DISASTER RISK AND BUSINESS CYCLES
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Discussed by Urban Jermann

Contribution

- Introduces *Time-varying Disaster Risk* into *Real Business Cycle* model
- Analytical results
- Quantitative findings:
  - Calibrated model matches key asset pricing and business cycle moments:
    - Unconditional moments for stock market and risk-free rate
    - Predictability regressions
    - Std($\Delta Y, \Delta I, \Delta C, \Delta N$) and Corr($\Delta Y, [\Delta I, \Delta C, \Delta N]$)
  - Disaster probability shocks measured to match actual P/D ratios produce reasonable business cycles

Model

$$W\left(K,z,p\right)=$$

$$\max_{C,I,N}\left\{\left(C^{\upsilon}\left(1-N\right)^{1-\upsilon}\right)^{1-\gamma}+\beta\left(E_{p',\varepsilon',x'}W\left(K',z',p'\right)^{\frac{1-\theta}{1-\gamma}}\right)^{\frac{1-\gamma}{1-\theta}}\right\}$$

s.t.:

$$C+I=z^{1-\alpha}K^{\alpha}N^{1-\alpha}$$

$$K'=\left(\left(1-\delta\right)K+\phi\left(\tfrac{I}{K}\right)K\right)\left(1-x'b_k\right)$$

$$\log z'=\log z+\mu+\sigma\varepsilon'+x'\log\left(1-b_{tfp}\right)$$

Analytical results

1. With $b_k = b_{tfp}$, a disaster leads to equal declines in K, Y, C and I, with N unchanged. (Also in Gabaix)
2. With $b_k = b_{tfp}$ economy with disasters is the same as one without disasters with different and time–varying discount factor

$$\beta^* = \beta \left(1 - p + p\left(1 - b_{tfp}\right)^{\upsilon(1-\theta)}\right)^{\frac{1-\gamma}{1-\theta}}$$

(as long as no disaster is realized)

Quantitative results 1

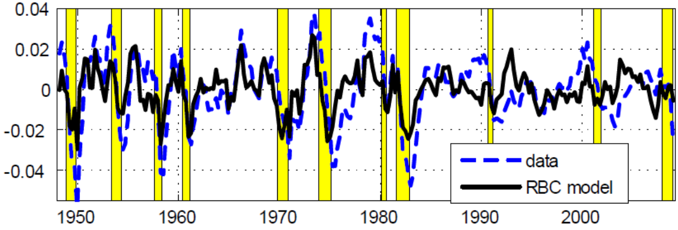
	$E\left(R_{e,lev} - R_b\right)$	$E\left(R_b\right)$	$\sigma\left(R_{e,lev}\right)$	$\sigma\left(R_b\right)$
Data	1.70	0.21	8.14	0.81
No disaster	0.03	0.71	1.59	0.04
Benchmark	1.51	0.42	7.14	0.85

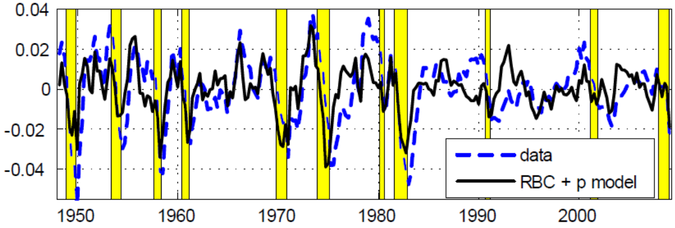
	$\frac{\sigma(\Delta \log C)}{\sigma(\Delta \log Y)}$	$\frac{\sigma(\Delta \log I)}{\sigma(\Delta \log Y)}$	$\frac{\sigma(\Delta \log N)}{\sigma(\Delta \log Y)}$	$\sigma(\Delta \log Y)$	$\rho_{C,Y}$	$\rho_{I,Y}$	$\rho_{N,Y}$	$\rho_{I,C}$
Data	0.57	2.68	0.92	0.98	0.45	0.68	0.71	0.49
No disaster	0.66	1.86	0.24	0.78	1.00	1.00	0.99	0.99
Benchmark	0.73	3.03	0.54	0.83	0.66	0.85	0.72	0.21

Quantitative results 2

1. D/P forecasts excess returns and dividend growth at 4 quarters with similar $\mathrm{R}^2 s$ as in the data
2. $Cov\left(\tilde{y}_t, R^e_{t+k} - R^f_{t+k}\right)$ matches roughly the data
3. VAR evidence of relationship between VIX and GDP matches roughly the data
4. $Cov\left(i_{t+k}, \log\left(P_t/D_t\right)\right)$ matches roughly the data
5. IES estimated with model data is 0.38 (IES is 2 in the model)

output


0.04
0.02
0
-0.02
-0.04
1950
1960
1970
1980
1990
2000
data
RBC model


0.04
0.02
0
-0.02
-0.04
1950
1960
1970
1980
1990
2000
data
RBC + p model

Definition of dividends in the model

- "Benchmark"

$$D_t = Y_t^{\lambda}, \qquad \text{with } \lambda = 2$$

- Unlevered payout to capital stock

$$D_t^{unlev} = Y_t - w_t N_t - I_t = \alpha Y_t - I_t, \qquad \text{with } \alpha = .34$$

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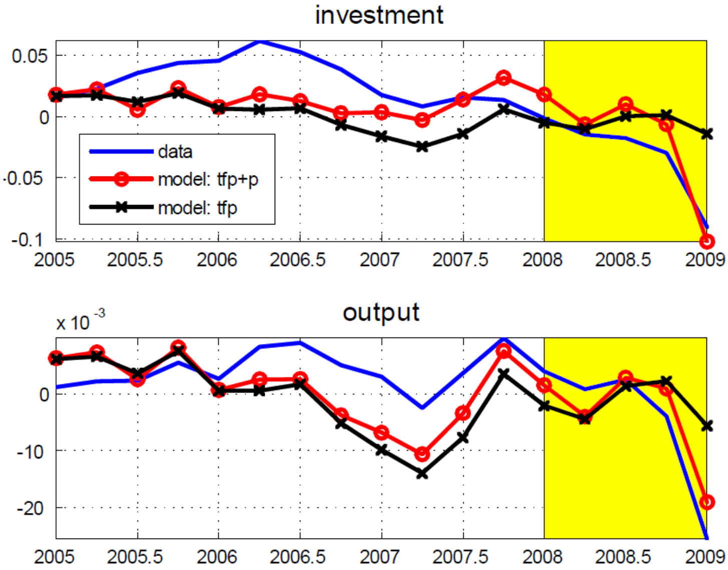
	$E\left(R_{e,lev} - R_b\right)$	$\sigma\left(R_{e,lev}\right)$
Data	1.70	8.14
Benchmark, $D_t = Y_t^{\lambda}$	1.51	7.14
$D_t^{unlev} = \alpha Y_t - I_t$	0.46	0.4

Possible solutions

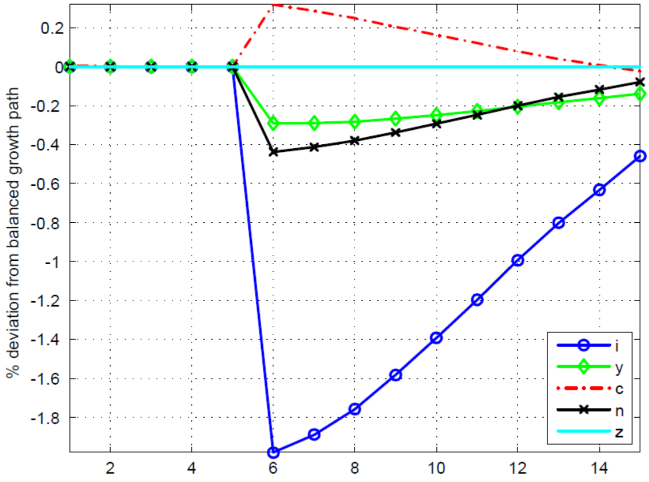
$$D_t^{unlev} = Y_t - w_t N_t - I_t = \alpha Y_t - I_t$$

Capital adjustment cost
Explicit financial leverage
Operational leverage (Gourio (2007), Danthine and Donaldson (2002))

2008/2009 Recession

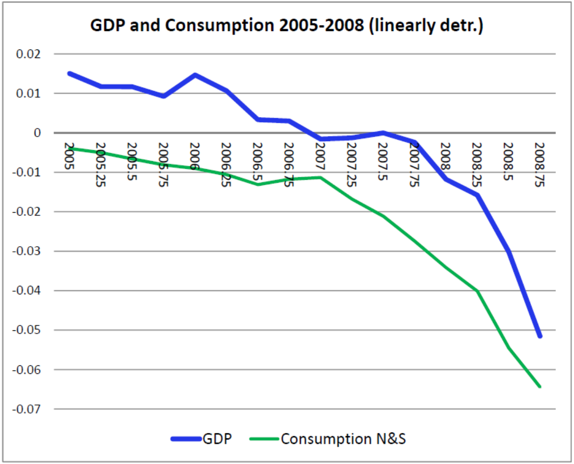


Responses to a shock in the disaster probability



$$Y \equiv z^{1-\alpha} K^{\alpha} N^{1-\alpha} = C + I$$

$$\underbrace{-\frac{u_N\left(C,N\right)}{u_C\left(C,N\right)}}_{\text{Labor Supply}} = w_t = \underbrace{F_N\left(z,K,N\right)}_{\text{Labor Demand}}$$

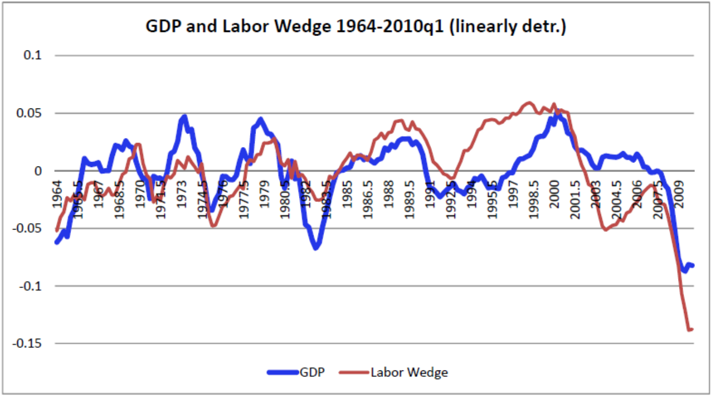

GDP and Consumption 2005-2008 (linearly detr.)
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
2005
2005.25
2005.5
2005.75
2006
2006.25
2006.5
2006.75
2007
2007.25
2007.5
2007.75
2008
2008.25
2008.5
2008.75
GDP
Consumption N&S

Labor efficiency wedge

$$-\frac{u_N(C,N)}{u_C(C,N)} = F_N(z,K,N)\cdot X$$

$$X = (1-\tau)$$

$$-\frac{u_N(C,N)}{u_C(C,N)} = (1-\alpha)\frac{Y}{N}\cdot X$$


GDP and Labor Wedge 1964-2010q1 (linearly detr.)
0.1
0.05
0
-0.05
-0.1
-0.15
1964
1965.5
1967
1968.5
1970
1971.5
1973
1974.5
1976
1977.5
1979
1980.5
1982
1983.5
1985
1986.5
1988
1989.5
1991
1992.5
1994
1995.5
1997
1998.5
2000
2001.5
2003
2004.5
2006
2007.5
2009
GDP
Labor Wedge

Potential drivers of labor wedge

- Tax increase
- Countercyclical markups
- Labor search frictions
- Financial frictions

Conclusion

- Very nice paper!
- Work to be done
  - Production models with realistic dividends
  - Richer business cycles