Credit Frictions and Optimal Monetary Policy

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Motivation

“New Keynesian” monetary models often abstract entirely from financial intermediation and hence from financial frictions.
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- Representative household
- Complete (frictionless) financial markets
- Single interest rate (which is also the policy rate) relevant for all decisions
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  • Representative household
  • Complete (frictionless) financial markets
  • Single interest rate (which is also the policy rate) relevant for all decisions

• But in actual economies (even financially sophisticated), there are different interest rates, that do not move perfectly together
Spreads
(Sources: FRB, IMF/IFS)
USD LIBOR-OIS Spreads
(Source: Bloomberg)
LIBOR 1m vs FFR target
(source: Bloomberg and Federal Reserve Board)
Motivation

Questions:

- How much is monetary policy analysis changed by recognizing existence of spreads between different interest rates?

- How should policy respond to “financial shocks” that disrupt financial intermediation, dramatically widening spreads?
The Model

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  - heterogeneity in spending opportunities
  - costly financial intermediation
The Model: Heterogeneity

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  - Other times, can borrow or lend only through intermediaries, at a one-period, riskless nominal rate, different for savers and borrowers

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- Consequence: long-run marginal utility of income same for all households, regardless of history of spending opportunities
Financial intermediation technology: in order to supply loans in (real) quantity $b_t$, must obtain (real) deposits

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- More generally, we allow
  \[ 1 + \omega_t(b_t) = \mu^b_t(b_t)(1 + \Xi_{bt}(b_t)), \]
  where $\{\mu^b_t\}$ is a **markup** in the banking sector (perhaps a risk premium)
Intertemporal IS relation:

\[ \hat{Y}_t = E_t \hat{Y}_{t+1} - \bar{\sigma} [\hat{i}_{t}^{avg} - \pi_{t+1}] - E_t [\Delta g_{t+1} + \Delta \hat{\Xi}_{t+1} - \bar{\sigma}_s \Omega \Delta \hat{\Omega}_{t+1}] \]

where

\[ \hat{i}_{t}^{avg} \equiv \pi_b \hat{i}_t^b + \pi_s \hat{i}_t^d , \]
Log-Linear Equations

- Intertemporal IS relation:

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where

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\hat{i}_{t}^{avg} \equiv \pi_b \hat{i}_t^b + \pi_s \hat{i}_t^d,
\]

- Variation in marginal-utility gap \( \hat{\Omega}_t \):

\[
\hat{\Omega}_t = \hat{\omega}_t + \delta E_t \hat{\Omega}_{t+1},
\]

where \( \hat{\omega}_t \) is deviation of credit spread from its steady-state value
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Hence the rate \(\hat{\iota}^{avg}_t\) that appears in IS relation is determined by

\[
\hat{\iota}^{avg}_t = \hat{i}^d_t + \pi_b\hat{\omega}_t
\]
Log-linear AS relation: generalizes NKPC:

\[ \pi_t = \kappa(\hat{Y}_t - \hat{Y}_t^n) + u_t + \zeta(s_\Omega + \pi_b - \gamma_b)\hat{\Omega}_t - \zeta \sigma^{-1}\hat{\xi}_t + \beta E_t \pi_{t+1} \]
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where definition of natural rate \( \hat{Y}_t^n \), cost-push shock \( u_t \), are same as in basic NK model.
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- Then the usual **3-equation model** suffices to determine paths of \( \{ \hat{Y}_t, \pi_t, \hat{i}^{avg}_t \} \):
  - AS relation
  - IS relation
  - MP relation (written in terms of implication for \( \hat{i}^{avg}_t \), given exogenous spread).
What Difference Do Frictions Make?

- Responses of output, inflation, interest rates to non-financial shocks (under a given monetary policy rule, e.g. Taylor rule) are identical to those predicted by basic NK model

- hence no change in conclusions about desirability of a given rule, from standpoint of stabilizing in response to those disturbances
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- But how robust this conclusion? For more general credit frictions, we resort to numerical solution of calibrated examples
Calibrated Model

- Calibration of **preference heterogeneity**: assume equal probability of two types, $\pi_b = \pi_s = 0.5$, and $\delta = 0.975$ (average time that type persists = 10 years)
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- Assume $C^b/C^s = 3.65$ in steady state (given $G/Y = 0.3$, this implies $C^s/Y \approx 0.3$, $C^b/Y \approx 1.1$)

  — implied steady-state debt: $\bar{b}/\bar{Y} = 0.5 - 0.6$
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- Assume \( \sigma_b / \sigma_s = 5 \)

  — implies credit contracts in response to monetary policy tightening (consistent with VAR evidence)
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Calibration of financial frictions: Resource costs $\Xi_t(b) = \tilde{\Xi}_t b^\eta$, exogenous markup $\mu^b_t$.
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- Zero steady-state markup; resource costs imply steady-state credit spread $\bar{\omega} = 2.0$ percent per annum (median spread between FRB C&I loan rate and FF rate)
  
  — implies $\bar{\lambda}^b/\bar{\lambda}^s = 1.22$
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- Calibrate $\eta$ so that 1 percent increase in volume of bank credit raises credit spread by .10 percent [relative VAR responses of credit, spread]
  
  $\eta = 6.06$
Numerical Results: Taylor Rule

Let monetary policy be specified by

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- Compare the predicted effects of policy for 3 alternative model specifications:
  - **FF model**: model with heterogeneity and credit frictions, as above
  - **No FF model**: same heterogeneity, but \( \omega_t = \Xi_t = 0 \) at all times
  - **RepHH model**: representative household with intertemporal elasticity \( \bar{\sigma} \)
Numerical Results: Taylor Rule

Responses to monetary policy shock: convex technology
Responses to technology shock: convex technology
Responses to wage markup shock: convex technology
Responses to shock to government purchases: convex technology
Responses to shock to government debt: convex technology
Numerical Results: Taylor Rule

Responses to shock to demand of savers: convex technology
Optimal Policy: LQ Approximation

- Compute a **quadratic approximation** to this welfare measure, in the case of small fluctuations around the **optimal steady state**.
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- Compute a quadratic approximation to this welfare measure, in the case of small fluctuations around the optimal steady state.

- Results especially simple in special case:
  - No steady-state distortion to level of output ($P = MC$, $W/P = MRS$) (Rotemberg-Woodford, 1997)
  - No steady-state credit frictions: $\bar{\omega} = \bar{\Xi} = \bar{\Xi}_b = 0$
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  —Note, however, that we do allow for shocks to the size of credit frictions

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Optimal Policy: LQ Approximation

- Approximate objective: max of expected utility equivalent (to 2d order) to minimization of quadratic loss function

\[ \sum_{t=0}^{\infty} \beta^t \left[ \pi_t^2 + \lambda_y (\hat{Y}_t - \hat{Y}_n)^2 + \lambda_\Omega \hat{\Omega}_t^2 + \lambda_\Xi \Xi_{bt} \hat{b}_t \right] \]
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- LQ problem: minimize loss function subject to log-linear constraints: AS relation, IS relation, law of motion for \( \hat{b}_t \), relation between \( \hat{\Omega}_t \) and expected credit spreads
Consider special case:

- No resources used in intermediation ($\Xi_t(b) = 0$)
- Financial markup $\{\mu_t^b\}$ an exogenous process

Result: optimal policy is characterized by the same target criterion as in basic NK model:

$$\pi_t + \left(\frac{\lambda y}{\kappa} \right) (x_t - x_{t-1}) = 0$$

(“flexible inflation targeting”)
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However, state-contingent path of policy rate required to implement the target criterion is not the same.
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But numerical results suggest still a fairly good \textit{approximation} to optimal policy
Numerical Results: Optimal Policy

Responses to technology shock, under 4 monetary policies
Numerical Results: Optimal Policy

Responses to wage markup shock, under 4 monetary policies
Numerical Results: Optimal Policy

Responses to shock to government purchases, under 4 monetary policies

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Responses to shock to demand of savers, under 4 monetary policies
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Responses to financial shock, under 4 monetary policies
Rule of thumb suggested by various authors (McCulley and Toloui, 2008; Taylor, 2008): adjust the intercept of the Taylor rule in proportion to changes in spreads:

\[ \hat{i}_t^d = \phi \pi_t + \pi_y \hat{Y}_t - \phi \omega \hat{\omega}_t \]
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- We allow for other possible values of $\phi \omega$
Responses to financial shock, under alternative spread adjustments
Numerical Results: Spread-Adjusted Taylor Rules

Responses to a shock to government debt
Numerical Results: Spread-Adjusted Taylor Rules

Responses to a shock to the demand of savers
Numerical Results: Spread-Adjusted Taylor Rules

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Responses to a technology shock
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Responding to Credit

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- Christiano et al. (2007) suggest modified Taylor rule:

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- We consider this family of rules, allowing also for \( \phi_b < 0 \)
Numerical Results: Responding to Credit

Responses to a “financial shock”
Numerical Results: Responding to Credit

Responses to a shock to government purchases
Responses to a technology shock
Provisional Conclusions

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- More generally, a generalization of basic NK model that retains many qualitative features of that model of the transmission mechanism.

- Quantitatively, basic NK model remains a good approximation, esp. if little endogeneity of credit spreads.
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- **Credit** a more important state variable than **money**

- However, **interest-rate spreads** really what matter more than variations in **quantity of credit**
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  - However, optimal **degree of adjustment** not same for all shocks
  - And such a rule inferior to **commitment to a target criterion**

- Guideline for policy: base policy decisions on a **target criterion** relating **inflation to output gap** (optimal in absence of credit frictions)
  - Take account of credit frictions only in **model** used to determine policy action required to **fulfill target criterion**