Sticky Leverage

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Overview

- GE Model with three appealing features
  - Endogenous persistence (sticky) in leverage
  - Debt-overhang $\Longrightarrow$ Debt is too costly, equity too..
  - Debt deflation $\Longrightarrow$ random shock to nominal debt (policy)

- **Application:** How big is the power of debt deflation?

Agenda

- Outline Model
- Main Force
  - What drives sticky leverage?
- Quant Result and Relevance of Policy Exercise

Environment

- Single Family Economy: Continuum of Firms
- Household's:
  - Labor
  - Assets: Equity & Risky Bonds
- Standard Consumption-Savings

Firms

- Hold k
- $y = Ak^{\alpha}h^{1-\alpha}$
- Return-to-Capital: $R = \max A\left(k/h\right)^{\alpha} - wh.$

- Net-Profits $\pi = R - z.$
  - $z \sim F, E\left[z\right] = 0.$
  - **Simplification**: z independent of labor

- Evolution of Capital : $k' = i + \left(1 - \delta\right)k$

Firm Finance

- Dividends: div
- Defaultable (Leland-Toft) Debt: b
  - Tax-Deductible Coupon $c = 1$
  - Principle payment: outstanding debt λ
  - Outstanding debt: $(1 - \lambda)$
- New debt issuance:

$$b' = n + (1 - \lambda)\, b$$

Firm Finance II

- Flow of funds:

$$\text{div} + i = \underbrace{(1-\tau)\,\pi(z)\,k}_{\text{Net-of-tax Profits}} - \underbrace{((1-\tau)\,c + \lambda)\,\frac{b}{\mu}}_{\text{Financial Expense}} + \underbrace{\tau\delta k}_{\text{Tax Credit}} + \underbrace{p\left(b'\right)n}_{\text{Debt Issuance}}$$

- Re-writing:

$$\text{div} + i = \underbrace{\tilde{\pi}(z)\,k}_{\text{Operating Profits}} - \underbrace{(1-\tau_d)\,\lambda\frac{b}{\mu}}_{\text{financial expense}} + \underbrace{p\left(b'\right)n}_{\text{Debt Issuance}}$$

Firm's Problem

- Firm's problem:

$$V(z, M, k, b) = \max_{\text{div}, i, n} \left\{ 0, \text{div} + \beta ME \left[V\left(z', M', k', b'\right) \right] \right\}$$

subject to

$$\begin{aligned} \text{div} + i &= \tilde{\pi}(z) k - (1 - \tau_d) \lambda \frac{b}{\mu} + p\left(b'\right) n \\ b' &= n + (1 - \lambda) b \\ k' &= i + (1 - \delta) k \end{aligned}$$

Firm's Problem II

The firm's problem:

$$V(z, M, k, b) = \max_{\text{div}, i, n} \left\{ 0, \text{div} + \beta ME \left[V\left(z', M', k', b'\right) \right] \right\}$$

subject to:

$$\text{div} + k' = \underbrace{\left(\tilde{\pi}(z) + (1-\delta)\right) k - (1-\tau_d)\lambda \frac{b}{\mu}}_{\textbf{Cash Flow = CF}} + \underbrace{p\left(b'\right)\left(b' - (1-\lambda)\frac{b}{\mu}\right)}_{\textbf{Liability Increase}}$$

$$\text{div} + k' = CF_t(z, k, b) + p\left(b'\right)\left(b' - (1-\lambda)\frac{b}{\mu}\right)$$

Summary

- Value upon non-default:

$$\underbrace{CF_t\left(z,k,b\right)}_{\textbf{Random Number}} - k' + p\left(b'\right)\left(b' - \left(1-\lambda\right)\frac{b}{\mu}\right) + \beta ME\left[V\left(z',M',k',b'\right)\right]$$

Homotheticity

- Nice (**AGGREGATION**) in K:

$$V(z, M, k, b) = V(z, M, 1, l)\, k$$

- ...conditional on survival:

$$k\left[CF_t(z, l) - g + p(l')\left(l' g(k) - (1-\lambda)\frac{l}{\mu}\right) + \beta M \mathbb{E}\left[V(z', M', l')\, g\right]\right]$$

- Conditional on not defaulting, choice of (g, l') independent of z.
  - Linearity $\longrightarrow$ inject equity to same scale and leverage
  - Differ in dividend decision

Sticky Leverage

- Focus on decisions...

$$\max_{g,l} -g + p\left(l'\right)\left(l'g\left(k\right) - \left(1-\lambda\right)\frac{l}{\mu}\right) + \beta M\mathbb{E}\left[V\left(z', M', l'\right)g\right]$$

- Note that choice of l' :
  - Linearity $\longrightarrow$ inject equity to same scale and leverage
  - Differ in dividend decision

- Important Role for Maturity: generates *sticky leverage*

Role of Maturity

- **Short-Term Debt:**

$$B^S: \ 1, 0, 0, ...$$

- **Long-Term Debt:**

$$B^{LT}: \ \lambda, \lambda\left(1-\lambda\right), \lambda\left(1-\lambda\right)^2, ...$$

- **Steady-State, Frictionless Prices:**

$$p\left(B^S\right) = \beta \text{ and } p\left(B^{LT}\right) = \beta \frac{\lambda}{\left(1-\left(1-\lambda\right)\beta\right)}.$$

- Borrow one dollar today in A debt:

$$\text{Payments: } \left(1, \beta^{-1}\right)$$

- Replicate s-Debt with LT-Debt Strategy:

$$\text{Payments: } \left(1, \beta^{-1}\right)$$

Role of Maturity

- Presence: taxes and default
- Driver of Sticky Leverage?
- **Taxes** $\longrightarrow$ don't change argument above...
- **Default option:** $p\left(B^S\right) = \beta \Pr\left[z > z^*\left(B^S\right)\right]$.
  - Not an issue per-se
  - If with LT-debt you can commit to default in same history...

- **Hold-up problem:**
  - Coupon: payed in goods
  - Face value: firm's new debt affects repurchase
  - So if you were to refinance replicating s debt...

Mechanism

- There is a **beatiful** mechanism
- Needs to be fleshed-out in paper!
- Forget about bankruptcy cost $\longrightarrow$ default 0.5% x 50% loss is small
- Instead, mechanism operates this way:
  - Deflation $[\Uparrow]$ raises debt
  - High debt, rates high $[\Longrightarrow]$ force not to borrow
  - High debt, rates high $[\Longrightarrow]$ force not to repay (hold up)
  - You don't want to inject equity either $[\Longrightarrow]$ risk and dilution are high

- **Incentives to:**
  - Introduce **debt covenants**
  - **Renegotiate debt:** ex-ante and ex-post
  - Convenant seem very common place (Sufi)

Quantitative Results

- Why are their macro effects large?
- Other models with financial frictions can't do it...(ask Urban)
- In other models, firm is constrained
  - Invests little
  - Has incentives to inject equity but doesn't have possibility
- Here, firm wants to take away resources
  - Won't want to take more debt
  - Wants to pay-out dividends
- Y falls a lot because $(I_t < 0)$!
  - C_t is increasing a lot because people are eating capital
  - Is this true?
- Capital irriversibility (ask Lars)

Debt Deflation Policy

- Authors look at effects of inflation
- Fine for helicopter drops
- ...however, I dispute a CB's ability to stimulate inflation, especially during crisis
- I really dislike this approach
  - Here, they appeal to a Fisher equation and FED moving nominal rate
  - ...without modeling actual banks and policy tools is odd
  - Who's euler equation are you moving?
  - Is that euler equation not distorted?
  - How's the FED doing this and buying from whom?

Conclusions

- Great framework
- Unfair emphasis on mechanics
- I wouldn't take quant or policy recs seriously
  - Not just now