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

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Introduction

▶ While the recent rise in public debt has received much attention, the increase in corporate debt has received less.

▶ We show that high corporate debt levels may impede monetary policy transmission and make it qualitatively and quantitatively less effective in controlling inflation.

▶ When firms' indebtedness is sufficiently high, the negative substitution effect on aggregate demand of higher nominal interest rates is offset or even dominated by an additional income effect on creditors and amplifies the cost channel of monetary policy.

▶ This mechanism is independent of standard financial and nominal frictions and aggravates the trade-off between inflation and output stabilization.

Corporate Debt has risen

	Advanced Economies					
	US	EA	SWE	CAN	UK	JPN
Dec-07	70	93.3	125.2	81.7	82.1	99.5
Dec-18	75.2	106.2	158.8	114.3	76.1	99
Dec-20	84.6	115.1	175.3	132.4	80	115.6
	Emerging Economies					
	CHN	KOR	HK	CHL	BRA	TUR
Dec-07	94.3	84.8	124	65.2	29.7	29.6
Dec-18	149.1	95.6	219.5	100.2	46.3	68.1
Dec-20	160.7	111.1	246.8	115.9	54	72.1

*Source: BIS. Numbers express non-financial corporate debt as % of GDP.*

Corporate Debt and Inflation

(a) Markup and non-financial corporate debt-to-GDP
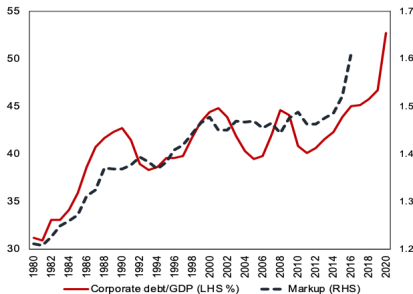
Source: The markup data is from De Loecker et al. (2020). Data on corporate debt and GDP are from Board of Governors of the Federal Reserve System (US) and U.S. Bureau of Economic Analysis, retrieved from FRED, Federal Reserve Bank of St. Louis.

(b) Core inflation and de-trended corporate debt/GDP
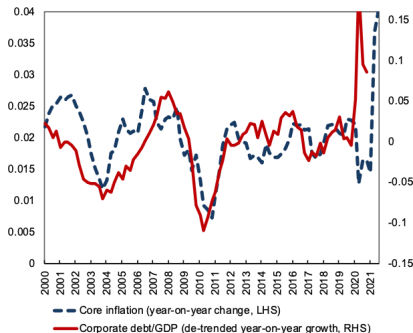
Source: Board of Governors of the Federal Reserve System (US) and U.S. Bureau of Economic Analysis, retrieved from FRED, Federal Reserve Bank of St. Louis, and authors' calculation.

Simplified Static Model

▶ The economy has *owner households* and *lender-working households*.

▶ Lender-working households hold safe corporate bonds for saving and supply labour.

▶ Owner households own firms that issue corporate bonds for financing.
- based on Fisher (1910) narrative of 'enterpriser-borrower' and 'creditor, the salaried man, or the labourer'
- See empirics on top rich investing more in stocks and low wealth holding liquid/safe assets Vissing-Jorgensen, 2002; Campbell, 2006; Toda and Walsh, 2020

▶ Lender-working households supply labour and do not actively participate in equity markets consistent with empirics in Benzoni et al., 2007

▶ Firms also subject to working capital financing requirement (inside money issued against credit to finance working capital). (see Barth and Ramey, 2001; Christiano et al., 2005; Ravenna and Walsh, 2006)

Households

Owner Households

$$U = c^o. \tag{1}$$

Their flow constraint is (2),

$$Pc^o = \Pi + m. \tag{2}$$

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

Households

Lender Households

$$U = log(c^l) - L. \tag{3}$$

In the morning the lender households obtain their labour income and carry the money till the evening
Their effective flow budget constraint is (4)

$$Pc^l = wL^l + \psi RD. \tag{4}$$

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

Firms

Technology is

$$y_j = Al_j. \tag{5}$$

The morning constraint is

$$wl_j = b_j, \tag{6}$$

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

the evening constraint is

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

and equivalently using (6)

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

Equilibrium Definition

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.

Equilibrium

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

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

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 deceasing on the real value of working capital (consistent with empirics in Ziliak and Kniesner (JPE, 1999) and Cesarini et al. (AER, 2017)).*

Substitution and Income Effects

Aggregate Supply is

$$Y = A - \frac{\psi RD}{P}\sigma(1+i). \tag{11}$$

Aggregate demand is

$$\frac{m}{P} + Y + i\left\{\psi\frac{RD}{P} - \frac{A}{\sigma(1+i)}\right\}. \tag{12}$$

From (12) 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.

Substitution and Income Effects

Intuition

The income effect of corporate debt affects both the aggregate demand and aggregate supply

- On AD, after monetary contraction, the increase of financial costs of wage bills put downward pressure on AD (usual 'intertemporal' substitution effect). But with the high fixed cost of debt, firms feel the need to spread the fixed cost over a larger production scale and demand more labour, leading to upward pressure on AD (income effect through debt on demand)

- On AS, after monetary contraction, the negative impact on lender-working households' wealth is less in the high debt scenario than low debt scenario, so labour more elastic when corporate debt level is high (this holds even when we consider fixed-coupon corporate bond)

Representative Agent

Aggregate demand becomes

$$\frac{m}{P} + Y - i\frac{A}{\sigma(1+i)}. \tag{13}$$

▶ Comparing (12) and (13), 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 1

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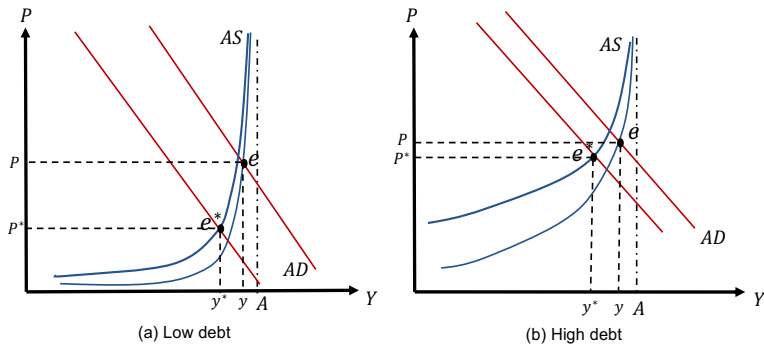
Figure 1: AS-AD diagram: a rise in policy rate

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.

Dynamic Model

▶ 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.

Quantitative Example

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%.

Monetary Shocks

▶ 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 $\bar{b}/\bar{y} = 4$.

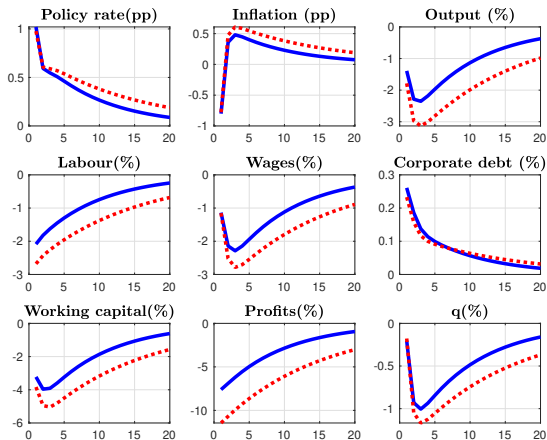# The Effect of Monetary Contractions

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.

Conclusions

▶ 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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