

# *Debt and Creative Destruction: Why Could Subsidizing Corporate Debt be Optimal?*

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- ▶ Bush's Advisory Panel on Federal Tax Reform (Nov 2005)

*“The tax bias against equity encourages firms to rely on debt more than they would if the tax system imposed no such bias. The use of high debt levels ... may increase the risk of bankruptcy and financial distress during **temporary** industry or economy-wide downturns....(and) can make the entire economy more volatile.”*

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- ▶ Goal → show hidden costs of removing subsidy
  - ▶ No attempt at why subsidy exists; was put in place

# *Debt spurs creative destruction in declining industries*

- ▶ Role of debt tax subsidy in **overcapacity** industries
  - ▶ **Permanent** demand/technology shift, rather than **temporary** negative shocks
- ▶ Creative destruction: early liquidation and capital redeployment are socially desirable
  - ▶ Bankruptcy gains accrue to other firms in industry → Individual firms hang on too long
  - ▶ Debt is socially beneficial as it helps firms (equity holders) internalize this externality and exit earlier
- ▶ Economic force counter to existing literature
  - ▶ Relevant for the recent tax reforms

# Example:

## Brick-and-mortar book retail industry

- ▶ Amazon decreased demand for buying books in physical stores.
- ▶ Industry at overcapacity as early as 2005
- ▶ Neither Borders nor Barnes and Noble cut capacity
  - ▶ “a game of stealing market share from competitors” (Barron's, 2005)
- ▶ Borders' *bankruptcy* on February 16, 2011
  - ▶ No buyers for liquidated Borders stores
    - ▶ Barnes & Noble: 70 percent are within 5 miles of own stores
    - ▶ Stores converted to sell other products

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- ▶ Our model is consistent with (some) IRS rules
  - ▶ Securities are tax-exempt must preserve equity-debt interest conflict
- ▶ Duration of distress determines trade-off b/w welfare benefits and costs of DTS.
- ▶ Private “Coasian” solution does not work
  - ▶ Justification for government intervention

## *Related literature*

- ▶ Creative destruction: Schumpeter (1934), Jovanovic and Tse (2006).
- ▶ Debt and welfare: Jensen and Meckling (1976), Leland (1994), Shleifer and Vishny (1992), Lorenzoni (2008), Almazan, Motta, and Titman (2012)
- ▶ War of attrition: Maynard Smith (1974), Fudenberg and Tirole (1986), Kreps and Wilson (1982), Hopenhyan and Squitnani (2011), Bulow and Klemperer (1999), Siegel (2009, 2010)
- ▶ Welfare & corporate taxation. Gordon and Dietz (2006), Chetty and Saez (2010), Farhi (2009)
- ▶ Financial policy and IO: Zingales (1998), Kovenock and Phillips (1997), Chevalier (1995), Chevalier and Scharfstein (1996), Bolton and Scharfstein (1990)
- ▶ Capital reallocations and macro: Ramey and Shapiro (1998, 2001), Eisfeldt and Rampini (2008).

# Model:

- ▶ Declining industry: supports one firm
- ▶ Timeline
  - ▶ Two firms initially all equity financed
  - ▶ Borrowing decision
  - ▶ “Compete” in an war of attrition (a la Bulow and Klemperer 1999)
    - ▶ While competing:  $-k$  (nonpecuniary externality)
    - ▶ After one exits: winner:  $\theta_i$ , loser redeploys: 0
- ▶ Productivity parameter  $\theta_i \in [\underline{\theta}, \bar{\theta}]$ 
  - ▶ Private information to the firm
  - ▶ i.i.d. with CDF  $F(\cdot)$  and PDF  $f(\cdot)$
  - ▶ Hazard rate  $h(\cdot) \equiv \frac{f(\cdot)}{1-F(\cdot)}$

# Financing and war of attrition

- ▶ Single payment callable debt, face value  $B(\theta)$ 
  - ▶  $B(\theta)$  potentially depends on firm type  $\theta$
- ▶ Competitive bank observe  $\theta_i$
- ▶ Firms with debt enter war of attrition; two dimensional types
  - ▶ Exogenous real strength  $\theta$ , endogenous financial strength  $b$
  - ▶ Unobservable to opponents
- ▶ Loan rolled over until default of repayment
  - ▶ **Repayment:** winner pays  $B(\theta)$ , banks receive  $\frac{B(\theta)}{1-\pi}$ 
    - ▶  $\pi$  marginal tax rate
  - ▶ **Default:** equity holders put the firm to banks

## *First best*

- ▶ Less productive firm exits immediately
- ▶ Note: ignore consumer surplus

# How do we proceed

## 1. Solving the unique symmetric pure strategy PBE

- ▶ War of attrition with endogenous financial strength:  
 $T(\theta, B(\theta); B(\cdot))$
- ▶ Equilibrium debt schedule:  $B(\theta)$  (depends on  $T(\cdot, \cdot; \cdot)$ )
- ▶ First show some properties of  $T(\theta, B(\theta); B(\cdot))$  and  $B(\theta)$
- ▶ Solve both in closed form

## 2. Welfare

## 3. Discussions and extensions



## *Equity holders' value*

- ▶ Type  $\theta$ , debt  $b$
- ▶ Exiting policy “exits at  $t \geq 0$  if the opponent remains at  $t$ ,”
- ▶ Facing a rival with exiting distribution  $G(\cdot)$ ;

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- ▶ If lose, i.e. drops out first which occurs with prob  $1 - G(t)$ 
  - ▶ PV of loss  $-\int_0^t k ds = -kt$
- ▶ If win; sup. other firm exits at time  $x < t$ :
  - ▶ PV from fighting  $-kx$
  - ▶ PV from winning  $(\theta - b)$
  - ▶ Then integrate over  $G(x)$  for  $x \in [0, t]$ .

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  - ▶ Then integrate over  $G(x)$  for  $x \in [0, t]$ .
- ▶ Equity value:

$$E(\theta, b, t) = \underbrace{(1 - G(t))(-kt)}_{\text{Firm exits before opponent}} + \underbrace{\int_0^t ((\theta - b) - kx) dG(x)}_{\text{Firm survives after opponent exits}}$$

- ▶ Debt value:

$$D(\theta, b, t) = G(t) \frac{b}{1 - \pi}$$

# Effective strength

- ▶ **Effective strength** of the firm (equity) is its productivity minus debt obligation  $\theta - b$

**Lemma 1.** *The equilibrium exit time  $T(\theta, b; B(\cdot))$  is a function of effective strength  $\theta - b$  only, and  $T(\theta - b)$  is increasing.*

Intuition: equity chooses  $t$  to maximize equity value

$$T(\theta, b) = \arg \max_t (1 - G(t))(-kt) + \int_0^t ((\theta - b) - kx) dG(x)$$

Marginal return to higher exit time increasing in  $\theta - b$

$$\frac{\partial^2 E(\theta - b, t)}{\partial(\theta - b) \partial t} = dG(t) > 0$$

## Monotone effective strength

**Lemma 2.** *In equilibrium, a firm's effective strength in the war of attrition  $\theta - B(\theta)$  is strictly increasing in  $\theta$ .*

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  - ▶ Opponents type effectively one dimensional
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- ▶ Ex post efficient sorting
  - ▶ Worry: subsidy destroys wrong firms
    - ▶ Productive firms lever up on juicy subsidy
    - ▶ Sometimes default earlier than weaker firms
  - ▶ We show it never happens

# Equilibrium exiting time

Bulow and Klemperer (1999)

- ▶ **Proposition 1.** *The exiting time is increasing in types, and*

$$\hat{T}(\theta; B(\cdot)) = \int_{\underline{\theta}}^{\theta} h(y) \frac{y - B(y)}{k} dy.$$



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- ▶ FOC: fight a bit longer  $d\hat{T}(\theta)$  :
  - ▶ The marginal cost is  $k d\hat{T}(\theta)$ .
  - ▶ The benefit: rival may exit, benefit  $\theta - B(\theta)$ , probability  $h(\theta) d\theta$ .
  - ▶  $\frac{d\hat{T}(\theta)}{d\theta} = h(\theta) \frac{\theta - B(\theta)}{k}$

## Equilibrium debt schedule

**Theorem 1.** *There exists a unique symmetric pure strategy perfect Bayesian equilibrium. The equilibrium debt schedule is*

$$B(\theta) = F(\theta)^{-\frac{1}{\pi}} \int_{\underline{\theta}}^{\theta} F(y)^{\frac{1}{\pi}} dy.$$

with  $B(\underline{\theta}) = 0$  and  $B(\theta) < \theta$  for  $\theta > \underline{\theta}$ . In the war of attrition stage, the equilibrium exit times are given by  $\widehat{T}(\theta; B(\cdot))$  in Proposition 1.

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- ▶ Key comparative static for welfare:

**Corollary.** *The debt schedule  $B(\theta; \pi)$  is strictly increasing and exit times  $\widehat{T}(\theta; B(\cdot; \pi))$  are strictly decreasing in the tax subsidy  $\pi$  for all  $\theta > \underline{\theta}$ .*

## Intuition

- ▶ Increase  $b$  slightly above equilibrium  $B(\theta)$

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$$MC = \frac{\partial(E + D)}{\partial T} \frac{\partial T}{\partial b} = \frac{B(\theta)}{1 - \pi} \frac{dG(T(\theta - B(\theta)))}{db}$$

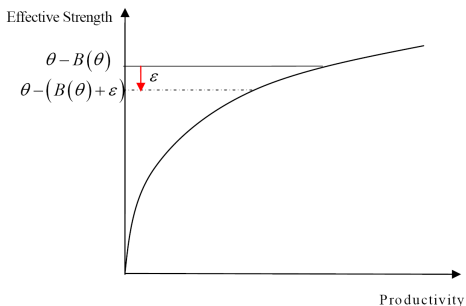
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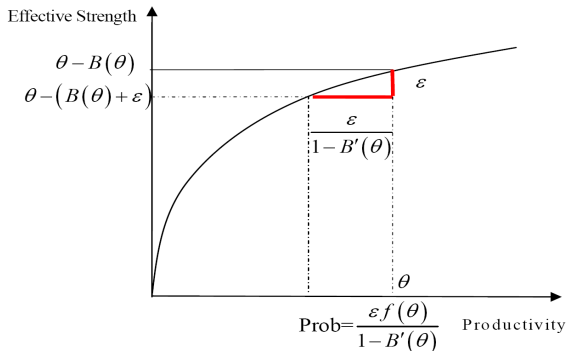
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$$MB : \frac{\pi}{1-\pi} F(\theta) = \frac{B(\theta)}{1-\pi} \frac{f(\theta)}{1-B'(\theta)} : MC$$





## Warfare analysis

- ▶ The surplus  $s(\theta, B(\cdot))$  for firm  $\theta$ , given debt schedule  $B(\cdot)$

$$\begin{aligned} & \underbrace{\theta F(\theta)}_{\text{Expected Win}} + \underbrace{\int_{\underline{\theta}}^{\theta} k \widehat{T}(y, B(\cdot)) f(y) dy}_{\text{Losses/win}} + \underbrace{(1 - F(\theta)) k \widehat{T}(\theta, B)}_{\text{Losses/lose}} \\ &= \int_{\underline{\theta}}^{\theta} f(y) \left[ \theta - \underbrace{(y - B(y))}_{\text{opponent's effective strength}} \right] dy \end{aligned}$$

- ▶ Planner should subsidize debt
- ▶ Subsidy  $\pi \uparrow \Rightarrow$  debt schedule  $B(\theta) \uparrow \Rightarrow$  effective strength  $\downarrow \Rightarrow$  Welfare  $\uparrow$

## *Without DTS: no debt in equilibrium*

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- ▶ Debt:
  - ▶ Ex-post transfer from equity to debt
  - ▶ Conflict of interest: distorts equity incentives to exit
  - ▶ Debt holder understands: in debt price ex-ante
- ▶ Debt financing:
  - ▶ Benefit: government subsidy
  - ▶ Cost: distort exit time
- ▶ No subsidy implies no debt, and firms exit too late

## Implementation: Which securities are tax-exempt?

- ▶ Factors determining whether a particular security should be considered tax-exempt (IRS)
- ▶ Emphasizing the equity-debt conflict of interest
  - ▶ *unconditional promise to pay a sum certain on demand or at a fixed maturity date that is in the reasonable foreseeable future*
  - ▶ *whether there is identity between the holders of the instrument and stockholders of the issuer*
  - ▶ *the rights of the instruments should not be subordinate to the rights of general creditors*
  - ▶ *the holders of debt should not have the right to participate in the management of the firm, giving equity the decision rights*
- ▶ In our model, government subsidizes the equity-debt conflict of interest which is socially beneficial

# Duration of distress

## Benefits versus Cost

- ▶ Permanent versus temporary shocks
- ▶ Suppose industry recovers at  $T_d$ 
  - ▶ Benchmark model  $T_d = \infty$
- ▶ First best: both firm should survive if
  - ▶ Recovery quick
  - ▶ Both firms very productive
  - ▶  $T_d$  decreases  $\Rightarrow$  more firm should survive

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- ▶ Subsidy:
  - ▶ Benefit: faster exit for firms that should exit
  - ▶ Cost: exit of firms which should survive
- ▶ Planner trades off both
  - ▶ Optimal debt subsidy

# Coasian Solution

*Do we need taxation to internalize externality?*

- ▶ Is there a private solution to “war of attrition” externality
- ▶ “Coasian” solution
  - ▶ Third firm purchases both firms
- ▶ Productivity is private information → Lemons problem.
- ▶ Adverse selection force very strong:
  - ▶ Third party loses whenever it internalizes this externality
  - ▶ Robust to static, contingent and time-varying offers
- ▶ Failure of private Coasian solution → room for government to intervene

## Concluding remarks

- ▶ We present a new mechanism which favors subsidizing debt
- ▶ Duration of distress & debt subsidy
  - ▶ Permanent adverse shocks  $\Rightarrow$  liquidation socially desirable
  - ▶ Current literature: temporary shocks  $\Rightarrow$  liquidation undesirable
    - ▶ For instance, financial intermediaries in this crisis
- ▶ Not about home mortgages; positive externalities of default?
- ▶ This mechanism can help understand why tax subsidy is implemented in the way that observed in practice
- ▶ Recent tax reforms propose removal of DTS; we point out the hidden cost and sources