

Corporate Legacy Debt, Inflation, and the Efficacy of Monetary Policy

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- ▶ **Non-financial** corporate debt level all time high globally (EA 115.1%, CHN: 160.7%, btw 2019 and 2020 alone, US rose by 12.5%)
- ▶ Meanwhile post-pandemic inflation surge propelled central banks to raise overnight rates, while labour market is tight
- ▶ **Are short-term rates effective in controlling inflation when the level of corporate debt is high?**

- ▶ Given corporate debt, interest rates i affects the elasticity of labor supply through real wages
- ▶ Presence of corporate debt affects transmission of i - its income effect offsets or even dominates the usual substitution effect
- ▶ As a result, the final consumption good may become a *Giffen Good* if Corporate Debt is sufficiently high
- ▶ Any level of corporate debt affects the trade-off between inflation and output stabilization

- 1 Setup:** household portfolio heterogeneity corresponding to firm capital structure
 - ▶ Owner household owns firms; firms owe corporate debt to lender-working household
 - ▶ Lender-working household hold corporate debt and supply labour (top rich income groups hold predominately equity; middle income fixed-income securities and housing)
- 2 Working Capital Channel:** transaction demand for money (liquidity-in-advance) à la [Barth and Ramey \(2001\)](#), [Christiano et al \(2005\)](#) and [Ravenna and Walsh \(2006\)](#)
 - before receiving production proceeds, firms borrow money via credit to pay for labour, at the interest cost of $i(> 0)$

- ▶ The economy has *owner households* and *lender-working households*.
- ▶ Owner households own firms that issue corporate bonds for financing.
 - Rich invest more in stocks and low wealth holding liquid/safe assets (Vissing-Jorgensen, 2002; Campbell, 2006; Toda and Walsh, 2020)
- ▶ Lender-working households supply labour, hold corporate bonds, and do not actively participate in equity markets (Benzoni et al., 2007)
 - We need some, but not all of the debt held by workers
- ▶ Firms also subject to working capital financing requirement (inside money issued against credit to finance working capital).

Owner Households

$$U = c^o. \quad (1)$$

Their flow constraint is (2),

$$Pc^o = \Pi + m. \quad (2)$$

where m is outside money (seigniorage transfer), endogenised via central bank discount window and OMO in the dynamic model, and Π are profits

Lender Households

$$U = \log(c^l) - L. \quad (3)$$

In the morning the lender households obtain their labour income and carry the money till the evening

Their effective flow budget constraint is (4)

$$Pc^l = wL^l + \psi RD. \quad (4)$$

(Fraction of corporate debt repaid ψ , corporate bond rate R , corporate debt D endogenised in the dynamic model.)

Technology is

$$y_j = Al_j. \quad (5)$$

The morning constraint is

$$wl_j = b_j, \quad (6)$$

(working capital credit to finance labour, inside money issued on demand against an offsetting credit)

the evening constraint is

$$\pi_j + \psi RD + b_j(1 + i) = p_j y_j, \quad (7)$$

and equivalently using (6)

$$\pi_j + (1 + i)wl_j + \psi RD = p_j y_j. \quad (8)$$

Allocation of resources and positive prices, given a positive monetary policy rate and monetary endowment, and legacy debt such that

1. Firms set prices while taking into account the price impact on demand,
2. Agents maximise subject to their budget and liquidity constraints,
3. Goods market, labour market, and money market clear, and expectations are rational.

$$\tilde{w} = \frac{A}{\sigma(1+i)}. \quad (9)$$

$$\epsilon_L = \frac{\frac{\partial L}{\partial \tilde{w}}}{\frac{L}{\tilde{w}}} = \frac{\psi RD}{P\tilde{w}L} = \frac{\psi}{\tilde{b}} \frac{RD}{P}. \quad (10)$$

Lemma 1

1. *Contractionary monetary policy reduces real wages.*
2. *The equilibrium labour supply elasticity with respect to real wages is increasing on the real value of legacy debt and decreasing on the real value of working capital (consistent with empirics in Ziliak and Kniesner (JPE, 1999) and Cesarini et al. (AER, 2017)).*

Definition 1

The consumption good is a *Giffen good* if, given that the labor market clears, debt is repaid, and dividends are paid, a decrease in the real wage caused by an increase in the policy rate increases Aggregate Demand

Proposition 1

When the real value of corporate debt is sufficiently high, the final consumption good is a Giffen Good.

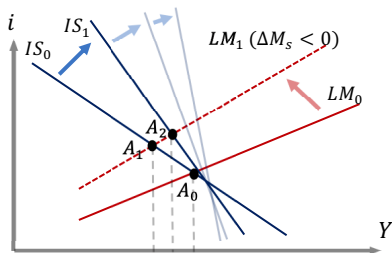
- ▶ The Giffen good property of Aggregate Demand is caused by the positive response of Owner households' demand to declines in the real wage caused by a higher policy rate.
- ▶ The response of Owner household's demand is caused by the response of the real value of dividends paid by firms to declines in the real wage caused by a higher policy rate.

- ▶ IS is the locus, given a price level, for output (Y) as a function of the policy rate i , in which the labor market clears,

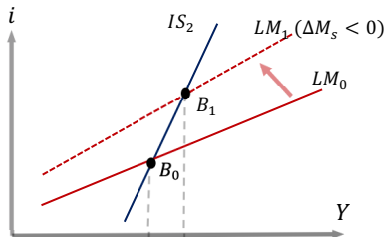
$$Y = \frac{m}{P} + \int_j y_j dj + i \left\{ \frac{\psi D}{P} - \frac{A}{\sigma(1+i)} \right\}. \quad (11)$$

- ▶ LM is the locus of points in which, given the price level, the demand for money equals the supply of money and is the upward-sloping LM curve.

$$i = \frac{P}{\sigma M_s} Y - 1. \quad (12)$$



(a) Downward IS



(b) Upward IS

- ▶ IS is locus the labor market clears but not necessarily the money market, LM is locus where the money market clears but not necessarily the labor market.
- ▶ The intersection is both the labor market and the money market clears, for a given price level
- ▶ The intersection of aggregate demand and supply will give us the equilibrium nominal price level.

Aggregate Supply is

$$Y = A - \frac{\psi RD}{P} \sigma(1 + i). \quad (13)$$

Aggregate demand is

$$\frac{m}{P} + Y + i \left\{ \psi \frac{RD}{P} - \frac{A}{\sigma(1 + i)} \right\}. \quad (14)$$

From (14) we can see two effects of monetary policy.

- ▶ Higher interest rates increase the financing cost of labour and less is demanded. These are the usual income and substitution effects.
- ▶ On the other hand, the presence of legacy debt renders labour supply more elastic, so that the increase in i causes the decrease in wage expenditure to dominate the increase the financing costs.
- ▶ This leads to upward pressure on profits and owner households' income, and hence, aggregate demand. This is the income effect through legacy debt.

Aggregate demand becomes

$$\frac{m}{P} + Y - i \frac{A}{\sigma(1+i)}. \quad (15)$$

- ▶ Comparing (14) and (15), given a price level, raising interest rates only reduces aggregate demand in the representative agent case.
- ▶ This is because in the representative agent case, the distribution of income does not matter, the upward pressure on profits from lower wage expenditure is exactly offset by the increase in financing costs, and hence, the income effect is no longer present.

Proposition 2

In equilibrium,

1. *when legacy debt is sufficiently low ($i\psi RD < b$),*
- 1.1 *the standard Taylor principle applies,*
- 1.2 *the higher debt is, the less effective is raising interest rates in lowering current inflation;*
2. *when legacy debt is sufficiently high ($i\psi RD > b$),*
- 2.1 *the Taylor principle is inverted - raising interest rates increases current inflation,*
- 2.2 *the higher debt, the worse inflation caused by raising interest rates.*

(In reality ψ is very low, $i\psi RD > b$ is an extreme scenario. It does not hold with data calibration)

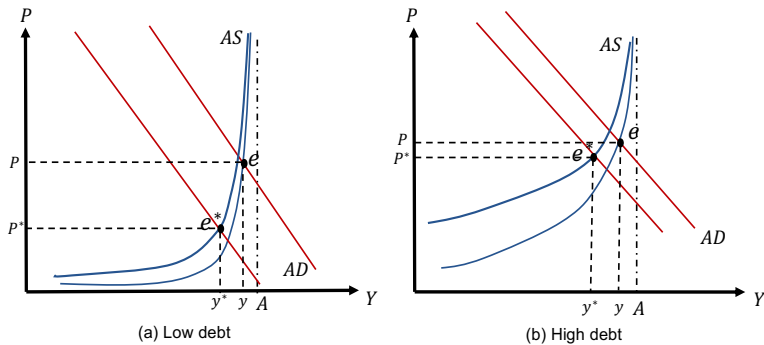


Figure 1: AS-AD diagram: a rise in policy rate

The left diagram (a) illustrates a low debt scenario. The right diagram (b) illustrates a high debt scenario. Equilibrium e is the equilibrium before the rise in the policy rate, and equilibrium e^* is the equilibrium after the rise in the policy rate. The vertical line at A is the output when there is no debt in the economy.

- ▶ We now build upon the canonical New Keynesian framework to extend our static model from an environment with flexible prices, to one with nominal rigidities (via *Calvo* pricing) and an endogenous monetary policy rule (*Taylor rule*).
- ▶ Wholesale producers are price-takers and can access short-term financing from the money market. Intermediate goods producers are static price-setters with market power.
- ▶ We assume a steady state level of legacy debt which wholesale firms choose to roll over at prevailing interest rates.
- ▶ We endogenise the monetary endowment of households with central bank open market operations in the bond market.

- ▶ Owner household:

$$c^o + k' = \tilde{\pi}_I + \tilde{r}_k k,$$

- ▶ Lender Household:

$$\tilde{q}\tilde{d}' + \frac{\phi_d}{2}\tilde{q}(\tilde{d}' - \bar{d})^2 + c^l = \tilde{w}l + \frac{\tilde{d}}{1 + \eta},$$

- ▶ Wholesale Firms:

1. working capital constraint

$$\tilde{w}l = \tilde{b},$$

2. Evening budget constraint

$$\tilde{\pi}_W + \tilde{r}_k k + \frac{1}{1 + \eta}\tilde{d}_W + \tilde{b}(1 + i) = \tilde{p}_W y_W + \tilde{q}d'_W$$

- ▶ Taylor Rule:

$$\frac{1+i}{1+\bar{i}} = \left(\frac{y}{\bar{y}}\right)^{\rho_y} \left(\frac{1+i_{-1}}{1+\bar{i}}\right)^{\rho_i} \left(\frac{1+\eta}{1+\bar{\eta}}\right)^{\rho_\eta} e^{\epsilon_i}, \quad (16)$$

- ▶ Flow Balance:

$$\tilde{M}i + \frac{\tilde{\mu}}{1+\eta} - \tilde{q}\tilde{\mu}' = 0. \quad (17)$$

$$(1 + \hat{\eta}) = \frac{(1 - \phi)(1 - \phi\beta)}{\phi} \hat{p}_W + \beta(1 + \hat{\eta}'). \quad (18)$$

where the marginal cost is given by

$$\hat{p}_W = - \frac{(1 + \hat{\eta}) + \bar{q}\hat{q}}{1 - \bar{q}} - \frac{(1 + \hat{i})}{((1 + \bar{i}) - 1)} \left\{ 1 - \frac{(1 + \bar{i})(1 - \alpha)\bar{d}(1 - \bar{q})}{2(\bar{w}\bar{l} + \bar{d}(1 - \bar{q}))} \right\} \\ - \hat{A} - \alpha\hat{k} - \frac{(1 - \alpha)\bar{d} \{ \bar{q}\hat{d}' - \hat{d} \}}{2(\bar{w}\bar{l} + \bar{d}(1 - \bar{q}))}. \quad (19)$$

As the steady state level of legacy debt increases, the absolute value of the coefficient of interest rates on the path of inflation declines.

We take the standard calibrated parameters from the recent literature

Table 1: Calibration

Parameter	A	α	β	i	σ	κ	ϕ	ϕ_d	ρ_y	ρ_η	ρ_i
Value	100	0.33	0.99	0.01	1.25	0.1	0.7	0.001	0.2	1.5	0.5

- ▶ Population share of owners 10% (see Toda and Walsh, 2020 and Campbell, 2006).
- ▶ Taylor rule parameters
 - ▶ Inflation 1.5, smoothing 0.5 (Gomes, Jermann and Schmid 2016)
 - ▶ Output 0.2 (Christiano, Trabandt and Walentin 2010).
- ▶ Corporate debt-to-GDP ratios based on US non-financial corporate debt to quarterly revenue from 2001 to date
 - ▶ Benchmark at ss 75 %
 - ▶ high debt case at ss 100%.

- ▶ As the debt level increases, the more pro-cyclical owner households' consumption appears, and the more acyclical lender households' consumption expenditure becomes.
- ▶ This result connects with the literature on the high sensitivity of consumption growth of wealthy stockholders to the stock market and aggregate fluctuations (Malloy et al. (2009) , Parker and Vissing-Jorgensen (2009), Mankiw and Zeldes, 1991; Parker, 2001).

Table 2: Cyclical properties: correlations with output

	c^o	c^l	b	l	d
y (BMK lev)	0.73	0.38	0.96	0.93	-0.76
y (High lev)	0.88	0.20	0.99	0.97	-0.86

BMK lev refers to the benchmark leverage of 75% (annual), or $\bar{b}/\bar{y} = 3$. High lev refers to the high debt leverage of 100% (annual), or $\bar{b}/\bar{y} = 4$.

The Effect of Monetary Contractions

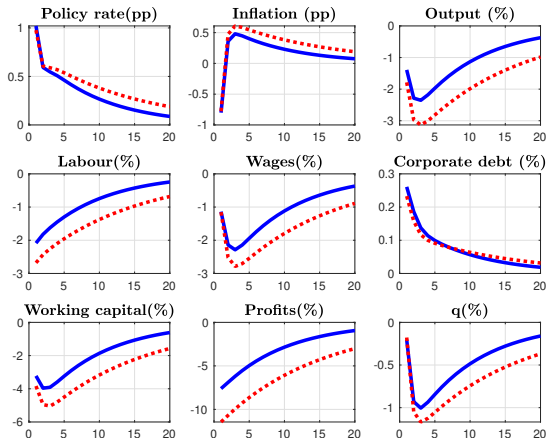


Figure 2: Tightening shock to nominal policy rate i .

Blue line is 75% leverage (low debt) and red line is 100% leverage (high debt). y -axis is % change and x -axis is the number of periods. Other than inflation and policy rate, all variables are in real terms.

- ▶ General equilibrium model to study the effect of corporate indebtedness on the monetary transmission mechanism.
- ▶ High corporate debt levels render contractionary monetary policy less effective in controlling inflation.
- ▶ When the level of corporate debt is sufficiently high, contractionary monetary policy even increases inflation.
- ▶ The mechanism of our central result is via income effect of debt, independent of standard financial and nominal frictions, and reinforces the cost channel of monetary policy.
- ▶ Future direction includes search for the threshold of rate increase such that debt-default-deflation could occur or optimal monetary policy given different corporate bankruptcy regimes.

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