Liquidity, Macroprudential Regulation, and Optimal Policy

Roberto Chang

Rutgers

March 2013

Liquidity Management and Policy

- So far we have emphasized models in which financial frictions affect aggregate outcomes

Liquidity Management and Policy

- So far we have emphasized models in which financial frictions affect aggregate outcomes
- And asset prices can determine the severity of financial frictions

Liquidity Management and Policy

- So far we have emphasized models in which financial frictions affect aggregate outcomes
- And asset prices can determine the severity of financial frictions
- The valuation of net worth becomes an important determinant of policy

- Holmstrom-Tirole, and others: investors presumably predict that they may be subject to liquidity constraints in the future

- Holmstrom-Tirole, and others: investors presumably predict that they may be subject to liquidity constraints in the future
- As a response, they choose how much liquidity to hold today vis a vis tomorrow

- Holmstrom-Tirole, and others: investors presumably predict that they may be subject to liquidity constraints in the future
- As a response, they choose how much liquidity to hold today vis a vis tomorrow
- Typically, this leads to a crucial *tradeoff between investment and liquidity*

The Pecuniary Externality Problem

- Lorenzoni: If collateral constraints depend on asset prices, then individual liquidity choices do not lead to a socially correct decision

The Pecuniary Externality Problem

- Lorenzoni: If collateral constraints depend on asset prices, then individual liquidity choices do not lead to a socially correct decision
- This is because each individual ignores the impact of his decision on asset prices and, therefore, on other agents' collateral constraints

The Pecuniary Externality Problem

- Lorenzoni: If collateral constraints depend on asset prices, then individual liquidity choices do not lead to a socially correct decision
- This is because each individual ignores the impact of his decision on asset prices and, therefore, on other agents' collateral constraints
- This implies that there may be a welfare improving role for policy

Macroprudential Policy Or Mopping After the Crash?

- Some have advocated ex ante restrictions on borrowing and lending

Macroprudential Policy Or Mopping After the Crash?

- Some have advocated ex ante restrictions on borrowing and lending
- Others to enact corrective policies only if collateral constraints become binding

Macroprudential Policy Or Mopping After the Crash?

- Some have advocated ex ante restrictions on borrowing and lending
- Others to enact corrective policies only if collateral constraints become binding
- Jeanne-Korinek (2012) gives a nice model to express these ideas

Jeanne-Korinek

- $t = 0, 1, 2$
- Entrepreneurs and workers

Workers

Linear utility:

$$Ec_0^w + c_1^w + c_2^w - \omega(l_1 + l_2)$$

This pins the real wage at ω, and the interest rate at zero.

Entrepreneurs

- Linear utility too:

$$E(c_0 + c_1 + c_2)$$

- Access to production function

$$y_t = (A_t k_t)^{\alpha} l_t^{1-\alpha}$$

- Let $\kappa A_t k_t =$ profit function
- A_1 is stochastic (the only source of uncertainty in the model)
- A_2 depends on investment x at $t = 1$:

$$A_2 = A(x)$$

Budget Constraints

- Workers are endowed with goods in period 0 (y_0)
- Then budget constraints are given by

Period	Entrepreneurs	Workers
$t = 0$	$c_0 + I(k) = d_0 k$	$c_0^w + b_0 = y_0$
$t = 1$	$xk + c_1 + d_0 k = \kappa A_1 k + d_1 k$	$c_1^w + b_1 = \omega l_1 + b_0$
$t = 2$	$c_2 + d_1 k = \kappa A_2 k$	$c_2^w = \omega l_2 + b_1$

Collateral Constraint

- If an entrepreneur walks away, his capital is seized and sold at some price $p_t = \kappa \tilde{A}_t$ (where the tilde denotes the *average* value of A_t)
- Hence debt contracts will satisfy:

$$d_t \leq \phi \min_t p_{t+1}$$

First Best (No Collateral Constraints)

- Assume there are no collateral constraints

First Best (No Collateral Constraints)

- Assume there are no collateral constraints
- Easy to show that $U^w = y_0$

First Best (No Collateral Constraints)

- Assume there are no collateral constraints
- Easy to show that $U^w = y_0$
- So the first best allocation maximizes the welfare of entrepreneurs: $E\left[\kappa A_1 + \kappa A(x) - x\right] k - I(k)$

First Best (No Collateral Constraints)

- Assume there are no collateral constraints
- Easy to show that $U^w = y_0$
- So the first best allocation maximizes the welfare of entrepreneurs: $E\left[\kappa A_1 + \kappa A(x) - x\right] k - I(k)$
- FOCs are

$$\begin{aligned} \kappa A'(x) &= 1 \\ I'(k) &= E\left[\kappa(A_1 + A_2) - x\right] \end{aligned}$$

Laissez Faire Equilibrium

- In period 2, the liquidation price of capital is

$$p_2 = \kappa A_2 = \kappa A(x)$$

Laissez Faire Equilibrium

- In period 2, the liquidation price of capital is

$$p_2 = \kappa A_2 = \kappa A(x)$$

- Hence the collateral constraint faced by each entrepreneur in period $t = 1$ is

$$d_1^i \leq \phi p_2 = \kappa \phi A(x)$$

Laissez Faire Equilibrium

- In period 2, the liquidation price of capital is

$$p_2 = \kappa A_2 = \kappa A(x)$$

- Hence the collateral constraint faced by each entrepreneur in period $t = 1$ is

$$d_1^i \leq \phi p_2 = \kappa \phi A(x)$$

- Combining with budget constraint, this implies

$$x^i + d_0^i \leq \kappa \left[A_1 + \phi A(x) \right]$$

Laissez Faire Equilibrium

- In period 2, the liquidation price of capital is

$$p_2 = \kappa A_2 = \kappa A(x)$$

- Hence the collateral constraint faced by each entrepreneur in period $t = 1$ is

$$d_1^i \leq \phi p_2 = \kappa \phi A(x)$$

- Combining with budget constraint, this implies

$$x^i + d_0^i \leq \kappa \left[A_1 + \phi A(x)\right]$$

- In a symmetric equilibrium, $x^i = x$. Assume $\kappa \phi A'(x) < 1$ to avoid multiple equilibria.

Laissez Faire Equilibrium

- In period 2, the liquidation price of capital is

$$p_2 = \kappa A_2 = \kappa A(x)$$

- Hence the collateral constraint faced by each entrepreneur in period $t = 1$ is

$$d_1^i \leq \phi p_2 = \kappa \phi A(x)$$

- Combining with budget constraint, this implies

$$x^i + d_0^i \leq \kappa \left[A_1 + \phi A(x) \right]$$

- In a symmetric equilibrium, $x^i = x$. Assume $\kappa \phi A'(x) < 1$ to avoid multiple equilibria.
- Then, if constraint binds, note the amplification effect:

$$dx = \frac{\kappa}{1 - \phi \kappa A'(x)} dA_1$$

- Easy to see that $c_0 = c_1 = 0$, so

$$d_0^i = d(k^i) = \frac{I(k^i)}{k^i}$$

- Assume collateral constraint does not bind at $t = 0$
- Then the entrepreneur chooses k^i to maximize the expectation of

$$\max_{x^i} \left[\kappa A_1 + \kappa A(x^i) - x^i\right] k^i - I(k^i) + \lambda^i \left[\kappa A_1 + \phi\kappa A_2 - x^i - d(k^i)\right] k^i$$

- Note that the FOC for x^i is

$$\kappa A'(x^i) = 1 + \lambda^i$$

- *Main result:* If $E(\lambda^{LF}) > 0$ then

$$k^{LF} < k^{FB}$$

- This says that if the collateral constraint is expected to bind, then the productivity enhancing expenditure x is expected to be below its first best level, which reduces the incentive to invest.

Externalities

- Consider the problem of a planner that chooses k and x to maximize the expectation of

$$\max_x \left[\kappa A_1 + \kappa A(x) - x\right] k - I(k) + \lambda \left[\kappa A_1 + \phi\kappa A(x) - x - d(k)\right] k$$

- This differs from the problem of the representative entrepreneur in that the planner knows $p_2 = \kappa A_2 = \kappa A(x)$
- The FOC for x is

$$\tilde{\lambda} = \frac{\kappa A'(x) - 1}{1 - \phi\kappa A'(x)}$$

- This says that the value of x to the planner is higher than in laissez faire: an increase in x increases p_2, which relaxes the collateral constraint

Macroprudential Regulation

- KJ ask: what if the planner discourages investment in period 0 with a lump sum tax?

Answer: Proposition 2:

1. $k^{MP} < k^{LF} (< k^{FB})$: the planner chooses lower investment in period 0

Intuition:

Macroprudential Regulation

- KJ ask: what if the planner discourages investment in period 0 with a lump sum tax?

Answer: Proposition 2:

1. $k^{MP} < k^{LF} (< k^{FB})$: the planner chooses lower investment in period 0
2. $\tau_0^{MP} > 0$

Intuition:

Macroprudential Regulation

- KJ ask: what if the planner discourages investment in period 0 with a lump sum tax?

Answer: Proposition 2:

1. $k^{MP} < k^{LF} (< k^{FB})$: the planner chooses lower investment in period 0
2. $\tau_0^{MP} > 0$
3. $E(\lambda^{LF}) > E(\lambda^{MP}) > 0$: the planner reduces but does not completely eliminate binding collateral constraints

Intuition:

Macroprudential Regulation

- KJ ask: what if the planner discourages investment in period 0 with a lump sum tax?

Answer: Proposition 2:

1. $k^{MP} < k^{LF} (< k^{FB})$: the planner chooses lower investment in period 0
2. $\tau_0^{MP} > 0$
3. $E(\lambda^{LF}) > E(\lambda^{MP}) > 0$: the planner reduces but does not completely eliminate binding collateral constraints

Intuition:

- To increase x relative to LF, the planner reduces initial investment

Macroprudential Regulation

- KJ ask: what if the planner discourages investment in period 0 with a lump sum tax?

Answer: Proposition 2:

1. $k^{MP} < k^{LF} (< k^{FB})$: the planner chooses lower investment in period 0
2. $\tau_0^{MP} > 0$
3. $E(\lambda^{LF}) > E(\lambda^{MP}) > 0$: the planner reduces but does not completely eliminate binding collateral constraints

Intuition:

- To increase x relative to LF, the planner reduces initial investment
- This is costly, however, since it brings investment away from first best. Hence it does not pay to eliminate collateral constraints completely.

Ex Post Bailout Measures

- Consider instead a policy in which entrepreneur i receives a subsidy transfer sk^i in period 1, if constrained

Ex Post Bailout Measures

- Consider instead a policy in which entrepreneur i receives a subsidy transfer sk^i in period 1, if constrained
- This is financed with a tax τ_2 on labor in period 2 (the planner issues debt in period $t = 1$)

Ex Post Bailout Measures

- Consider instead a policy in which entrepreneur i receives a subsidy transfer sk^i in period 1, if constrained
- This is financed with a tax τ_2 on labor in period 2 (the planner issues debt in period $t = 1$)
- The assumption that the financing of bailouts is distortionary is *crucial*: if not, then bailouts would suffice to deal with collateral constraints and the first best would be attainable. (Benigno et al.)

Ex Post Bailout Measures

- Consider instead a policy in which entrepreneur i receives a subsidy transfer sk^i in period 1, if constrained
- This is financed with a tax τ_2 on labor in period 2 (the planner issues debt in period $t = 1$)
- The assumption that the financing of bailouts is distortionary is *crucial*: if not, then bailouts would suffice to deal with collateral constraints and the first best would be attainable. (Benigno et al.)
- The tax reduces period 2 profit of entrepreneurs to $k(\tau_2)A_2k_2$

Ex Post Bailout Measures

- Consider instead a policy in which entrepreneur i receives a subsidy transfer sk^i in period 1, if constrained
- This is financed with a tax τ_2 on labor in period 2 (the planner issues debt in period $t = 1$)
- The assumption that the financing of bailouts is distortionary is *crucial*: if not, then bailouts would suffice to deal with collateral constraints and the first best would be attainable. (Benigno et al.)
- The tax reduces period 2 profit of entrepreneurs to $k(\tau_2)A_2k_2$
- Time consistency issue: the solution depends on whether the planner acts under commitment or discretion

Optimal Bailout Policy Under Discretion

1. There is a bailout if and only if the financial constraint is binding under laissez faire
2. The bailout mitigates the constraint but does not fully eliminate it
3. $k^{BL} > k^{LF}$: initial investment is more than under laissez faire (because the return to capital increases due to the bailout policy)

Bailout Policy Under Commitment

- Under commitment, bailouts are smaller than under discretion

Bailout Policy Under Commitment

- Under commitment, bailouts are smaller than under discretion
- This reflects the fact that investment incentives are too large under discretion

Optimal Policy Mix

If the planner can use both ex ante and ex post measures, he will choose:

- $\tau_0^{MIX} > 0$: a positive initial tax on investment
- Bailouts if and only if financial constraint binds
- Binding financial constraints are not fully eliminated

Investment and Overborrowing

- Under the optimal policy,

$$k^{MP} < k^{MIX} < k^{BL}$$

Investment and Overborrowing

- Under the optimal policy,

$$k^{MP} < k^{MIX} < k^{BL}$$

- However, k^{MIX} can be greater than or smaller than k^{LF}

Investment and Overborrowing

- Under the optimal policy,

$$k^{MP} < k^{MIX} < k^{BL}$$

- However, k^{MIX} can be greater than or smaller than k^{LF}
- Implications for debate on *overborrowing:* in this model, a comparison between k^{MIX} and k^{LF} does not suffice to determine the direction of the optimal macroprudential policy (τ_0^{MIX})

Optimal Policy Mix and Time Consistency

- KJ show that the optimal policy mix is the same whether the planner acts under commitment or discretion.
- This reflects that the planner has enough policy instruments: bailouts can be used to deal with financial constraints, and macroprudential policy to correct the impact on expectations.

Alternative Ex-Post Policy Measures

KJ examine alternatives for ex post bailouts, such as:

- Lump Sum Transfers
- Forgiveness of initial debt
- Investment tax credit
- Subsidy to new borrowing

The key is that all of these can be tailored so as to alleviate collateral constraints in the same way. They may provide different incentives for investment at $t = 0$. But one can correct for those via macroprudential policy.

Prop. 12: All of the ex post measures, when complemented with an appropriate adjustment of τ_0, implement the same optimal policy mix allocation.