On "Sticky Leverage" by Gomes, Jermann and Schmid

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Overview

Real effects of inflation shocks in a representative agent DSGE model with perfect competition and flexible prices

Elements

- nominal, defaultable debt (expected maturity $\frac{1}{\lambda}$)
- tax advantage of debt (coupon payments $(1-\tau)c$)
- i.i.d. profit shocks $z^j k \Rightarrow$ within-period default heterogeneity
- restructuring (debt-equity swap) under default (real/financial losses $\xi^r \xi k$)
- risk-sharing family of households (like CIA worker-shopper arrangement)

Irving Fisher (1933) meets Stewart Myers (1977)

Debt deflation: Fisher (1933) "The Debt-Deflation Theory of Great Depressions"

- deflation increases real debt, reducing firms' net worth, precipitating bankruptcies and lower output, employment and confidence
- hard to operationalize if debt-deflation is merely a redistribution from debtors to creditors (Bernanke (1995))

Debt overhang: Myers (1977) "Determinants of Corporate Borrowing"

- in event of default, (some) cashflows generated by investment projects accrue to debt holders, not shareholders
- risky debt makes shareholders underinvest - even in good, safe projects

$\Rightarrow$ New theory of debt-deflation recessions via debt-overhang channel

Debt overhang (corporate finance 101)

two-period firm with risky cashflows (no discounting)

- 100 with probability 0.5, and 20 with probability 0.5
- predetermined debt = 50 (due next period)

$$\begin{aligned} \text{equity value:} \quad & S = 0.5(100-50) + 0.5(0) = 25 \\ \text{debt value:} \quad & D = 0.5(50) + 0.5(20) = 35 \\ \text{total firm value:} \quad & S + D = 60 \end{aligned}$$

excellent new investment project on offer

- project pays 15 next period with probability 1; costs 10 now

$$\begin{aligned} \text{equity value if adopt:} \quad & \widetilde{S} = 0.5(115-50) + 0.5(0) = 32.5 \\ \text{debt value if adopt:} \quad & \widetilde{D} = 0.5(50) + 0.5(20+15) = 42.5 \\ \text{total firm value if adopt:} \quad & \widetilde{S} + \widetilde{D} = 75 \end{aligned}$$

- (shareholder) firm rejects project $NPV = (32.5 - 25) - 10 = -2.5$

Dividend stream to shareholders

- Equity value of firm j (limited liability)

$$J_t(k,b,z^j;\mu) = \max\left\{0,\ \underbrace{(1-\tau)[R-z^j]k}_{\text{after-tax operating profit}} - \underbrace{[(1-\tau)c+\lambda]\frac{b}{\mu}}_{\text{coupon+repayment}} + V_t(k,b;\mu)\right\}$$

- Continuation value (to current or new shareholders)

$$V_t(k,b;\mu) = \max_{k',b'}\left[\underbrace{q_t(k',b';\mu)[b'-(1-\lambda)\frac{b}{\mu}]}_{\text{new loans}} - \underbrace{\frac{k'-(1-\delta)k}{k}k}_{\text{invest.}} + \underbrace{\tau\delta k}_{\text{dep. allow.}} + E_t M_{t,t+1}\underbrace{\int_{\underline{z}}^{z^*_{t+1}(k',b';\mu')}}_{\text{debt overhang}} J_{t+1}(k',b',z';\mu')d\Phi(z')\right]$$

Default, restructuring and loan rates

Default triggers costly restructuring (debt/equity swap)

- no coupon/principal collection $[c+\lambda]\frac{b}{\mu}$; run firm $(1-\tau)(R-z)k - \xi k$
- sell shares $V_t(k,b;\mu)$, retain debt $q_t(k,b;\mu)(1-\lambda)\frac{b}{\mu}$ (or vice-versa)
- real losses to household family: $\xi^r \xi k + \tau c$ (ξ^r governs wealth effect)

Equilibrium loans: $q_t(k',b';\mu)b'$

$$= E_t M_{t,t+1} \left[\begin{array}{l} \left[c+\lambda+(1-\lambda)q_{t+1}(h_k(k',b';\mu'),h_b(k',b';\mu');\mu')\right]\frac{b'}{\mu'}\Phi\left(z^*(k',b';\mu')\right) \\ \quad + \int_{z^*_{t+1}(k',b';\mu')}^{\overline{z}} \left[(1-\tau)(R'-z')k' - \xi k' + V_{t+1}(k',b';\mu')\right] d\Phi(z') \\ \quad + \int_{z^*_{t+1}(k',b';\mu')}^{\overline{z}} \left[(1-\lambda)q_{t+1}(h_k(k',b';\mu'),h_b(k',b';\mu');\mu')\frac{b'}{\mu'}\right] d\Phi(z') \end{array} \right]$$

- coupon rate calibrated so $q=1$ for safe debt (amplifies debt overhang?)

Mechanics following a one-period deflation shock

special case where a pure financial shock has no real effects

$\mu \downarrow \Rightarrow$ increased real burden of debt $-[(1-\tau)c + \lambda]\frac{b}{\mu}$

If $\lambda = 1$ and $\xi^r = 0$ and $\mu \sim iid$, there is no debt overhang channel.

- shareholders suffer full loss immediately or default
- smooth debt-equity swap under default (ξk pure cash loss)
- pure transfer of wealth inside a family (no winners/losers)
- end-of-period share values $V_t(k;\mu)$ (irrespective of default)

Here, multi-period debt is essential to drive real effects of financial shock.

Omitted channels driving real effects with short-lived debt

Many models with one-period (real) debt *do* get persistent real effects.

- representative firm: Jermann and Quadrini (2012)
- heterogeneous households: Guerrieri and Lorenzoni (2011)
- heterogenous firms: Buera and Moll (2015), Khan and Thomas (2013)
- heterogeneous firms with default: Arellano, Bai and Kehoe (2012), Shourideh and Zetlin-Jones (2014), Khan, Senga and Thomas (2014)

Various channels are closed off here to focus squarely on debt overhang.

- endogenous TFP effects via misallocation
- endogenous labor wedge
- real production loss and/or firm death under default

Debt overhang channel at work

temporary deflation shock drives persistent damage when maturity exceeds 1

- capital choice

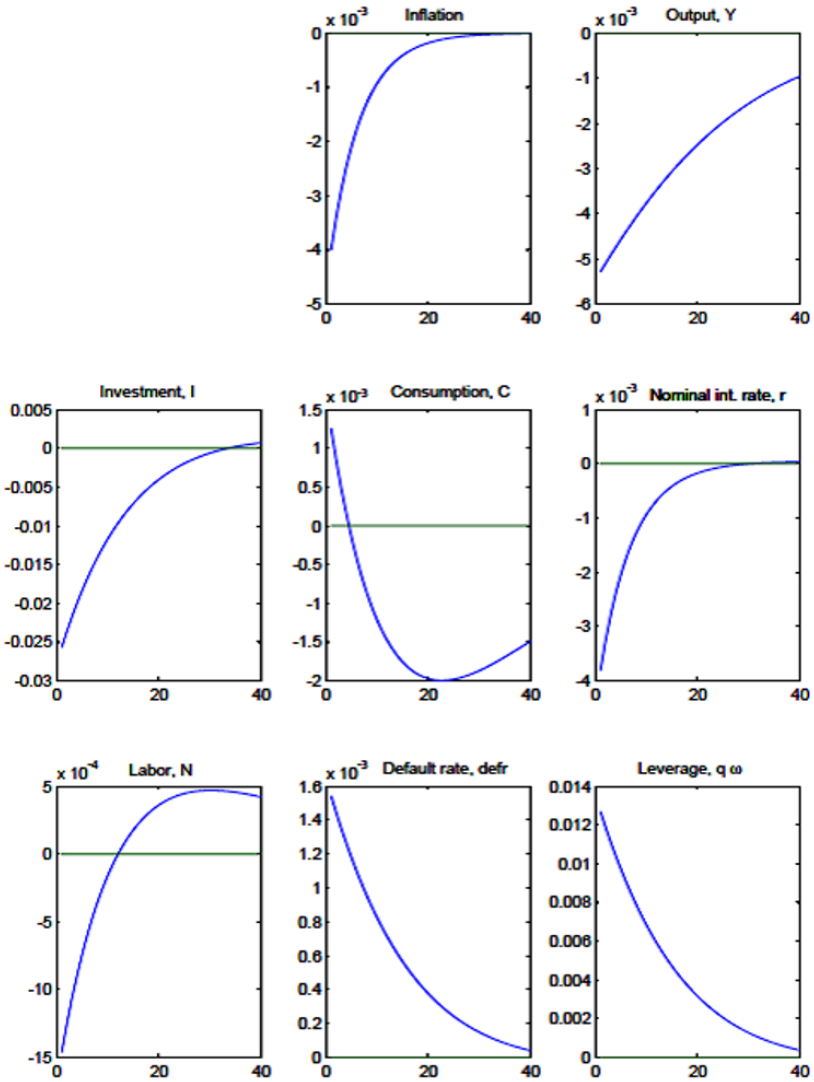
$$1 - \frac{\partial q_t(k', b'; \mu)}{\partial k'}[b' - (1-\lambda)\frac{b}{\mu}]$$
$$= E_t M_{t,t+1} \underbrace{\int_{\underline{z}}^{z^*_{t+1}(k', b'; \mu')}}_{\text{debt overhang}} \Big[(1-\tau)[R' - z'] + \frac{\partial V_{t+1}(k', b'; \mu')}{\partial k'}\Big] d\Phi(z')$$

- debt choice

$$q_t + \underbrace{\frac{\partial q_t(k', b'; \mu)}{\partial b'}}_{\text{sticky leverage}}[b' - (1-\lambda)\frac{b}{\mu}]$$
$$= E_t M_{t,t+1} \int_{\underline{z}}^{z^*_{t+1}(k', b'; \mu')} \Big[\frac{(1-\tau)c + \lambda}{\mu'} - \frac{\partial V_{t+1}(k', b'; \mu')}{\partial b'}\Big] d\Phi(z')$$

where $z^*_{t+1}(k', b', \mu')(1-\tau) = (1-\tau)R' - \frac{b'}{k'\mu'}[(1-\tau)c + \lambda] + V_{t+1}\left(\frac{k'}{b'}; \mu'\right)$

Persistent deflation shock (w/ real default costs)

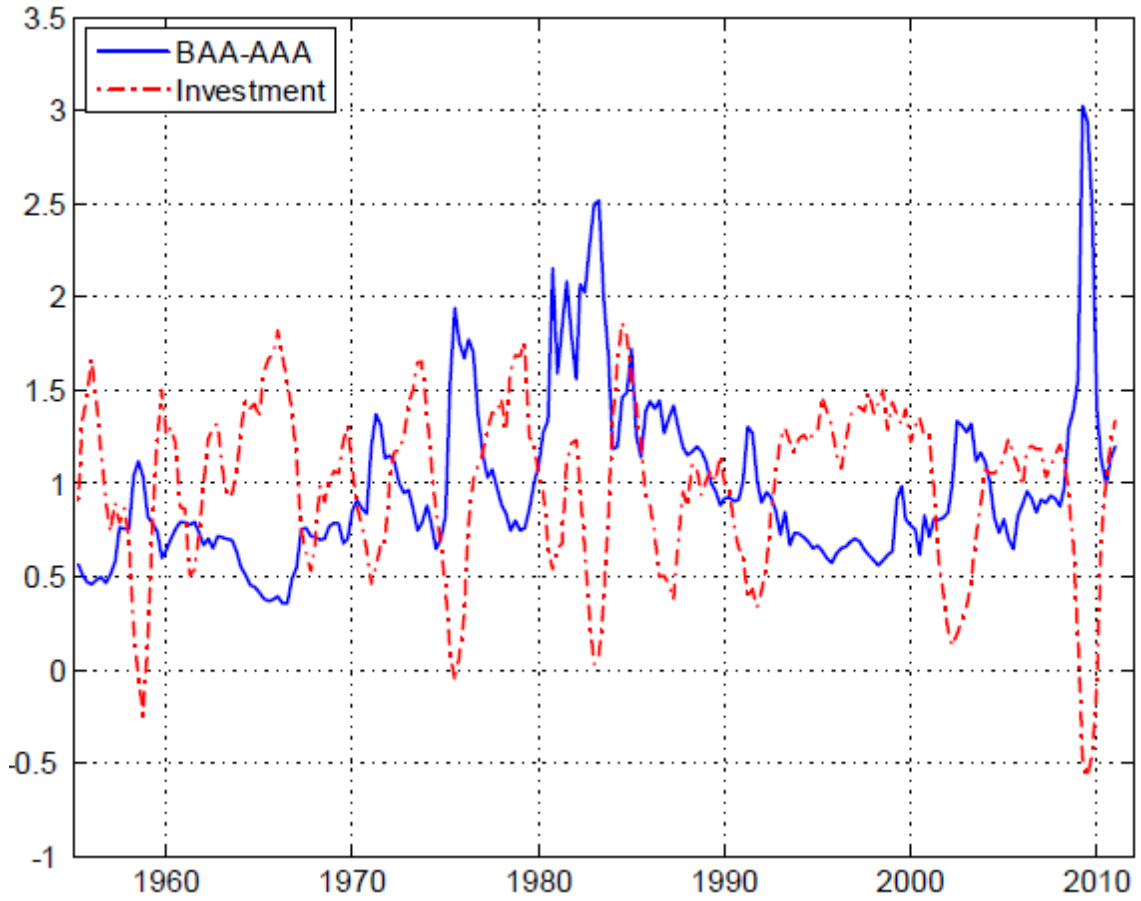


- debt burden rises
  - $\Rightarrow$ default rises and incurs real costs
  - $\Rightarrow$ default risk (t+1) raised 2 ways
  - $\Rightarrow$ investment, hours, GDP slump
- consump. rise mitigated by $\xi^r = 1$??
- responses with $\xi^r = 0$??

  (disentangling mechanics/magnitudes)
- VAR evidence in support ??
- empirical counterpart to $q\omega$??

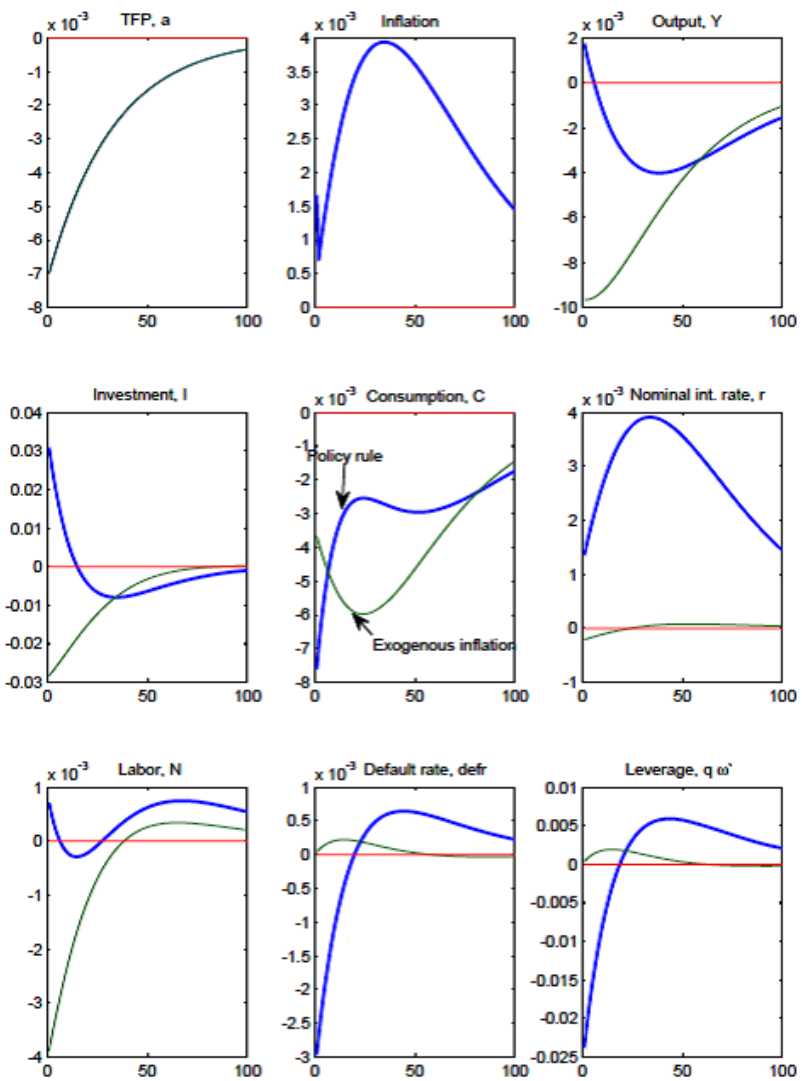
  $\sigma_\omega = 0.72\%$ $\sigma_{q\omega} = 1.67\%$
- match to credit spreads ▸ evidence ??

Credit spread evidence: Gourio (2012)



- mean: 0.94% (puzzling by comparison to expected default loss 0.20%)
- standard deviation over '47 - '11: 0.41%

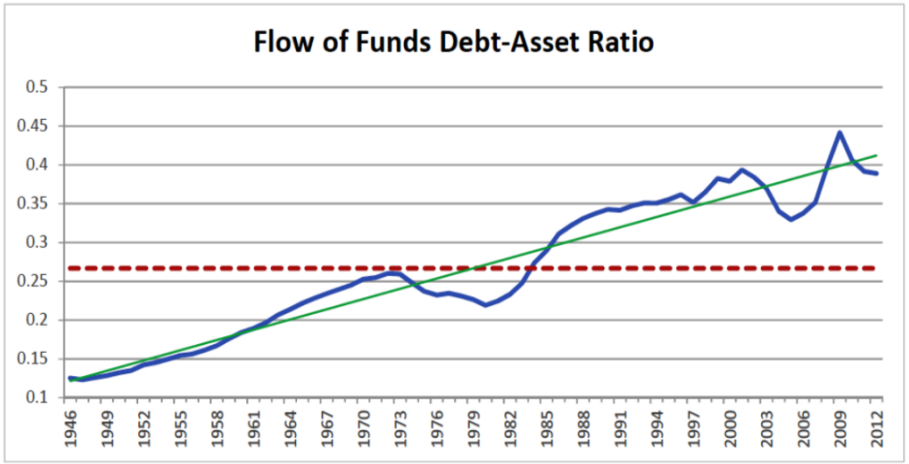
Persistent negative shock to TFP (w/ real default costs)

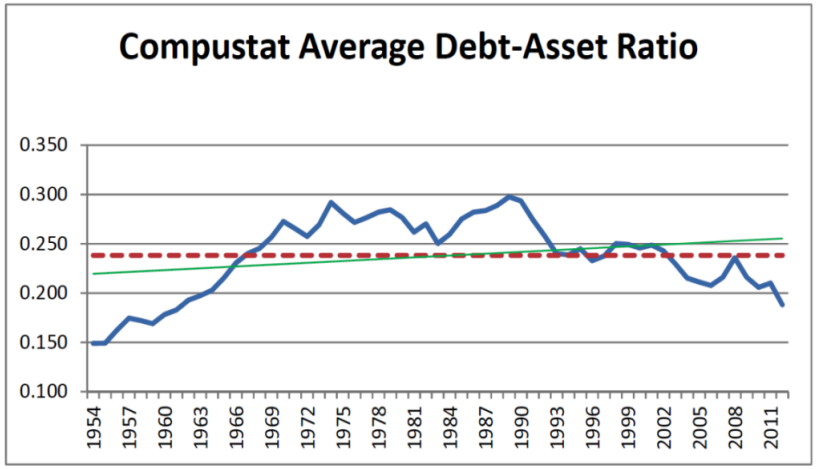


- exogenously constant inflation ??
  - $\Rightarrow$ familiar business cycle dynamics
- under an active Taylor rule
  - raised inflation reduces real debt
  - $\Rightarrow$ default and expected default fall!
  - $\Rightarrow$ investment rises!
- role of extended family assumption !!
- results under fixed $k - percent$ rule ??

Debt-asset ratios over time

The higher is τ, the more prominent is debt-overhang.





- Calibrating $\tau = .40$ to hit FoF liabilities/nonfinancial assets ('71-'13): 0.42
  (versus .25 statutory wedge)
- Compustat average current liabilities + LT debt/book assets: 0.43
- Compustat average debt in current liabilities + LT debt/book assets: 0.24
  (less evident trend; better agreement with visible wedge)

Parting thoughts and questions

Clean model highlighting mechanism delivering debt deflation recession

- unique focus on nominal debt (overhang), eschewing other channels that transmit financial shocks to real economy
- tackles multi-period-debt; tidy solution avoiding direct assumptions on first derivative of q function
- wish money was here (endogenous inflation responses outside Taylor rule)

Interesting recommendation: raise nominal rate during adverse real shock

- pushes hard on extended family assumption (no losers from inflation)
- what about longer-term policy reducing corporate preference for debt?

Which recession is the model best suited to explain?

- typical recession: TFP shock with inflation stabilization (??)
- 2007 recession: Taylor rule shock (??), *not* disaster shock (investment).