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

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Introduction

- The rise in public debt and its implications for policy has received much attention recently, the rise in corporate debt has received less so.
- We argue that high levels of corporate debt may impede the transmission mechanism of monetary policy and therefore make it less effective in controlling inflation.
- The (distributional) income effect of higher nominal interest rates offsets or even dominates its usual negative substitution effect on aggregate demand and is quantitatively important.
- This mechanism is independent of standard financial and nominal frictions, and instead works through heterogeneous households and reinforces the cost channel of monetary policy.

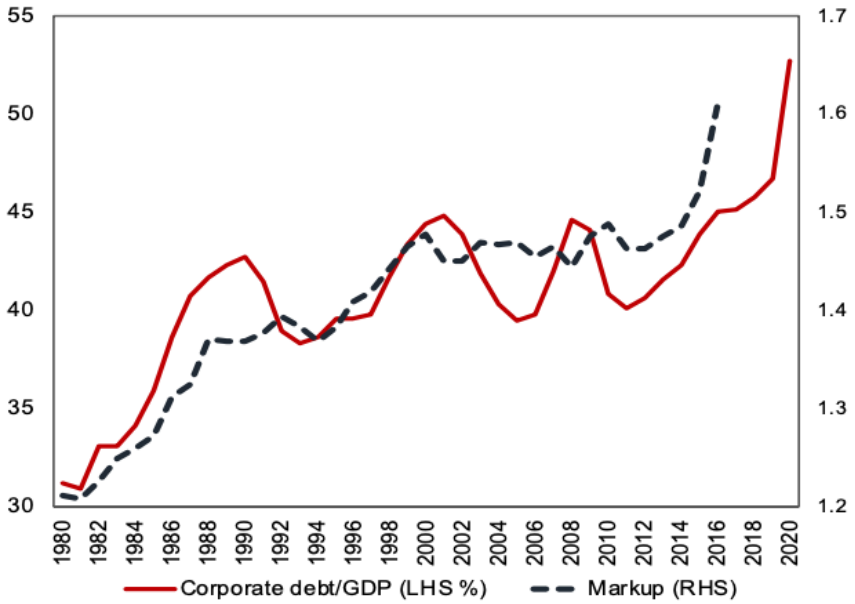
Corporate debt has risen

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.

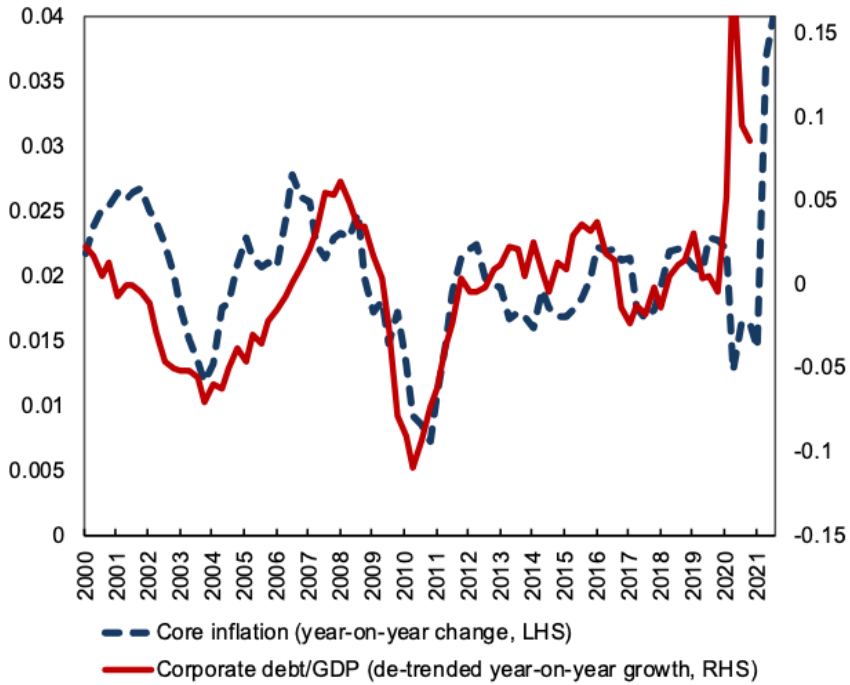
Corporate Debt and Inflation

(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.

Related Literature

- There is a flourishing literature focusing on corporate debt and its implications for inflation and monetary policy
- Much of the existing work has focused on the drag of debt on firm investment or aggregate demand, or the impact of unexpected inflation on the real burden of debt (Abraham et al., 2020; Bräuning and Wang, 2020; Brunnermeier and Krishnamurthy, 2020; Gomes et al., 2016; Goodhart and Pradhan, 2020; Jordà et al., 2020; Ottonello and Winberry, 2020),
- but less attention has been paid to how nominal debt could affect the efficacy of monetary policy in controlling inflation. Our work serves to fill this gap in the literature.

Related Literature

- Mian et al. (2021) focus on household debt, propose a theory of indebted demand and show that large household debt lowers aggregate demand and the natural rate of interest.
- The mechanism there works through the demand side where the assumption of nonhomothetic preferences generates the property that large debt levels weigh negatively on aggregate demand via the Slutsky equation.
- Our results reinforce the importance of the heterogeneity of households and the relatively high pro-cyclicality of income and consumption expenditure of high income and high wealth households that own an overwhelmingly large share of financial assets (see Parker et al., 2010, for a deconstruction of the cyclical properties of household groups in the US).

Related Literature

- Much of the empirical literature on corporate debt investigates the real consequences of corporate debt on investment, output, or tail risks (see for example, Mian et al., 2017; Jordà et al., 2020), but there is limited work turning to how corporate debt affects the monetary transmission mechanism and whether it hampers the monetary authority's ability to control inflation, for which our model provides testable implications.
- Nevertheless, our results echo a similar point in Schularick and Taylor (2012) that credit and money deserve to be watched carefully when implementing monetary policy rules.

Related Literature

- **Heterogeneous Agent New Keynesian models** (Kaplan, Moll, and Violante, 2018; Auclert, 2019; Bayer, Luetticke, Pham-Dao, Tjaden, 2019, Hagedorn and Mitman 2020; non-exhaustive): heterogeneity of the households in our model is based on the ownership and lending relationships with the firm sector, rather than labour income shocks combined with the coexistence of liquid and illiquid assets in financial portfolios, as usually in HANK models. While HANK models emphasise the aggregate consumption implications of policy in the presence of household heterogeneity, we complement this channel with the direct effect of the working capital channel on firm output dynamics. The two channels co-existing creates a new trade-off that impedes the effective conduct of monetary policy.

- The income effect through corporate debt in our framework amplifies the **working capital cost channel** effect of monetary policy (see Kashyap, Stein and Wilcox, 1993; Kashyap, Lamont and Stein, 1994; Gertler and Gilchrist, 1994; Christiano, Eichenbaum and Evans, 2005; Ravenna and Walsh, 2006, and more recently Phaneuf, Sims and Victor, 2018; Ascari, Phaneuf and Sims, 2018; Grosse-Rueschkamp, Steffen and Streitz, 2019; Gomez, Landier, Sraer and Thesmar, 2021, non-exhaustive)

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)

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

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 the flow budget constraint is:

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

Equilibrium

Equilibrium is defined as an allocation of resources and positive prices, given a positive monetary policy rate and monetary endowment, and legacy debt such that

(i) firms set prices while taking into account the price impact on demand,
(ii) agents maximise subject to their budget and liquidity constraints,
(iii) 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. *Given the price level, the effective 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, 1999; Cesarini et al., 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. This is the usual substitution effect.
- On the other hand, the presence of legacy debt renders labour supply more elastic, so that the increase in i causes the decrease in real wage expenditure to offset the increase in 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.

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)

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.*

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

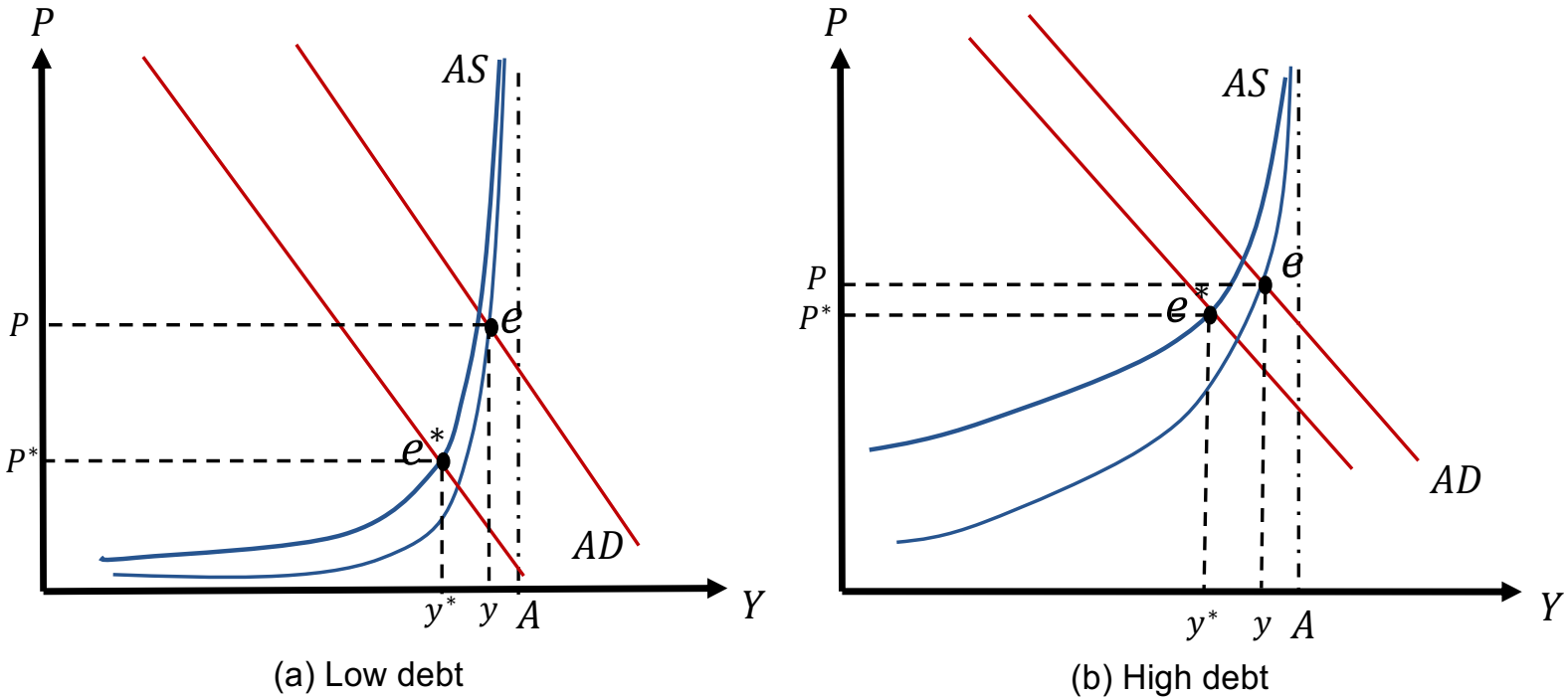


Figure 1: AS-AD diagram: a rise in policy rate

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.

Taking Stock

- We have assumed no firm expected to go into **bankruptcy** for reasons below
  1. Policies have been so expansionary: high liquid savings and tight labour market.
  2. Post-pandemic, high-debt zombie firms staying afloat with imminent firm defaults at record lows (see e.g., Acharya et al., 2021; Caballero et al., 2008).
  3. With bankruptcy possibilities, the basic problem of contractionary monetary policy with high corporate debt is that a small increase in rates may not restore inflation back to target, while a larger increase might bring large bankruptcies as to bring about a recession.
- To study the quantitative importance and show the mechanism of the static model holds in a dynamic general equilibrium, we now embed the key ingredients in a canonical New Keynesian framework.

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 also replace the monetary endowment of households with central bank open market operations in the bond market.

We obtain the *Phillips curve*:

$$(1 \hat{+} \eta) = \frac{(1-\phi)(1-\phi\beta)}{\phi}\hat{p}_W + \beta(1 \hat{+} \eta'). \tag{13}$$

where the marginal cost is given by

$$\hat{p}_W = -\frac{(1 \hat{+} \eta) + \bar{q}\hat{q}}{1-\bar{q}} - \frac{(1 \hat{+} i)}{((1 \bar{+} i) - 1)}\left\{1 - \frac{(1 \bar{+} i)(1-\alpha)\bar{d}(1-\bar{q})}{2(\bar{w}\bar{l} + \bar{d}(1-\bar{q}))}\right\}$$
$$- \hat{A} - \alpha\hat{k} - \frac{(1-\alpha)\bar{d}\left\{\bar{q}\hat{d}' - \hat{d}\right\}}{2(\bar{w}\bar{l} + \bar{d}(1-\bar{q}))}. \tag{14}$$

As the steady state level of legacy debt increases, the absolute value of the coefficient of interest rates on the path of inflation declines, i.e. changes in interest rates have smaller negative effect on inflation.

Dynamic Properties

We obtain the ***dynamic* IS curve**:

$$\hat{q} + (1 \hat{+} i) - \hat{p}_W - \hat{y}(1 - \frac{2}{1-\alpha}) - 2\frac{\hat{A} + \alpha\hat{k}}{1-\alpha}$$
$$= (1 \hat{+} i)' - \hat{p}'_W - \hat{y}'(1 - \frac{2}{1-\alpha}) - 2\frac{\hat{A}' + \alpha\hat{k}'}{1-\alpha} - (1 \hat{+} \eta)'. \quad (15)$$

The level and dynamics of corporate debt affects aggregate demand through the real marginal cost $\hat{p}_W$.

Output gap would reflect two distortions: 1) price rigidities;
2) market incompleteness affecting wealth distribution, and hence, AD and AS.

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 response to inflation 1.5 and smoothing parameter 0.5 (Gomes, Jermann and Schmid 2016)
  Taylor rule output coefficient 0.2 (Christiano, Trabandt and Walentin 2010).
- benchmark corporate debt-to-GDP ratio at ss 75 %
  high debt case corporate debt-to-GDP ratio at ss 100% (conservative take). (debt ratios based on US non-financial corporate debt to quarterly revenue from 2001 to date)

Monetary Shocks

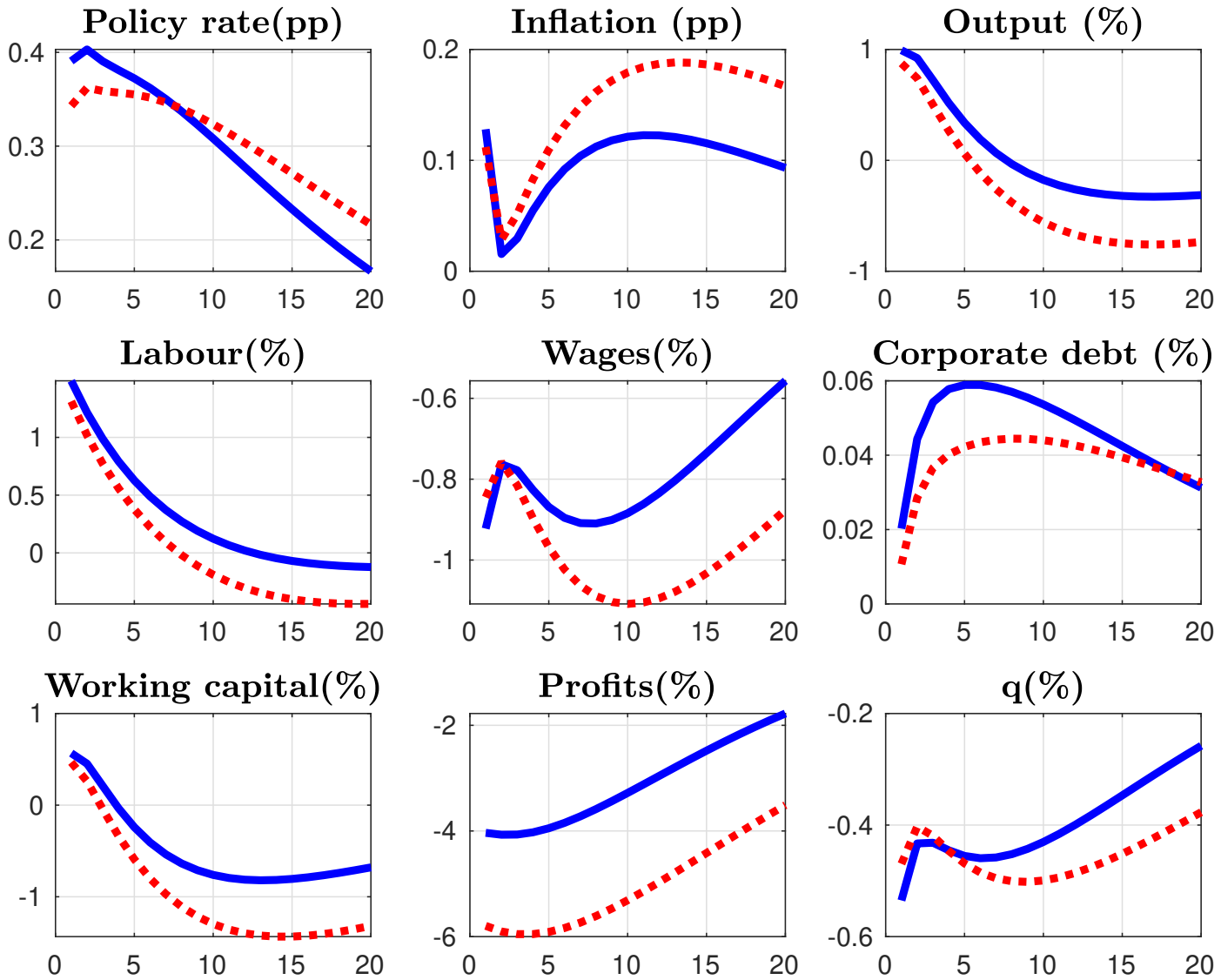
- As the debt level increases, the more pro-cyclical owner households' consumption appears, and the more acyclical lender households' consumption expenditure becomes.
- This result connects with the literature on the high sensitivity of consumption growth of wealthy stockholders to the stock market and 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

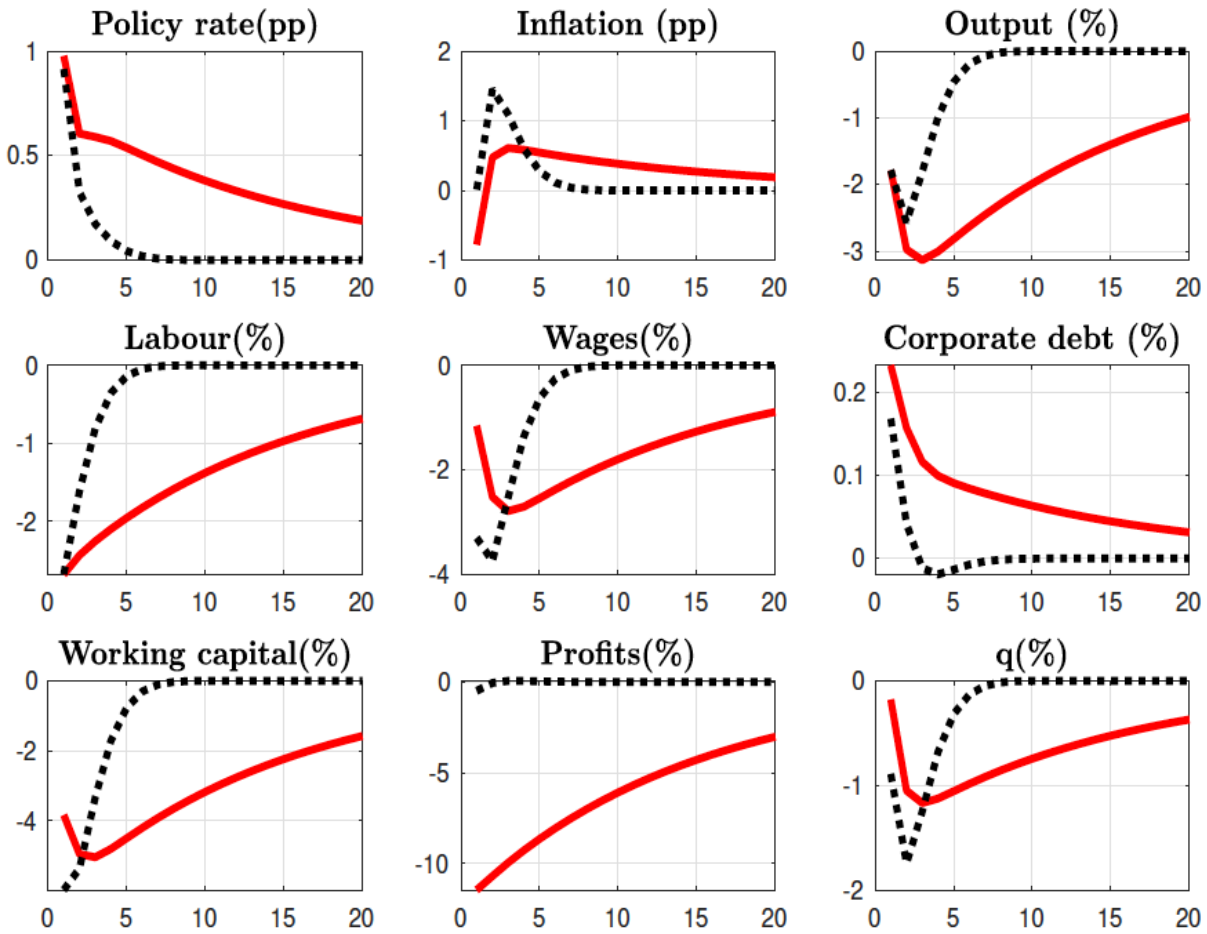
BMK lev refers to the benchmark leverage of 75% (annual), or $\bar{b}/\bar{y} = 3$. High lev refers to the high debt leverage of 100% (annual), or $\bar{b}/\bar{y} = 4$.

The Effect of a Positive Demand Sh



Inflation and Output Stabilisation

Figure 3: Monetary contractions with or without output stabilisation



Red solid line is benchmark Taylor rule with output coefficient 0.2, and dashed black line is output stabilisation Taylor rule with output coefficient 0.9. Y-axis is % change.

Robustness Check

- Monetary contractions lead to a reduction in both real wages and corporate bond price.
- One might be concerned that lenders' wealth takes a more significant hit in the high debt case than the low debt case, particularly if lenders are holding fixed coupon bonds. Would the the effective labour elasticity still turn out higher in the high debt case?
- We added a two-period fixed coupon bond whose steady-state quantity is set four times as much as that of the floating rate bond. This is to generate a noticeable decrease in lender working households' non-labour income wealth after monetary contractions.
- All results go through.

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 different from standard cost-push 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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