Monetary Economics

Chapter 7: Quantitative vs. Credit Easing

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Object of the chapter

- In Chapter 6, we studied one kind of unconventional monetary policy: forward guidance, i.e. communication about future policy interest rates.

- In Chapter 7, we will study two other kinds of unconventional monetary policy: quantitative easing and credit easing.

- Broadly speaking,
    - "**quantitative easing**" (QE) refers to an increase in bank reserves (on the liability side of the central bank's balance sheet),
    - "**credit easing**" (CE) refers to an increase in private loans and securities (on the asset side of the central bank's balance sheet).

- According to these definitions,
    - the Bank of Japan has conducted QE from 2001 to 2006,
    - the Federal Reserve has been conducting CE since 2008.

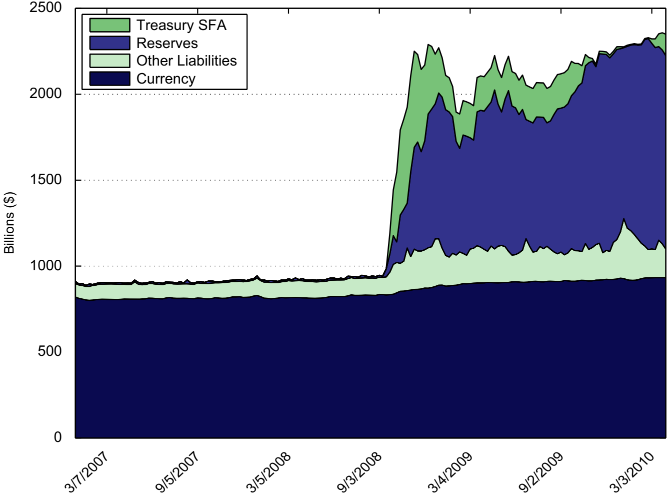
In Bernanke's (2009) words I

"The Federal Reserve's approach to supporting credit markets is conceptually distinct from quantitative easing (QE), the policy approach used by the Bank of Japan from 2001 to 2006. Our approach – which could be described as 'credit easing' – resembles quantitative easing in one respect: It involves an expansion of the central bank's balance sheet. However, in a pure QE regime, the focus of policy is the quantity of bank reserves, which are liabilities of the central bank; the composition of loans and securities on the asset side of the central bank's balance sheet is incidental. Indeed, although the Bank of Japan's policy approach during the QE period was quite multifaceted, the overall stance of its policy was gauged primarily in terms of its target for bank reserves.

In Bernanke's (2009) words II

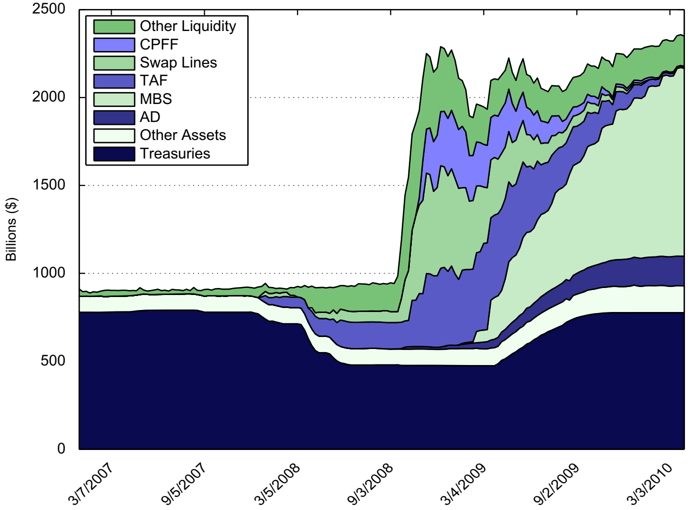
In contrast, the Federal Reserve's credit easing approach focuses on the mix of loans and securities that it holds and on how this composition of assets affects credit conditions for households and businesses. This difference does not reflect any doctrinal disagreement with the Japanese approach, but rather the differences in financial and economic conditions between the two episodes. In particular, credit spreads are much wider and credit markets more dysfunctional in the United States today than was the case during the Japanese experiment with quantitative easing. To stimulate aggregate demand in the current environment, the Federal Reserve must focus its policies on reducing those spreads and improving the functioning of private credit markets more generally."

Liabilities of the Fed, 2007-2010



Source: Cúrdia and Woodford (2011).

Assets of the Fed, 2007-2010



Source: Cúrdia and Woodford (2011).

Glossary

- SFA: Supplemental Financing Account (Sept. 2008 – July 2011).
- CPFF: Commercial Paper Funding Facility (Oct. 2008 – Feb. 2010).
- TAF: Term Auction Facility (Dec. 2007 – March 2010).
- MBS: Mortgage-Backed Securities (Nov. 2008 – March 2010, Sept. 2012 – present).
- AD: Agency Debt (Nov. 2008 – March 2010).

Extending the basic New Keynesian model

- The basic New Keynesian model is unable to capture any role for these unconventional policies, because it has
  - no financial exchanges (as all households are identical),
  - no financial frictions (as loans are costless and safe).
- To analyze these policies, we will use Cúrdia and Woodford's (2011) model, which introduces, into the basic New Keynesian model,
  - heterogeneity across households (to generate financial exchanges),
  - financial intermediaries (to generate financial frictions).

Outline of the chapter

Households' preferences

- Each household i seeks to maximize

$$\mathbb{E}_0 \sum_{t=0}^{+\infty} \beta^t \left\{ u^{\tau_t(i)} \left[c_t(i) \right] - \int_0^1 v^{\tau_t(i)} \left[h_t(j;i) \right] dj \right\},$$

where $\tau_t(i) \in \{b, s\}$ is household i's type at date t,

$$u^{\tau}(c) \equiv \frac{c^{1-\sigma_\tau}}{1-\sigma_\tau} \quad \text{and} \quad v^{\tau}(h) \equiv \frac{\psi_\tau}{1+\nu} h^{1+\nu},$$

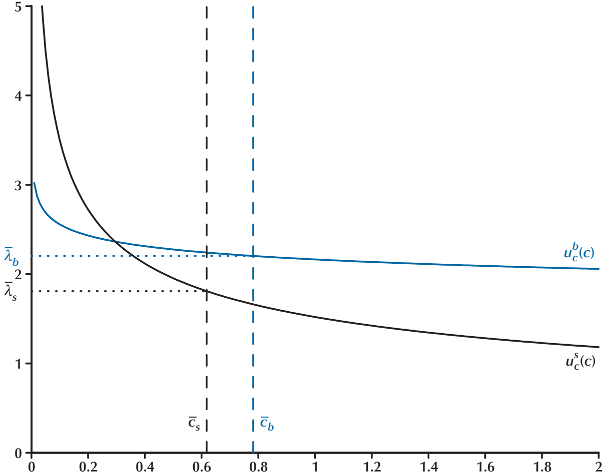
with $\sigma_\tau > 0$, $\nu > 0$, and $\psi_\tau > 0$ for $\tau \in \{b, s\}$.

- Type b will stand for "borrower", type s for "saver".

Households' types

- At each date, with probability δ, the type remains the same as in the previous date.
- With probability $1-\delta$, the type is drawn again:
  - it is b with probability π_b,
  - it is s with probability $\pi_s = 1 - \pi_b$.
- Therefore, under adequate initial conditions, the population fractions of the two types are constant over time, equal to π_τ for each type τ.
- It is assumed that $u_c^b(c) > u_c^s(c)$ for all values of c that can occur in equilibrium.
- So, for the same consumption level, households of type b value more marginal consumption than households of type s.

Marginal utilities of consumption for the two types



Source: Cúrdia and Woodford (2010). The values $\overline{c}^s$ and $\overline{c}^b$ indicate the steady-state consumption levels of the two types, and $\overline{\lambda}^s$ and $\overline{\lambda}^b$ the corresponding marginal utilities.

Financial contracts

- Households can
  - save only by depositing funds with financial intermediaries, at the one-period nominal interest rate i_t^d,
  - borrow only from financial intermediaries, at the one-period nominal interest rate i_t^b.
- Only one-period riskless nominal contracts with the intermediaries are possible for either savers or borrowers.
- There is also one-period riskless nominal government debt, which for households is a perfect substitute to deposits with intermediaries.

An insurance mechanism to simplify aggregation I

- Without any insurance mechanism, each household's current consumption decision would depend on his/her whole type history.
- Therefore, the distribution of consumption across households would become more and more dispersed over time.
- To avoid this complexity, it is assumed that households
  - originally start with identical financial wealth,
  - are able to sign state-contingent contracts with one another, through which they may insure one another against idiosyncratic risk,
  - are able to receive transfers from the insurance agency only when they draw a new type (and before knowing this type).

An insurance mechanism to simplify aggregation II

- These state-contingent contracts will be such that all households drawing their types at the same date will have the same marginal utility of income at that date before learning their new types (if each has behaved optimally until then).
- Given that they have identical continuation problems at that time (before learning their new types), these contracts will be such that they have the same post-transfer financial wealth at that date (if each has behaved optimally until then).
- Contractual transfers are contingent only on the history of aggregate and idiosyncratic exogenous states, not on households' actual wealths (otherwise this would create perverse incentives).

An insurance mechanism to simplify aggregation III

- It can be shown that, under certain conditions, households that have not re-drawn their type have the same marginal utility of income as households that have re-drawn their type and are of the same type.

- Therefore, in equilibrium, the marginal consumption utility of any given household i at any given date t depends only on its type at this date: $\lambda_t(i) = \lambda_t^{\tau_t(i)}$.

- Therefore, in equilibrium, the consumption of any given household i at any given date t depends only on its type at this date: $c_t(i) = c^{\tau_t(i)}[\lambda_t^{\tau_t(i)}]$.

- This insurance mechanism facilitates aggregation, as the goods-market clearing condition can then be written $Y_t = \sum_{\tau \in \{b,s\}} \pi_\tau c^\tau(\lambda_t^\tau) + \Xi_t$, where Ξ_t denotes resources consumed by intermediaries.

Euler equations

- It can be shown that, under certain conditions, in equilibrium,
  - households of type s always have positive savings,
  - households of type b always borrow.

- Therefore, the intertemporal first-order conditions of households' optimization programs are

$$\lambda_t^\tau = \beta \mathbb{E}_t \left\{ \frac{1 + i_t^{b \mathbb{1}_{\tau=b} + d \mathbb{1}_{\tau=s}}}{\Pi_{t+1}} \left[\left[\delta + (1-\delta)\pi_\tau \right] \lambda_{t+1}^\tau + (1-\delta)\pi_{-\tau} \lambda_{t+1}^{-\tau} \right] \right\}$$

  for each type $\tau \in \{b, s\}$, where for either type τ, $-\tau$ denotes the opposite type, and $\Pi_{t+1} \equiv \frac{P_{t+1}}{P_t}$ denotes the gross inflation rate.

- Compared to the basic New Keynesian model, there are two Euler equations, not just one.

Credit spread and financial-intermediation inefficiency

- Let $\omega_t \equiv \frac{i_t^b - i_t^d}{1+i_t^d}$ denote the credit spread.
- Let $\Omega_t \equiv \frac{\lambda_t^b}{\lambda_t^s}$ be a measure of financial-intermediation inefficiency.
- Log-linearizing the two Euler equations and substracting one from the other gives
$$\widehat{\Omega}_t = \widehat{\omega}_t + \mu \mathbb{E}_t \widehat{\Omega}_{t+1},$$
where $\mu < 1$ and variables with hat denote log-linearized variables.
- This equation can be solved forward to give $\widehat{\Omega}_t = \mathbb{E}_t \sum_{j=0}^{+\infty} \mu^j \widehat{\omega}_{t+j}$.

IS equation

- Log-linearizing the goods-market-clearing condition and using it to compute a weighted average of the two log-linearized Euler equations gives the following IS equation:

$$\widehat{Y}_t = \mathbb{E}_t \widehat{Y}_{t+1} - \frac{1}{\overline{\sigma}} \left(\widehat{i}_t^{avg} - \mathbb{E}_t \pi_{t+1} \right) - \mathbb{E}_t \Delta \widehat{\Xi}_{t+1} - k_1 \widehat{\Omega}_t + k_2 \mathbb{E}_t \widehat{\Omega}_{t+1},$$

  where $\overline{\sigma} > 0$, $k_1 > 0$, $k_2 > 0$, and $\widehat{i}_t^{avg} \equiv \pi_b \widehat{i}_t^b + \pi_s \widehat{i}_t^d = \widehat{i}_t^d + \pi_b \widehat{\omega}_t$.

- Compared to the basic New Keynesian model, what matters for aggregate-demand determination is not only the expectation of the future path of the general level of interest rates $\widehat{i}_t^{avg}$, but also the expectation of the future path of the credit spread $\widehat{\omega}_t$ (via $\widehat{\Omega}_t$).

Phillips curve

- The log-linearized Phillips curve is of the form

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \overline{\kappa} \widehat{Y}_t + k_3 \widehat{\Omega}_t - k_4 \widehat{\Xi}_t,$$

where $\overline{\kappa} > 0$, $k_3 > 0$, and $k_4 > 0$.

- Compared to the basic New Keynesian model, the main change is the presence of the terms $k_3 \widehat{\Omega}_t$ and $-k_4 \widehat{\Xi}_t$, which capture the effects of credit frictions.

Case where $\widehat{\omega}_t$ and $\widehat{\Xi}_t$ are exogenous I

- In the case where both $\widehat{\omega}_t$ and $\widehat{\Xi}_t$ can be treated as exogenous (and hence so can $\widehat{\Omega}_t$), $(\pi_t, \widehat{Y}_t, \widehat{i}_t^{avg}, \widehat{i}_t^{d})_{t\in\mathbb{Z}}$ is determined by
  - the Phillips curve,
  - the IS equation,
  - the equation $\widehat{i}_t^{avg} = \widehat{i}_t^{d} + \pi_b \widehat{\omega}_t$,
  - the policy-interest-rate rule for $\widehat{i}_t^{d}$.

- Moreover, in this case, assuming an optimal employment subsidy, the second-order approximation of the weighted average of households' utility functions is

$$L_t = \mathbb{E}_t \sum_{k=0}^{+\infty} \beta^k \left[\pi_{t+k}^2 + \overline{\lambda} \left(\widehat{Y}_{t+k} - \widehat{Y}_{t+k}^n \right)^2 \right]$$

with $\overline{\lambda} \equiv \frac{\overline{\kappa}}{\varepsilon}$, where ε denotes the elasticity of substitution between differentiated goods and Y_t^n the natural (i.e., flexible-price) level of output.

Case where $\widehat{\omega}_t$ and $\widehat{\Xi}_t$ are exogenous II

- Therefore,
  - the determination of optimal mon. policy is the same as in Chapter 2,
  - the implementation of monetary policy is the same as in Chapter 3.

- The only differences are that
  - the reduced-form coefficients are different: $(\overline{\kappa}, \overline{\lambda}, \overline{\sigma}) \neq (\kappa, \lambda, \sigma)$,
  - the exogenous shocks now have financial components.

Financial intermediaries I

- Financial intermediaries
  - take deposits, on which they pay the nominal interest rate i_t^d,
  - make loans, on which they demand the nominal interest rate i_t^b,
  - holds M_t reserves at the central bank, on which they receive the nominal interest rate i_t^m.
- Although they are perfectly competitive, we have $\omega_t > 0$ because
  - they use resources to originate loans,
  - they cannot distinguish between good borrowers (who will repay their loans) and bad ones (who will not), so that they charge a higher interest rate to all borrowers.

Financial intermediaries II

- More specifically, we assume that for any L_t good loans originated,
  - there are $\chi_t(L_t)$ bad loans originated, with $\chi_t' \geq 0$ and $\chi_t'' \geq 0$,
  - $\Xi_t^p(L_t; m_t)$ resources must be consumed, with $\Xi_{L,t}^p \geq 0$, $\Xi_{m,t}^p \leq 0$, $\Xi_{LL,t}^p \geq 0$, $\Xi_{mm,t}^p \geq 0$, and $\Xi_{Lm,t}^p \leq 0$, where $m_t \equiv \frac{M_t}{P_t}$,
  - there exists a finite satiation level of reserve balances $\overline{m}_t(L_t)$, defined as the lowest value of m for which $\Xi_{m,t}^p(L_t; m) = 0$.
- We also assume that deposits are acquired in the maximum quantity d_t that can be repaid from the anticipated returns of the assets:

$$(1 + i_t^d)d_t = (1 + i_t^b)L_t + (1 + i_t^m)m_t.$$

Financial intermediaries III

- At each date t, financial intermediaries choose L_t and m_t so as to maximize their distribution of earnings to their shareholders

$$d_t - m_t - L_t - \chi_t(L_t) - \Xi_t^p(L_t; m_t),$$

taking i_t^b, i_t^d and i_t^m as given.

- The first-order conditions are

$$\Xi_{L,t}^p(L_t; m_t) + \chi_{L,t}(L_t) = \omega_t \equiv \frac{i_t^b - i_t^d}{1 + i_t^d},$$

$$-\Xi_{m,t}^p(L_t; m_t) = \delta_t^m \equiv \frac{i_t^d - i_t^m}{1 + i_t^d},$$

and give the two spreads as functions of L_t and m_t.

Dimensions of central-bank policy

- The central bank uses its liabilities m_t to fund its assets: loans to the private sector L_t^{cb} and holdings of government debt.
- Therefore, two (unconventional) policy instruments are m_t and L_t^{cb}, subject to $0 \leq L_t^{cb} \leq m_t$.
- The resource cost of central-bank extension of credit to the private sector is $\Xi_t^{cb}(L_t^{cb})$, with $\Xi_t^{cb\prime}(0) > 0$ and $\Xi_t^{cb\prime\prime} \geq 0$.
- A third and last (conventional) policy instrument is the interest rate i_t^d.
- So there are three independent dimensions of central-bank policy:
    - interest-rate policy (i_t^d),
    - reserve-supply policy (m_t),
    - credit policy (L_t^{cb}).

Optimal reserve-supply policy

- Optimal policy requires that financial intermediaries be satiated in reserves: $m_t \geq \overline{m}_t(L_t)$, since
    - for $m_t < \overline{m}_t(L_t)$, raising m_t increases welfare by reducing both Ξ_t^p and ω_t (for a given L_t),
    - for $m_t \geq \overline{m}_t(L_t)$, raising m_t affects neither Ξ_t^p nor ω_t (for a given L_t), and hence does not affect welfare.
- This is a Friedman-rule-type result, but one that has no consequences for interest-rate policy.
- Indeed, it implies only that the interest-rate differential δ_t^m should be equal to zero at all times, so that the central bank is still free to set its policy interest rate i_t^d as it wants.

Is a reserve-supply target needed?

- Should the monetary-policy committee take a decision on m_t, in addition to a decision on i_t^d, at each of its meetings?

- No need: it is equivalent and simpler to
    - use i_t^m, rather than m_t, as the instrument,
    - mechanically set i_t^m equal to i_t^d,
    - let the central-bank staff adjust m_t accordingly.

- In practice,
    - the Bank of Canada sets i_t^m only 25 basis points lower than i_t^d,
    - the Reserve Bank of New Zealand set i_t^m equal to i_t^d.

Is there a role for quantitative easing? I

- Quantitative easing refers to an increase in the supply of reserves m_t beyond the satiation level $\overline{m}_t(L_t)$ for a given quantity of central-bank loans to the private sector L_t^{cb}.

- The model implies that there is no benefit from quantitative easing.

- It can be desirable to set $m_t > \overline{m}_t(L_t)$ only if this is necessary to set the optimal L_t^{cb} (as $L_t^{cb} \leq m_t$).

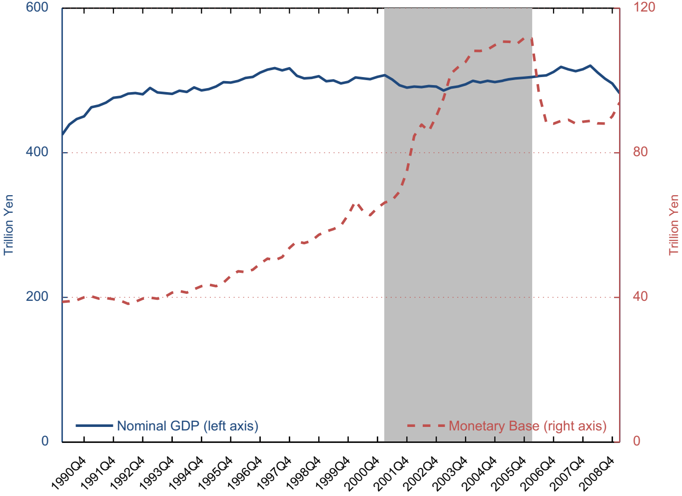
- As can be seen on Slide 6, the Federal Reserve financed its newly created liquidity and credit facilities
  - first by reducing its holding of Treasury securities,
  - then by increasing reserves, but only when it decided to expand these facilities beyond the scale that could be entirely financed by reducing its holding of Treasury securities.

Is there a role for quantitative easing? II

- The Bank of Japan's policy from March 2001 to March 2006 was a quantitative-easing policy because
  - its aim was to increase the supply of reserves (or, equivalently, the monetary base), rather than to acquire any particular type of assets,
  - the assets purchased consisted primarily in Japanese government securities and bills issued by commercial banks.

- In accordance with the model's predictions, this policy seems to have had little effect on aggregate demand, as apparent on the next slide.

Monetary base and nominal GDP in Japan, 1990-2009



Source: Cúrdia and Woodford (2011). The shaded region shows the quantitative-easing period.

Optimal credit policy I

- Let us now (numerically) determine optimal credit policy
  - under the assumption that reserve-supply policy is optimal, so that

$$\Xi_t^p(L_t; m_t) = \Xi_t^p(L_t; \overline{m}_t(L_t)) \equiv \overline{\Xi}_t^p(L_t),$$
$$\omega_t(L_t; m_t) = \omega_t(L_t; \overline{m}_t(L_t)) \equiv \overline{\omega}_t(L_t),$$

  - under various alternative assumptions about interest-rate policy.

- A rise in L_t^{cb} can increase welfare on two grounds: for a given volume of private borrowing $L_t + L_t^{cb}$, it decreases the volume of private lending L_t, which reduces
  - the resources Ξ_t^p consumed by the intermediary sector,
  - the equilibrium credit spread ω_t (and hence $\widehat{\Omega}_t$).

Optimal credit policy II

- If central-bank policy were costless, then the optimal credit policy would be such that $L_t = 0$.

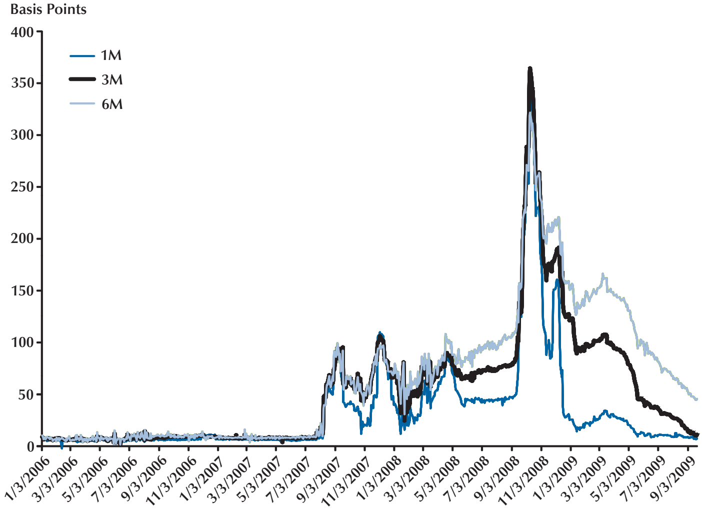
- If $\Xi^{cb\prime}(0)$ is large enough, then the optimal credit policy is $L_t^{cb} = 0$.

- The model is calibrated such that the optimal credit policy
  - is $L_t^{cb} = 0$ at the steady state,
  - may be such that $L_t^{cb} > 0$ for large enough financial shocks.

- These financial shocks are exogenous shifts in the functions $\overline{\Xi}_t^p(L)$ or $\chi_t(L)$ of a type that increase the equilibrium credit spread $\overline{\omega}_t(L)$ for a given volume of private credit.

- Credit-spread increases have been an important feature of the recent crisis, as apparent on the next slide.

LIBOR-OIS spread in the US, 2006-2009



Source: Cúrdia and Woodford (2010).

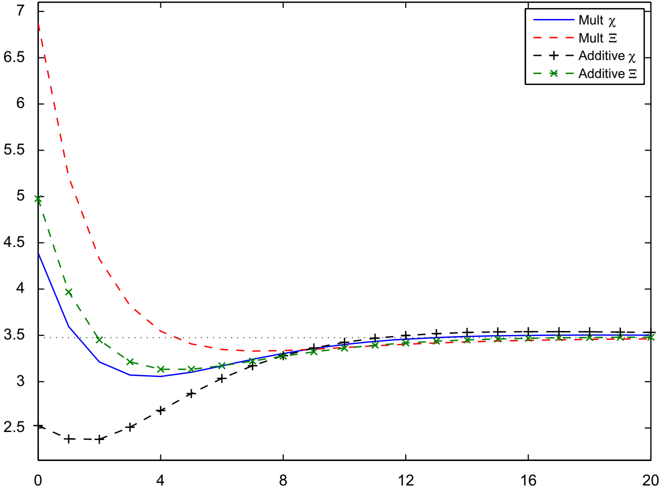
Four kinds of financial shocks I

- Let $\Xi^{cb\prime,crit}$ denote the minimal marginal cost of central-bank lending $\Xi^{cb\prime}(0)$ required for $L_t^{cb} = 0$ ("Treasuries only") to be optimal.
- The model's calibration is such that
  - $\overline{\Xi}^{p\prime}$ is 2.0 percent per annum at the steady state,
  - $\Xi^{cb\prime,crit}$ is nearly 3.5 percent per annum at the steady state.
- We distinguish between
  - "additive shocks", which translate the schedule $\overline{\omega}_t(L)$ vertically by the same amount,
  - "multiplicative shocks", which multiply the entire schedule $\overline{\omega}_t(L)$ by some constant factor greater than 1.

Four kinds of financial shocks II

- We also distinguish between
  - "Ξ shocks", which change the function $\overline{\Xi}_t^p(L)$,
  - "χ shocks", which change the function $\chi_t(L)$.
- The next slide plots the dynamic response of $\Xi^{cb\prime,crit}$ to each of the four kinds of financial shocks
  - under optimal reserve-supply and interest-rate policies,
  - for an initial increase in $\overline{\omega}_t(\overline{L})$ of 4 percentage points per annum, from $\overline{\omega} = 2.0\%$ to $\overline{\omega}_0(\overline{L}) = 6.0\%$,
  - for a subsequent decrease in $\omega_t(\overline{L})$ according to $\overline{\omega}_t(\overline{L}) = \overline{\omega} + [\overline{\omega}_0(\overline{L}) - \overline{\omega}]\rho^t$, where $\rho = 0.9$.
- These shocks are small enough for the Zero-Lower-Bound constraint not to be binding under optimal interest-rate policy.

Response of $\Xi^{cb\prime,crit}$ under optimal interest-rate policy I



Source: Cúrdia and Woodford (2011).

Response of $\Xi^{cb\prime,crit}$ under optimal interest-rate policy II

- The optimal credit-policy response to the credit-spread increase depends on the nature of the financial shock.

- When the credit-spread increase is due to a multiplicative Ξ shock,
  - the resource cost $\overline{\Xi}^{p}$ increases,
  - the credit spread $\overline{\omega}$ increases as $\overline{\Xi}^{p\prime}$ increases,

  so that $\Xi^{cb\prime,crit}$ increases substantially.

- When the credit-spread increase is due to an additive Ξ shock or a multiplicative χ shock, only one of these two effects is present, so that $\Xi^{cb\prime,crit}$ increases more modestly.

- When the credit-spread increase is due to an additive χ shock, none of these two effects is present, so that $\Xi^{cb\prime,crit}$ actually decreases (due to the decrease in L_t).

Response of $\Xi^{cb\prime,crit}$ under alternative IR policies I

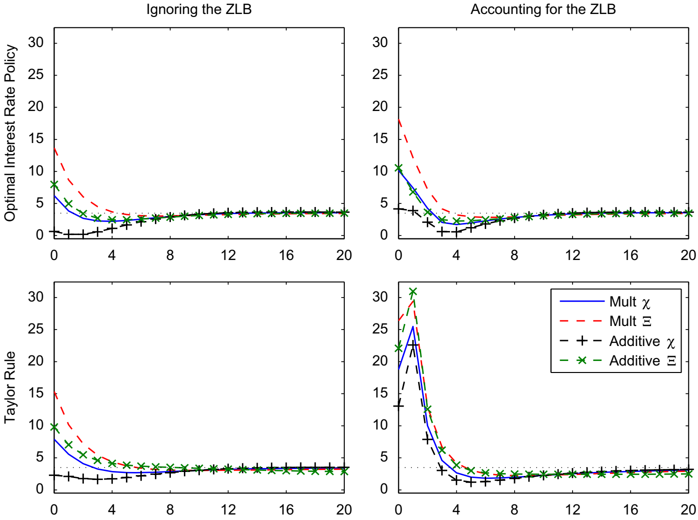
- Now consider the same financial shocks, but three times as large as previously, i.e. such that $\overline{\omega}_t(\overline{L})$ increases by 12% per annum.

- These shocks are large enough for the Zero-Lower-Bound (ZLB) constraint to be binding under optimal interest-rate policy.

- The next slide plots the dynamic response of $\Xi^{cb\prime,crit}$ to these shocks under four alternative interest-rate (IR) policies:
  - the optimal IR policy without ZLB constraint (i.e. allowing for $i_t^d < 0$),
  - the optimal IR policy with ZLB constraint (i.e. Chapter 6's optimal monetary policy under commitment),
  - the IR policy $i_t^d = \overline{r}^d + \phi_\pi \pi_t + \phi_y \widehat{Y}_t$ without ZLB constraint,
  - the IR policy $i_t^d = max[\overline{r}^d + \phi_\pi \pi_t + \phi_y \widehat{Y}_t, 0]$ (close to Chapter 6's optimal monetary policy under discretion),

where $\phi_\pi = 2$, $\phi_y = 0.25$, and $\overline{r}^d$ is the steady-state real policy interest rate.

Response of $\Xi^{cb\prime,crit}$ under alternative IR policies II



Source: Cúrdia and Woodford (2011).

Response of $\Xi^{cb\prime,crit}$ under alternative IR policies III

- Compared to the Taylor rule, optimal IR policy reduces at least slightly the welfare gain from active credit policy.
- The case for active credit policy is clearer when the ZLB constraint is binding, as credit policy can then complement IR policy.
- In the latter case, to a first approximation, only the size and persistence of the credit spread matter, not the nature of the underlying financial shock.