Monetary Easing, Investment and Financial Instability

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Introduction

- Unprecedented monetary easing in all major currencies post 2008
- Spurred risk taking in financial markets:
  - Non-bank financial institutions entered into maturity transformation: "carry trades" into high-yield corporate bonds, MBS (Stein 2013), and emerging-market bonds (Acharya and Vij 2016, Bruno and Shin 2014, Feroli et al. 2014)
  - Non-financial corporations: corporate leverage is close to historical highs for large firms, net equity issuance has been negative due to historically high payouts (IMF 2017)

Disappointing impact on investment

- Capital expenditures have not returned yet to pre-recession trends...
- ...despite a large wedge between historically low interest rates and historically high returns on capital...
- ...that have been largely paid out to shareholders, notably in the form leveraged share buybacks (see, e.g., Furman 2015)

This paper...

...offers a model in which three features jointly develop in equilibrium:

- low official interest rate
- a surge in leverage and maturity transformation ("carry trades") leading to the build-up of excessive financial fragility
- an increase in the fraction of firms' profits that are paid out at the expense of investment despite a marginal rate of return on capital above the policy rate

These facts amplified after the 2007-8 crisis...

...but pre-dated it

- Gutierrez and Philippon (2016) trace back to the early 2000s:
  - increase in firms' share buybacks
  - decline in U.S. private fixed investment despite a high Tobin's q
- Taylor (2011, 2012) traces the start of a "Great Deviation" around the same time
  - monetary policy became relatively more accommodative
  - prudential regulation looser
  - contributed to the build-up of financial fragility leading to the 2008 crisis
- Contentious though (see, e.g., Bernanke 2010)

Broad intuition

- Consider an economy in which agents can borrow or lend at a (real) risk-free rate controlled by the public sector in order both to smooth consumption and to invest in a storage technology with decreasing returns to scale
- As the risk-free rate becomes small, agents borrow large amounts in order both to invest large quantities, and to borrow against future profits for early consumption (=leveraged share buyback)
- If this "storing and destoring" yields an excess demand for funds, then constrained agents allocate borrowing capacity between investment and share buybacks up to the point at which the returns are equal, both above the risk-free rate

Broad intuition

- In our setup, as the policy rate becomes lower, firms
  - invest more (produce more capital)
  - lever up more against their future profits holding capital fixed in order to increase early payout (=leveraged share buyback)
  - take maturity risk by doing so (carry trades)
- The monetary authority correctly anticipates that setting the policy rate too low would generate an excess demand for funds:
- Endogenous lower bound below which leveraged share buybacks crowd out investment and create socially undesirable financial fragility

Broad intuition

- Optimal policy makes this lower bound as low as possible by offering emergency lending at a punitive rate. This minimizes the amount of undesirable financial risk taking per unit of real investment
- Second-best policy that still generates in equilibrium:
  - financial fragility in the form of large carry-trade activity
  - marginal indifference between share buybacks relative to productive investment despite a large wedge between the policy rate and the marginal return on capital...
  - ...that reflects the cost from taking on liquidity risk on carry trades

Roadmap

1. An elementary model of monetary easing
2. Monetary policy and financial instability

1. An elementary model of monetary easing

Setup

- Time is discrete
- 2 types of private agents:
  - Workers
  - Entrepreneurs
- Public sector

Setup

- 2 desirable goods:
  - A perishable consumption good that serves as numéraire
  - A capital or durable good. One unit of capital good produced at date t generates one unit of the consumption good at date $t+1$
- Bond market. There is a competitive market for one-period risk-free bonds denominated in the numéraire good

Workers

- Unit mass born at each date and live for two dates
- Supply one unit of labor when young
- Consume when old. Risk neutral
- Each worker owns a technology that transforms I units of labor into $g(I)$ contemporaneous units of the consumption good

Entrepreneurs

- Unit mass born at each date and live for two dates
- Risk neutral over consumption at each date. No discounting
- Each entrepreneur born at date t is endowed with a technology that transforms I units of labor at date t into $f(I)$ contemporaneous units of the capital good

Public sector

The public sector

- Does not consume and maximizes the total utility of the private sector, discounting that of future generations with a factor arbitrarily close to 1
- Monetary policy. The public sector announces at each date an interest rate at which it is willing to absorb any net demand for bonds
- Fiscal policy. The public sector can tax workers as it sees fit, and can, in particular, apply lump-sum taxes. It cannot tax nor regulate entrepreneurs

Comments

Monetary model of a "cashless" economy where

- Money only serves as a unit of account
- The public sector sets the nominal interest rate
- and this affects the real interest rate in the presence of nominal rigidities

Simplification here: extreme nominal rigidity—fixed price level for one good—to abstract from price level determination and focus on controlling the real rate

Steady-state

- We study steady-states in which the public sector announces a constant interest rate r. Denote w the market wage, and l the quantity of labor that workers supply to entrepreneurs
- Entrepreneurs then borrow wl to pay wages. If $r < 1$, they borrow the additional amount $(f(l) - rwl)/r$ against their next-date profit $f(l) - rwl$
- Workers invest in bonds both their labor income w and their profit $g(1 - l) - w(1 - l)$
- Firms maximize profits

$$g'(1 - l) = w,$$
$$f'(l) = rw$$

Steady-state

The consumption of a given cohort is then:

$$\underbrace{\left[1+\mathbf{1}_{\{r<1\}}\left(\frac{1}{r}-1\right)\right](f(l)-rwl)}_{\text{Entrepreneurs' income}}+\underbrace{rwl+rg(1-l)}_{\text{Old workers' pre-tax income}}$$

$$+\underbrace{(1-r)\left[g(1-l)-\mathbf{1}_{\{r<1\}}\left(\frac{f(l)}{r}-wl\right)\right]}_{\text{Rebate to old workers}}$$

$$=f(l)+g(1-l)$$

Steady-state

$$f(l) + g(1 - l)$$

Maximized by setting the interest rate at $r^* = 1$. In this case, the market wage w^* solves

$$w^* = g'(1 - l^*) = f'(l^*) = r^* w^*$$

Comments

1. Welfare irrelevance of leveraged share buybacks. Borrowing against their future profit $f(I) - rwl$ by young entrepreneurs when $r < 1$ in order to consume admits a straightforward interpretation as a leveraged share buyback
   Welfare-neutral transfer from workers to entrepreneurs. Immaterial if they do not create borrowing constraints, they are immaterial (purely redistributive)

2. Excess demand for funds. Does the public sector always has the sufficient tax capacity to accommodate bond trading by private agents? Yes, if $r \geq 1$. Not necessarily when r is sufficiently small, because young entrepreneurs' borrowing might exceed the income that young workers and the public sector (via taxation of old workers) can lend. Ignore this constraint for now

Monetary easing

- Suppose now that the date-0 cohort of workers have a less productive technology than that of the others
- Transforms x units of labor into $\rho g(x)$ contemporaneous units of the consumption good instead of $g(x)$, where $\rho \in (0, 1)$

Monetary easing - Flexible wage

- With a flexible wage, the interest rate $r^* = 1$ is still optimal at all dates
- The date-0 wage decreases to $w_0 < w^*$ such that investment grows at the optimal level $I_0 > I^*$

$$w_0 = \rho g'(1 - I_0) = f'(I_0)$$

Monetary easing - Rigid wage

Assumption. (Downward rigid wage) *The wage cannot be smaller than* w^* *at any date*

- The public sector can make up for the absence of appropriate price signals in the date-0 labor market by setting the date-0 policy rate at

$$r_0 = \frac{w_0}{w^*}$$

- Entrepreneurs invest up to the optimal level I_0 since

$$f'(I_0) = r_0 w^* = w_0.$$

- Each worker accommodates by applying in his own firm the residual quantity of labor that the other firms are not willing to absorb at the prevailing market wage w^*

Relationship to new Keynesian models/Interpretation

- In NK models optimal monetary policy anchors inflation expectations and sets the real interest rate at the natural level that would prevail under flexible prices
- Here only latter role: Monetary policy in our framework plays the very same latter role of mitigating distortions induced by nominal rigidities by gearing real variables towards their "natural" levels
- The natural level is not defined by an intertemporal rate of substitution here, but rather by the relative marginal productivities of two sectors

2. Monetary policy and financial instability

Liquidity risk

- Modify the modelling of entrepreneurs and capital-good technology so that both investment and share buybacks involve taking on liquidity risk

- Rest unchanged. In particular, financial instrument=one-period risk-free bond

Liquidity risk

- Entrepreneurs live for three dates, and value consumption at the initial and last dates of their lives
- A unit of capital good produced at date t yields one unit of consumption good at date $t+2$. Alternatively, can be liquidated at date $t+1$, generating $1/(1+\lambda)$ units of consumption at this date
- Liquidity risk. An entrepreneur born at date t has access to the bond market at date $t+1$ with probability $1-q$ only. (Diamond 1997)
- LOLR. In addition to monetary and fiscal instruments, the public sector can act as a lender of last resort or emergency lender, offering credit to the entrepreneurs who are excluded from the bond market at whichever conditions he sees fit

Analysis

Now entrepreneurs need to rollover short-term debt to finance wages and share buybacks. Liquidity risk (entrepreneurs stand both for firms and financial institutions here)

Same 2 steps as before:

1. Steady-state with constant productivity at each date
2. Productivity shock ρ on the consumption-good technology at date 0

Steady-state

Optimum unchanged

- $r^* = 1$, l^*, w^* as in the model without liquidity risk ($w^* = g'(1 - l^*) = f'(l^*)$)
- Unlimited emergency lending at a unit rate as well for middle-aged entrepreneurs excluded from markets
- The public sector fully insures entrepreneurs against liquidity risk at no cost

Date-0 productivity shock

- Productivity shock ρ on the consumption-good technology at date 0 and downward-rigid wage
- Unanticipated shock for expositional simplicity
- For each ρ define again $r_0(\rho)$ and $l_0(\rho)$:

$$\rho g'(1 - l_0(\rho)) = f'(l_0(\rho)) = r_0(\rho)w^*.$$

Optimal public policy?

- It cannot be efficient to distort the behavior of cohorts born at other dates than 0
  - It is still optimal to set the policy rate at 1 at all other dates than 0
  - It is still optimal to set the emergency rate at 1 at all other dates than 1
- Only need to characterize the date-0 policy rate r and emergency-lending policy at date 1 Λ
- It cannot be optimal to let date-0 entrepreneurs inefficiently liquidate assets at date 1: $\Lambda \leq 1 + \lambda$

Liquidity risk and share buybacks

Suppose that a date-0 entrepreneur has one unencumbered unit of the capital good. When does the entrepreneur borrow $1/r\Lambda$ for early consumption, and consume from the residual at date 2 if he has not been excluded from the market at date 1?

$$\frac{1}{r\Lambda} + \frac{(\Lambda - 1)(1 - q)}{\Lambda} > 1,$$

or

$$r < \frac{1}{1 + (\Lambda - 1)q}$$

The term $(\Lambda - 1)q$ represents the expected cost of liquidity risk. Define $\overline{\rho}$ as

$$r_0(\overline{\rho}) = \frac{1}{1 + \lambda q}$$

Optimal policy with small productivity shocks

(Monetary response to small productivity shocks) If $\rho \geq \overline{\rho}$, then the public sector optimally sets the policy rate at $r_0(\rho)$ at date 0. It acts as a lender of last resort at date 1 by lending up to $r_0(\rho)l_0(\rho)w^*$ at a unit rate to each entrepreneur at date 1.
There are no leveraged share buybacks in equilibrium, and the marginal date-0 return on capital is equal to the interest rate:

$$\frac{f'(l_0(\rho))}{w^*} = r_0(\rho).$$

Liquidity risk helps the public sector as it makes share buybacks unappealing at the optimal policy rate $r_0(\rho)$ provided $\rho \geq \overline{\rho}$

Optimal policy with larger productivity shocks

- If $\rho < \overline{\rho}$, then the public sector cannot set the date-0 policy rate at $r_0(\rho)$ and ration emergency lending this way
- This would induce share buybacks and inefficient liquidation
- Attaining the first-best date-0 output requires setting a date-0 policy rate r that induces share buybacks. This is not problematic per se as long as it does not lead to a binding borrowing constraint
- We now determine the values of $\rho < \overline{\rho}$ for which the first-best output level can be attained without hitting such a borrowing constraint

Optimal policy with larger productivity shocks

The optimal policy (r, Λ) implements the first-best investment level while minimizing date-0 entrepreneurs' demand for funds. It solves

$$\min_{r,\Lambda} \left\{ \frac{1}{r\Lambda} \right\}$$

s.t.

$$\frac{f'(I_0(\rho))}{w^*} = \frac{r\Lambda}{1 + r(\Lambda - 1)(1 - q)},$$
$$\Lambda \leq 1 + \lambda.$$

- The solution is attained at $\Lambda = 1 + \lambda$ and $r = r_\lambda(\rho) < r_0(\rho)$
- Borrowing constraint slack at this solution if $\rho \geq \underline{\rho}$

Optimal policy with intermediate productivity shocks

(Monetary response to intermediate productivity shocks) There exists $\underline{\rho} \leq \overline{\rho}$ such that for all $\rho \in [\underline{\rho}, \overline{\rho})$, the public sector can implement the first-best output, there are leveraged share buybacks at date 0, and emergency lending prevents inefficient liquidation of capital. The optimal policy consists in setting a date-0 rate $r_\lambda(\rho) < r_0(\rho)$. Emergency lending takes place at a rate $1 + \lambda$ without any restriction on quantities. The marginal return on capital is strictly above the date-0 rate:

$$\frac{f'(I_0)}{w^*} = r_0 > r_\lambda.$$

Intuition: the optimal policy minimizes the size of the carry trade for each unit of investment. Minimizes financial risk taking for each dollar of capital expenditure

Optimal policy with large productivity shocks

(Monetary response to large productivity shocks) If $\rho < \underline{\rho}$, then the public sector cannot implement the first-best output level. It cannot spur more investment than the optimal level $f(I_0(\underline{\rho}))$ corresponding to a policy rate $r_\lambda(\underline{\rho})$. There are leveraged shares buyback and emergency lending at a punitive rate $1 + \lambda$. If the public sector mistakenly sets the date-0 rate at a level below $r_\lambda(\underline{\rho})$, then investment snaps back to the steady-state level $f(I^*)$

Intuition

- If the shock is large ($\rho < \underline{\rho}$), then any policy $(r, 1+\lambda)$ that would implement the first-best output absent borrowing constraint would generate a borrowing constraint
- A constrained entrepreneur allocates his borrowing capacity B between investment $w^* I$ and early consumption $B - w^* I$ so as to maximize, up to a constant,

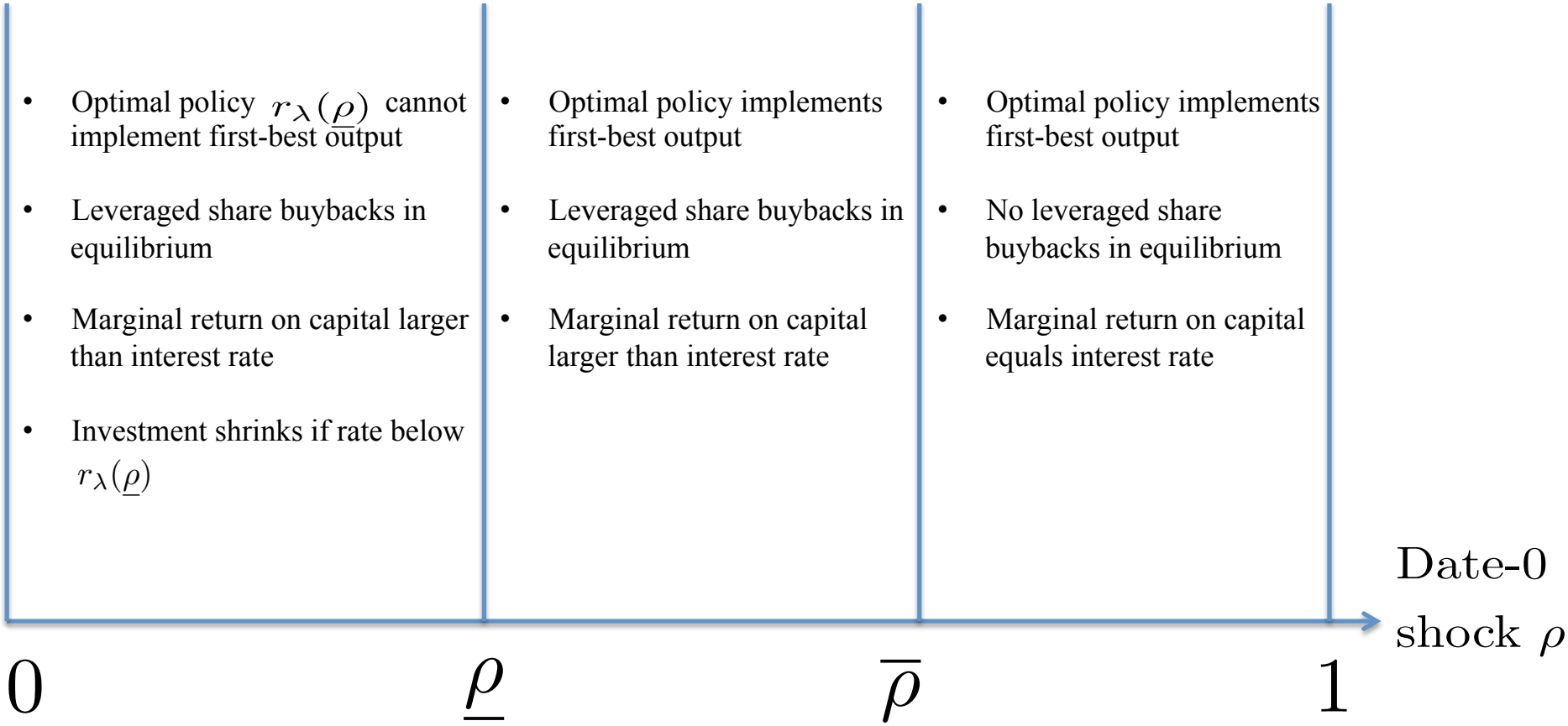
$$f(I) + B - w^* I$$

and thus chooses I such that

$$f'(I) = w^*$$

- Thus investment snaps back to the non-stimulated level

Summary


• Optimal policy $r_\lambda(\underline{\rho})$ cannot implement first-best output
• Leveraged share buybacks in equilibrium
• Marginal return on capital larger than interest rate
• Investment shrinks if rate below $r_\lambda(\underline{\rho})$
• Optimal policy implements first-best output
• Leveraged share buybacks in equilibrium
• Marginal return on capital larger than interest rate
• Optimal policy implements first-best output
• No leveraged share buybacks in equilibrium
• Marginal return on capital equals interest rate
Date-0 shock ρ
0
$\underline{\rho}$
$\overline{\rho}$
1

Discussion and extensions

The role of asset liquidity

- Threshold $\overline{\rho}$ above which there are no leveraged share buybacks in equilibrium is decreasing in λ
- Threshold $\underline{\rho}$, below which aggregate borrowing is constrained and investment is suboptimal, is also decreasing in λ
- Second-best result: More illiquid assets give more degrees of freedom to the public sector and makes it easier to spur investment

Shadow banking and maturity transformation outside banks

- Monetary easing must spur a strong demand for "carry trades" in an economy in which maturity transformation is not strictly regulated
- In line with the rapid growth of an important shadow-banking system that accompanied the "Great Deviation" identified by Taylor (2011) and collapsed in 2008
- Following post-2008 unconventional monetary policy, unregulated maturity transformation has moved over to asset management industry flows into junk bonds, mortgage-backed assets, emerging market government and corporate bonds

Political-economy constraints

- Extreme assumption on the irrelevance of transfers
- First-best output fails to be implemented only when entrepreneurs' demand for loans exceeds the entire supply of funds in the economy. This clearly is an extreme view
- It is straightforward to add to this setup a constraint on the magnitude of the transfer from old workers towards young entrepreneurs at date 0. The tighter the constraint, the higher the threshold $\underline{\rho}$ below which the first-best output is out of reach

Asset purchases

- An important component of the post 2008 unconventional monetary policy is the purchase of mortgage-backed securities by the Federal Reserve
- In our setup, equivalent would be swaps of units of the capital good for public bonds between the public sector and the entrepreneurs
- Swapping $1/r_0$ bonds for each unit of capital produced at date 0, would generate the first-best output without triggering any excess demand of funds due to share buybacks at date 0
- But the risk that such an excess demand of funds arises is only postponed to date 1: overpaying for private assets creates a public deficit at this date