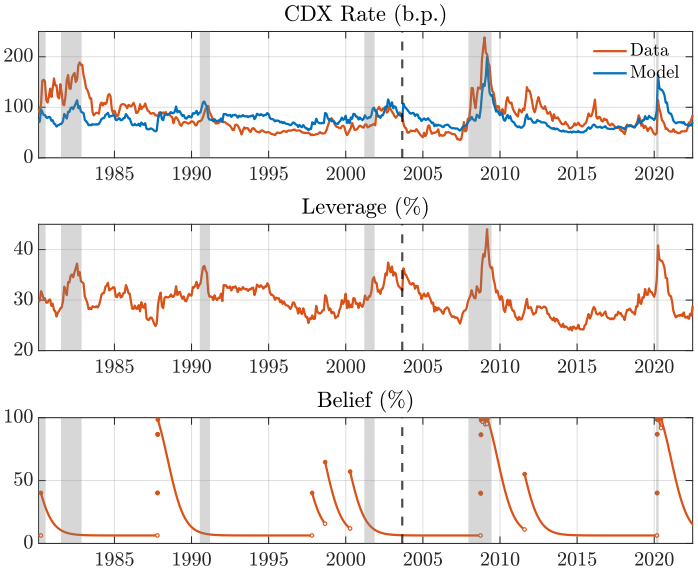
Experiment - Great Depression



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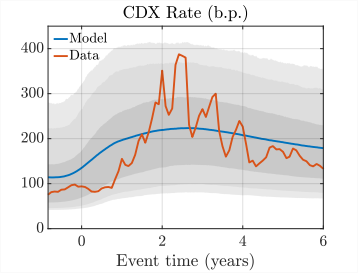

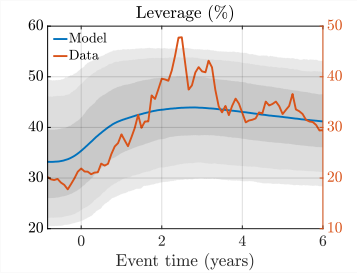

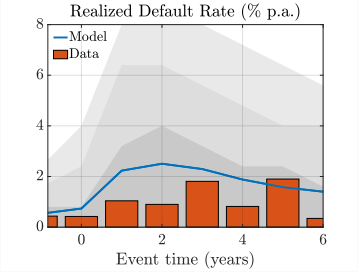

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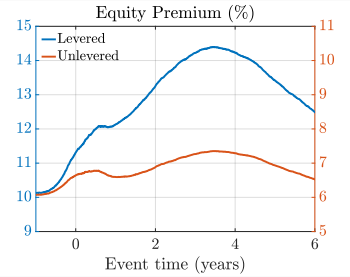

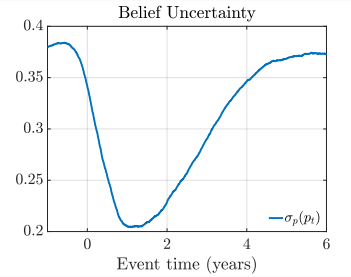

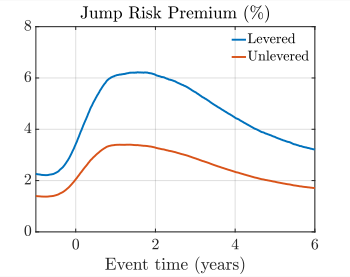

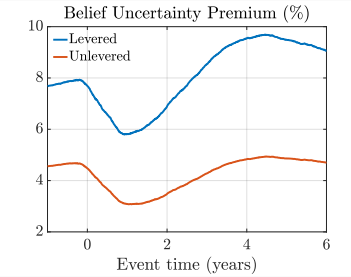

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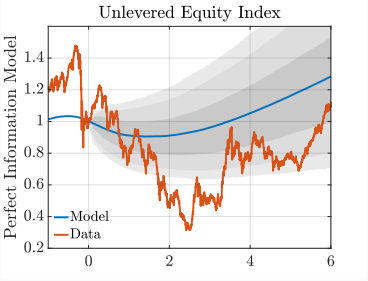
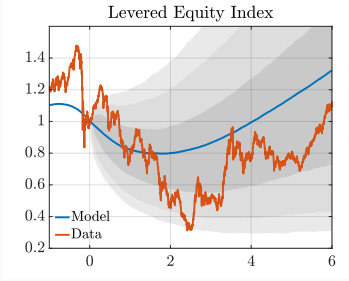
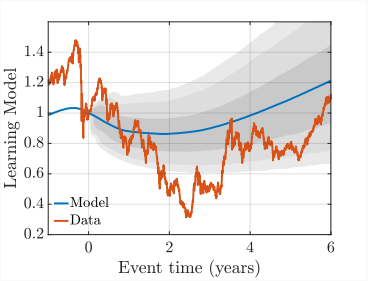
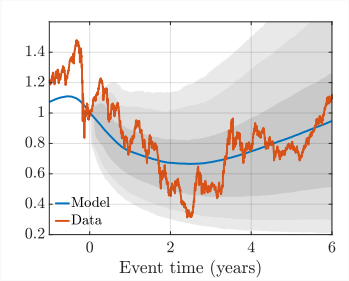


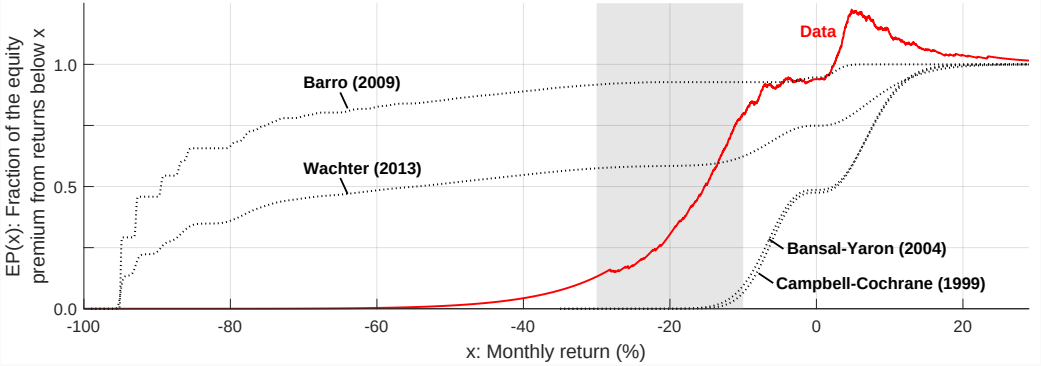






1) Dissecting the equity premium

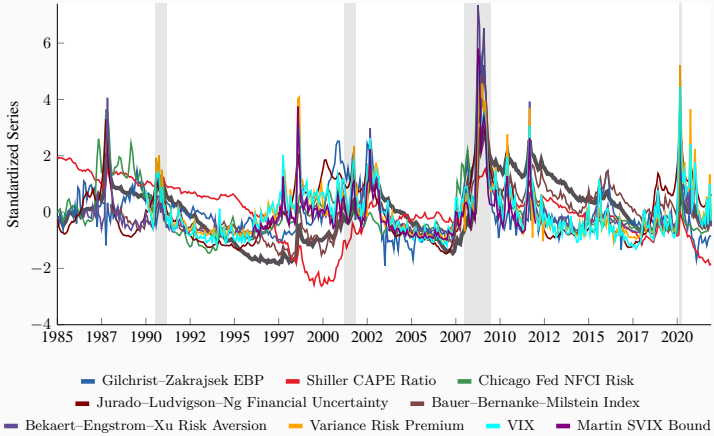
- paper emphasizes careful modeling of evolution of crises
- Beason and Schreindorfer (2022) emphasize that most of the equity premium is generated by 'intermediate' disasters
- how does the model do here?



2) How persistent are risk premia in typical recessions / financial crises?

- In many episodes, increases in proxies for risk premia are more transitory (Meeuwis et al. (2024))

Figure A.1: Time-Varying Risk Premia in the Data



3) Should we expect this mechanism to fit all of the decline during Great Depression?

- effects of monetary policy, debt deflation?
- what else is missing?
- is the linear projection a good way how extend the CDX data to the Great Depression?
- why learning from consumption disasters (apart from the connection to the literature?)

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4) How to interpret the fit of the observed trajectory within an IRF 'fan chart'?

- the fan chart is not a confidence interval for the path in a meaningful sense

Summary

Well executed paper with a clear mechanism

- attention to careful calibration of firms' cash flows
- interesting (and ambitious) Great Depression experiment

Think about

- alternative ways how to assess the asset pricing implications
- how to isolate the learning-leverage mechanism from everything else that happened during the Great Depression

Appendix

Beason, Tyler and David Schreindorfer. 2022. "Dissecting the Equity Premium." *Journal of Political Economy* 130 (8):2203–2222.

Meeuwis, Maarten, Dimitris Papanikolaou, Jonathan Rothbaum, and Lawrence D. W. Schmidt. 2024. "Time-Varying Risk Premia and Heterogeneous Labor Market Dynamics."