Monetary Policy Rules with Financial Instability

Presentation at the Vienna Institute for International Economic Studies, February 8, 2010

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IMF Working Paper No. 08/18

Contributions of the paper

- Modeling central bank response to financial instability in a general equilibrium context
- Model predictions are consistent with the evidence that central banks react to financial instability with monetary easing
- Does not require restrictive assumptions on the CB utility function

1. Motivation

Do we know what are central banks doing?

- CB "watching" used to be difficult …
  - Währungspolitik als Kunst des Unmöglichen
  - No obvious, predictable "rules"
- … until John Taylor came up with his "backward-looking" rule (past inflation and output gap)…
- …and CBs built "forward-looking" rules into their forecasting models ($E(\pi_{t+1})$), announcing that they base policymaking on such rules

Policy meeting with a rule…

… should be over in one hour

What is wrong with the rule?

- No hint when/why the policymaker should depart from the rule
- Financial system enters only indirectly, through the outup gap (Schwartz, 1995, Crockett, 1997)
- Explains at best 2/3 of the policy rate variance (Svensson, 2003)
  - No clue about the remaining 1/3
- Parameter uncertainty: smoothing vs aversion to inflation (Carare and Tchaidze, 2005)

What are CBs really doing?

1. Central banking is forward-looking
   - Trading stories based on the “Beige book”
2. Little attention paid to the past output gap
   - Measurement issues (Orphanides & Williams, 2002)
3. A lot of attention to financial stability
   - Highlighted by recent actions by central banks

2. Empirical results and stylized facts

Cecchetti and Li (NBER, 2005)

- Policymakers react to the banking system’s balance sheet (the U.S., Germany, Japan)
- Counteract (neutralize) the procyclical effect of prudential capital regulation
  - ”For a given level of economic activity and inflation, the optimal policy reaction dictates setting interest rates lower the more financial stress there is in the banking system”

Bulíř and Čihák (IMF, 2008)

- Quarterly panel of 28 countries
- Financial instability associated with ST rates below those implied by the simple rule
  - One s.d. increase in the "probability of crisis" variable ➔ short-term rates lower by 0.2 percentage points [a freely floating country; contemporaneous one-period impact]
- Reaction to financial instability stronger in:
  - Closed economies
  - Economies where CB is also a supervisor

Theoretical literature…

- …has until recently ignored the link between financial instability and central bank behavior
- Major problem: how to give the central bank an informational advantage over the private sector (commercial banks)
- We build on the following

Williamson (JPE 1987)

- General equilibrium business cycle model
- Financial intermediation arises endogenously and matters for business cycle behavior
- A reduction in loans extended by intermediaries in the current period reduces next period's output
- No financial instability ➔ idiosyncratic risk is perfectly diversified by banks

Bernanke, Gertler, & Gilchrist (NBER, 1998)

- The authors incorporate a partial equilibrium model of the credit market into a standard dynamic New Keynesian framework with sticky prices
- Credit market frictions amplify both real and nominal shocks to the economy
- No financial instability → idiosyncratic risk is perfectly diversified by banks
  - Recent evidence provided by Christiano, Motto, and Rostagno (2008)

Brousseau and Detken (ECB, 2001)

- Financial instability modeled as a sunspot event
- Standard new Keynesian model
- The central bank can dampen the economic consequences of a crisis ➔ the simple policy rule is no longer optimal
- No economic justification for the sunspot effects

3. Model

What we want to model

- Financial intermediaries that supply external financing to firms
- Survival of these firms is interest-sensitive (the lending channel of monetary policy)
  - Higher central bank policy rate ➔ more default
- Defaults affect intermediaries and depositors
- The expected result: the central bank eases the policy rate in response to defaults

Model elements

- Modified version of the standard new Keynesian model with sticky prices
- 5 sectors
  - households
  - “goods” firms (independent on ext. financing)
  - “innovative” firms (depend on ext. financing)
  - financial intermediaries (banks)
  - central bank

Households

- Representative household's problem:

$$\max_{c_t, n_t} \; E_o \sum_{t=0}^{\infty} \beta^t U(c_t, n_t)$$

- subject to

$$P_t c_t + P_t d_t = P_t w_t n_t + r_t P_{t-1} d_{t-1} + P_t \Pi_t + P_t T_t$$

Goods firms (=no external financing)

- Continuum of monopolistic competitors that produce final goods with technology

$$y_t(j) = a_t n_t(j)$$

- Cost minimization implies

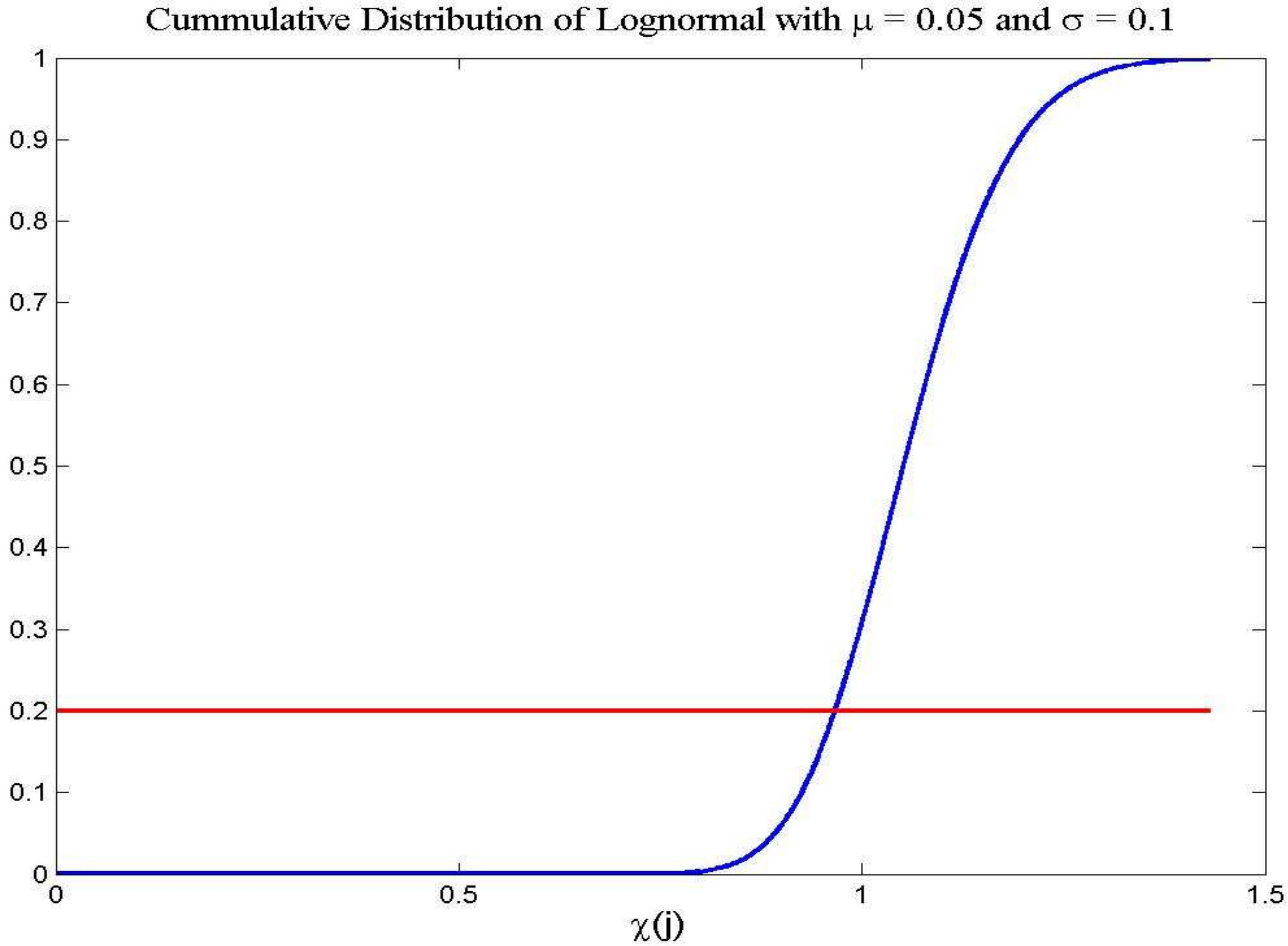
$$W_t = P_t w_t$$

- Staggered price setting á la Calvo
  - Each period: constant probability $1-\theta$ that the firm will be able to adjust its price, independently of past history

Innovative firms (=need external financing)

- Live for two periods
  - *t* … invest in a project
  - *t+1* … obtain a return
- Technology: $s_{t+1}(j) = \chi(j) s_t(j)$
- Risk/return trade-off
  - A fraction γ of firms survives in t+1 with certainty
  - These are the least profitable firms
  - The rest may die at t+1 with probability $\delta_{t+1} \rightarrow \delta$ known only after the firm received a loan
  - A firm that does not survive obtains return of 0

Innovative firms distribution of returns



Financial intermediaries (banks)

- Receive deposits from households; lend to innovative firms
- Pay a rate r_t for deposits; charge z_t for loans
- Cannot distinguish among firms; charge a common rate for all loans
- Infinite demand for loans → provide a constant fraction of deposits to every firm that applies for a loan
- Banks are able to monitor without cost whether a firm exists or not in period *t+1*

Technology

- Economy-wide ("total") technology: $a_t = {a_t^i}^{\alpha} {a_t^s}^{1-\alpha}$
- Where
  - exogenous (stochastic) component $\widehat{a}_t^s = \rho^a \widehat{a}_{t-1}^s + \varepsilon_t^a$
  - innovative firms technology:

$$a_t^i = \left[\int_{\omega_{t-1}}^{1} \left(\chi(j) \delta_t^*(j) \right)^{\frac{\tau-1}{\tau}} dj \right]^{\frac{\tau}{\tau-1}} \frac{d_{t-1}}{1-\omega_{t-1}}$$

Central bank

- Basic policy rule (Galí, 2002): $\hat{i}_t = \phi_\pi \hat{\pi}_t + \phi_x x_t$

  π_t … inflation rate (deviation from steady state),
  x_t … output gap at *t*, and $\phi_\pi > 1, \phi_x > 0$
  robustness check: inflation expectation instead of actual inflation

- Central bank responds to private information:

$$\hat{i}_t = \begin{cases} \phi_\pi \hat{\pi}_t + \phi_x x_t & \text{if } (\delta_{t+1} - E_t \delta_{t+1}) < 0 \\ \phi_\pi \hat{\pi}_t + \phi_x x_t + (\phi_\delta + \nu^\delta)(\delta_{t+1} - E_t \delta_{t+1}) & \text{otherwise} \end{cases}$$

Robustness check

- Forward-looking policy rule
- The central bank reacts to expected inflation
  - Model-consistent inflation projection

$$\hat{i}_t = \phi_\pi E_t \hat{\pi}_{t+1} + \phi_x x_t$$

Timing of events

- Beginning of a period: shocks realized
- Total technology observed; financial stability observed *only* by the central bank
- Households decide on consumption, saving, and labor allocations
- The central bank sets policy rate

4. Simulation results

Calibration

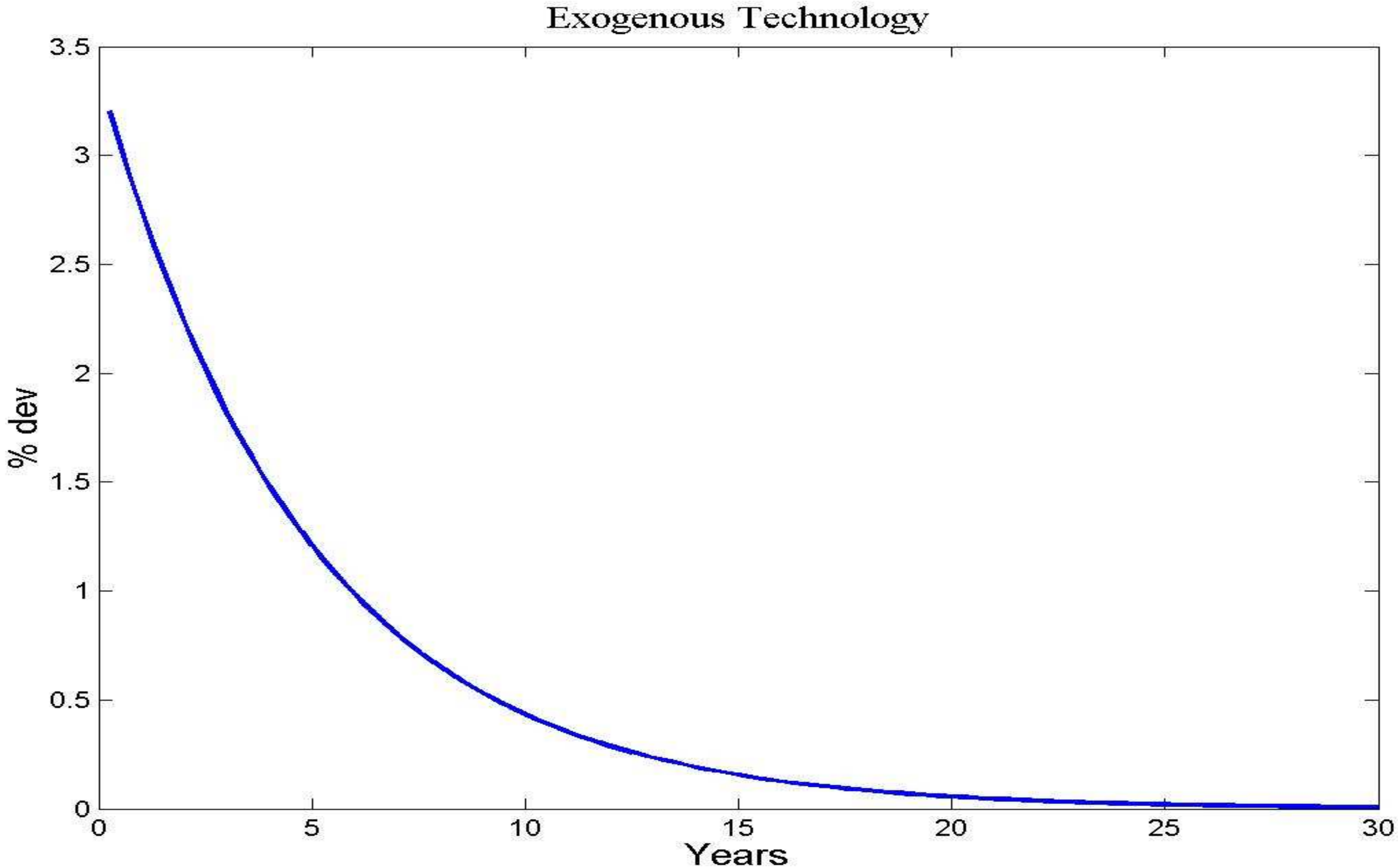
Utility Function	$\frac{c_t^{1-\sigma}}{1-\sigma} - \frac{n_t^{1+\varphi}}{1+\varphi}$
β	0.99
θ	0.75
Process for exogenous technology	$a_t^s = \rho^a a_{t-1}^s + \varepsilon_t^a, \quad \rho^a = 0.9$
Process for probability of survival	$\delta_t = \delta + \rho^\delta \delta_{t-1} + \varepsilon_t^\delta, \quad \mathrm{E}(\delta_t) = 0.0075, \quad \rho^\delta = 0.25$
Taylor Rule	$\phi_\pi = 1.5, \quad \phi_x = 0.5$
ϕ_δ	-0.5

Shocks

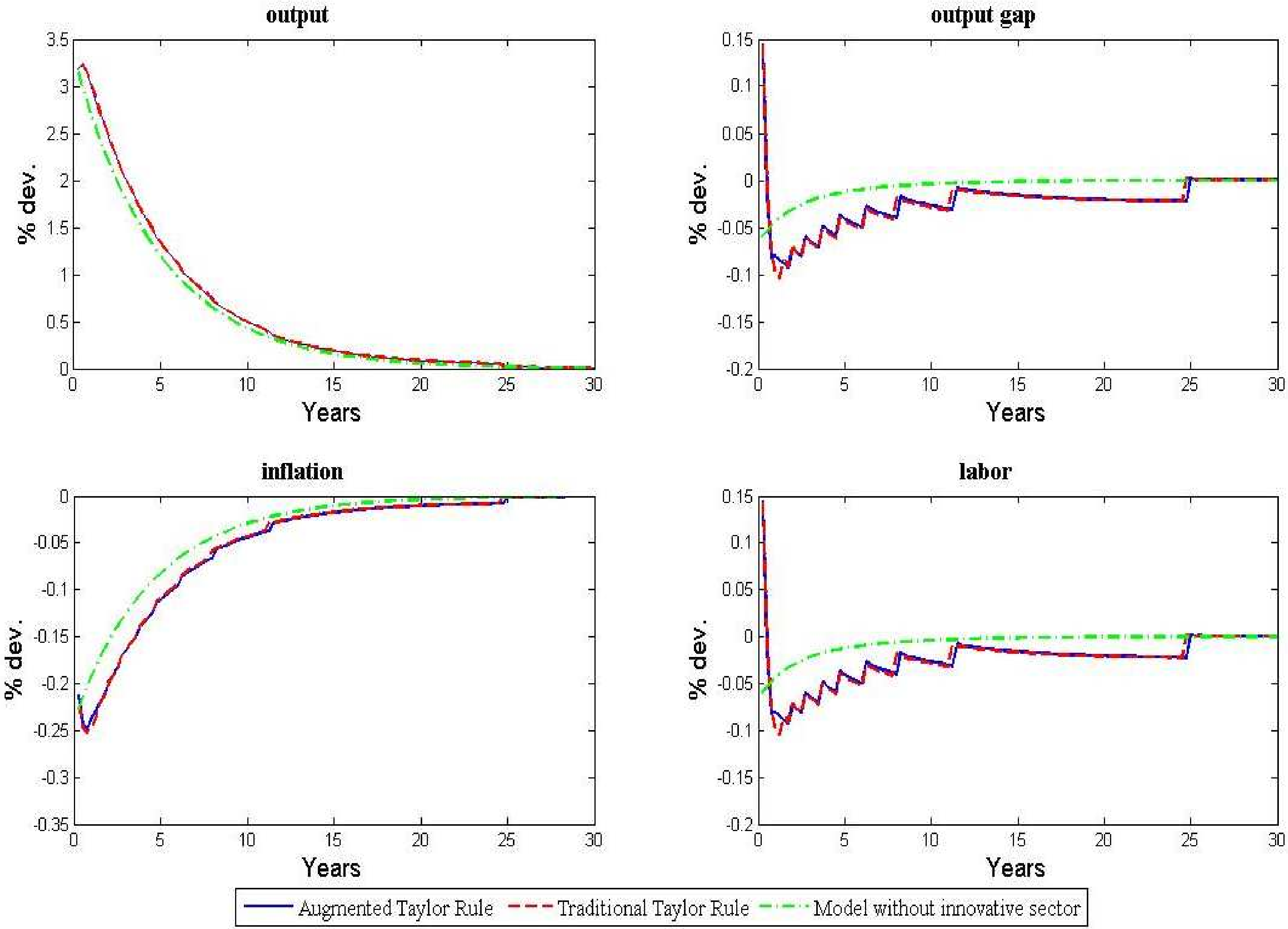
- We consider two shocks
- Technology shock
  - The "standard" shock used in the literature
  - The form of the rule does not matter
- Default shock
  - A novel shock in this paper
  - **Observed by the central bank with one-period lead**
  - Will feed into *ex post* returns on deposits

Shock to exogenous technology

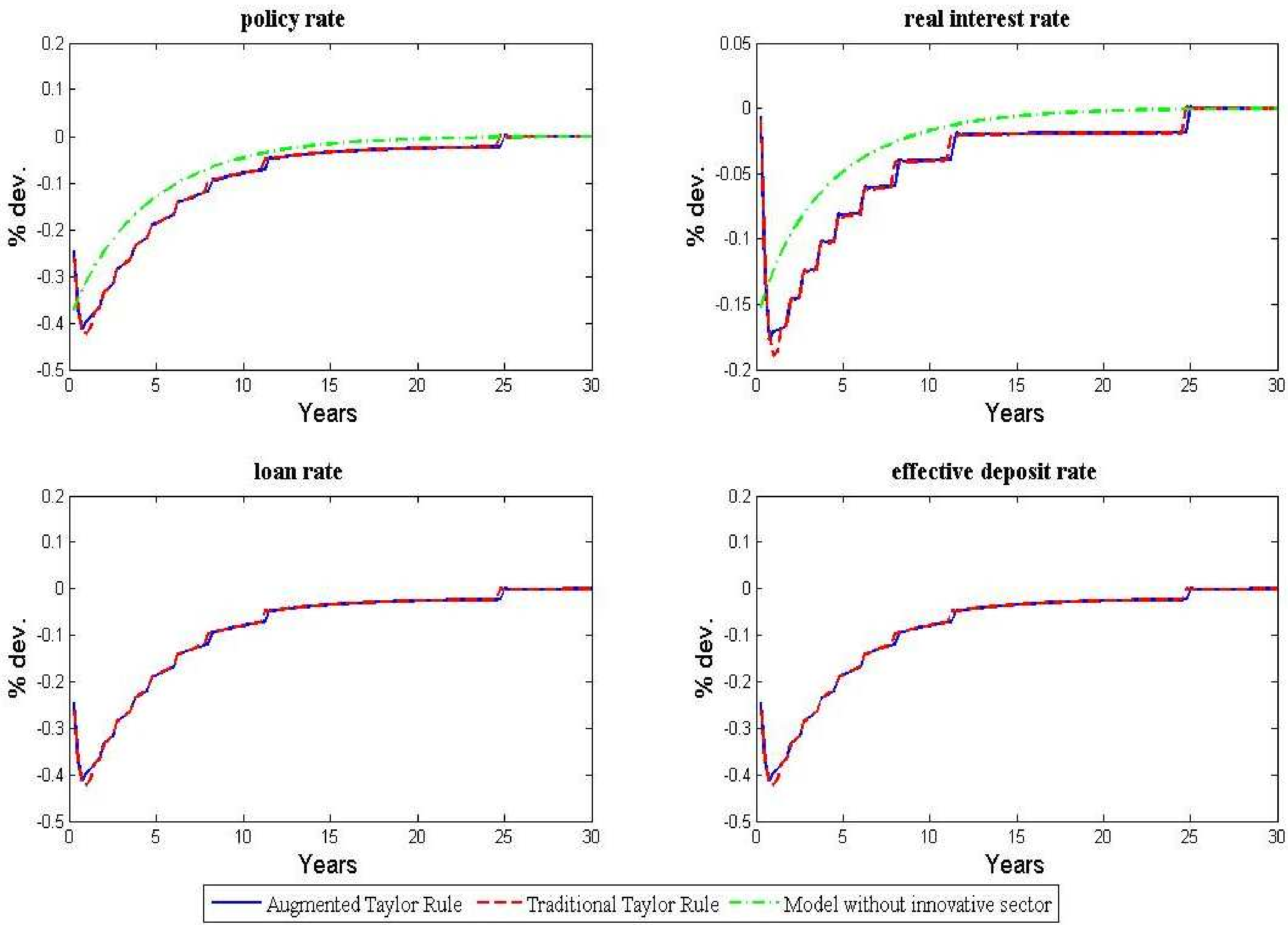
(1 standard deviation of the technology shock)



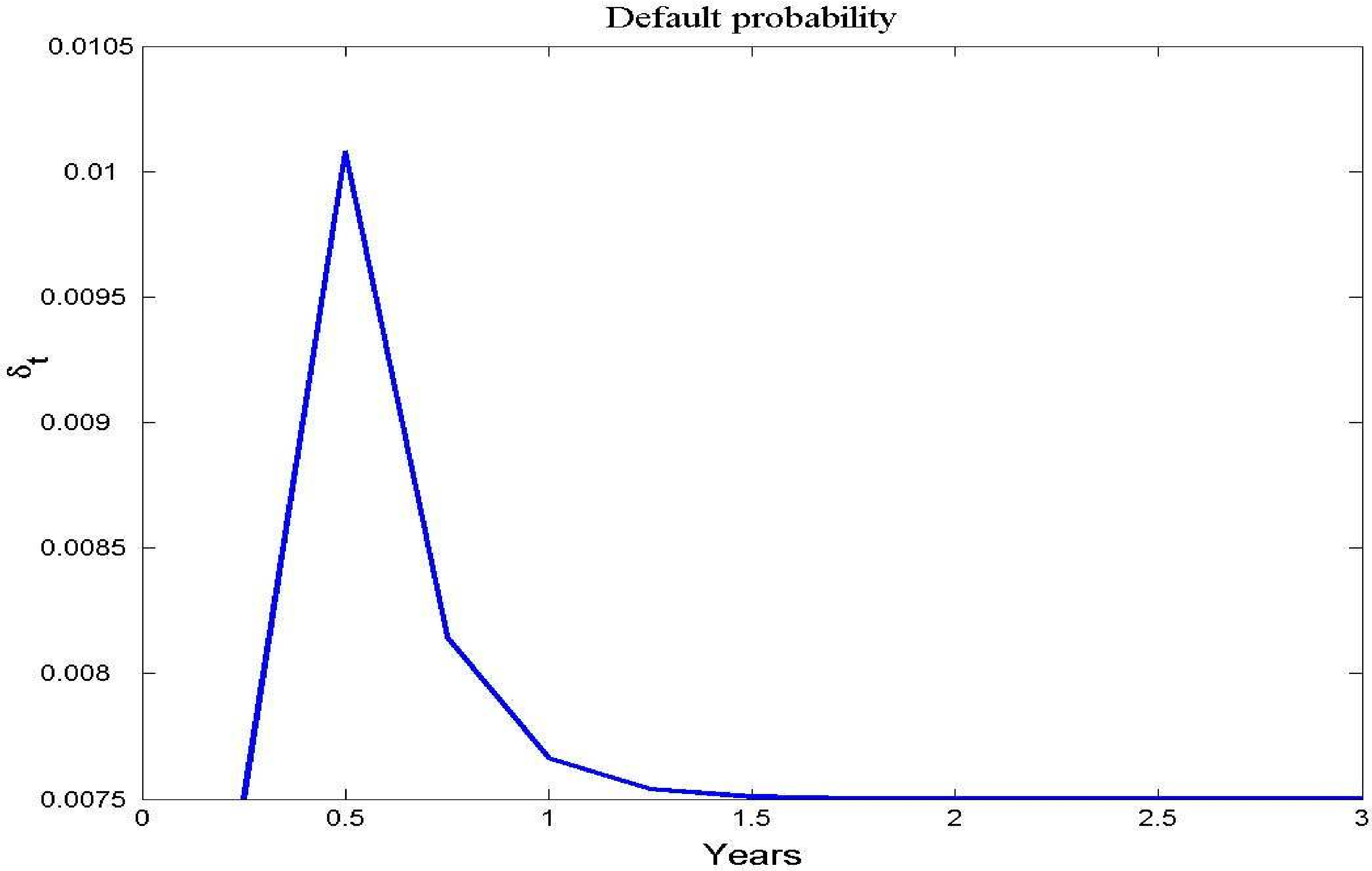
Shock to exogenous technology



Shock to exogenous technology



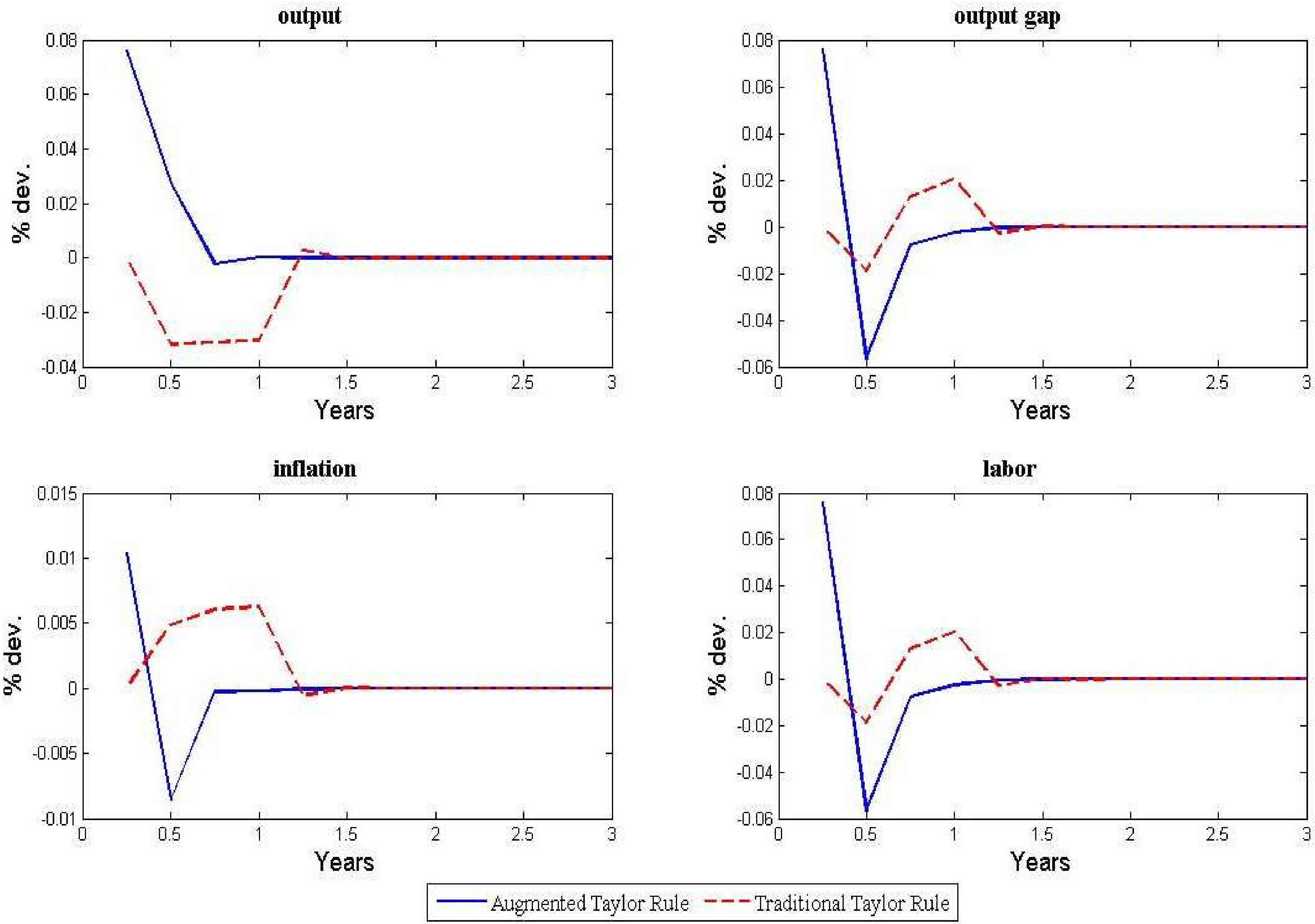
Shock to probability of default
(1 standard deviation)



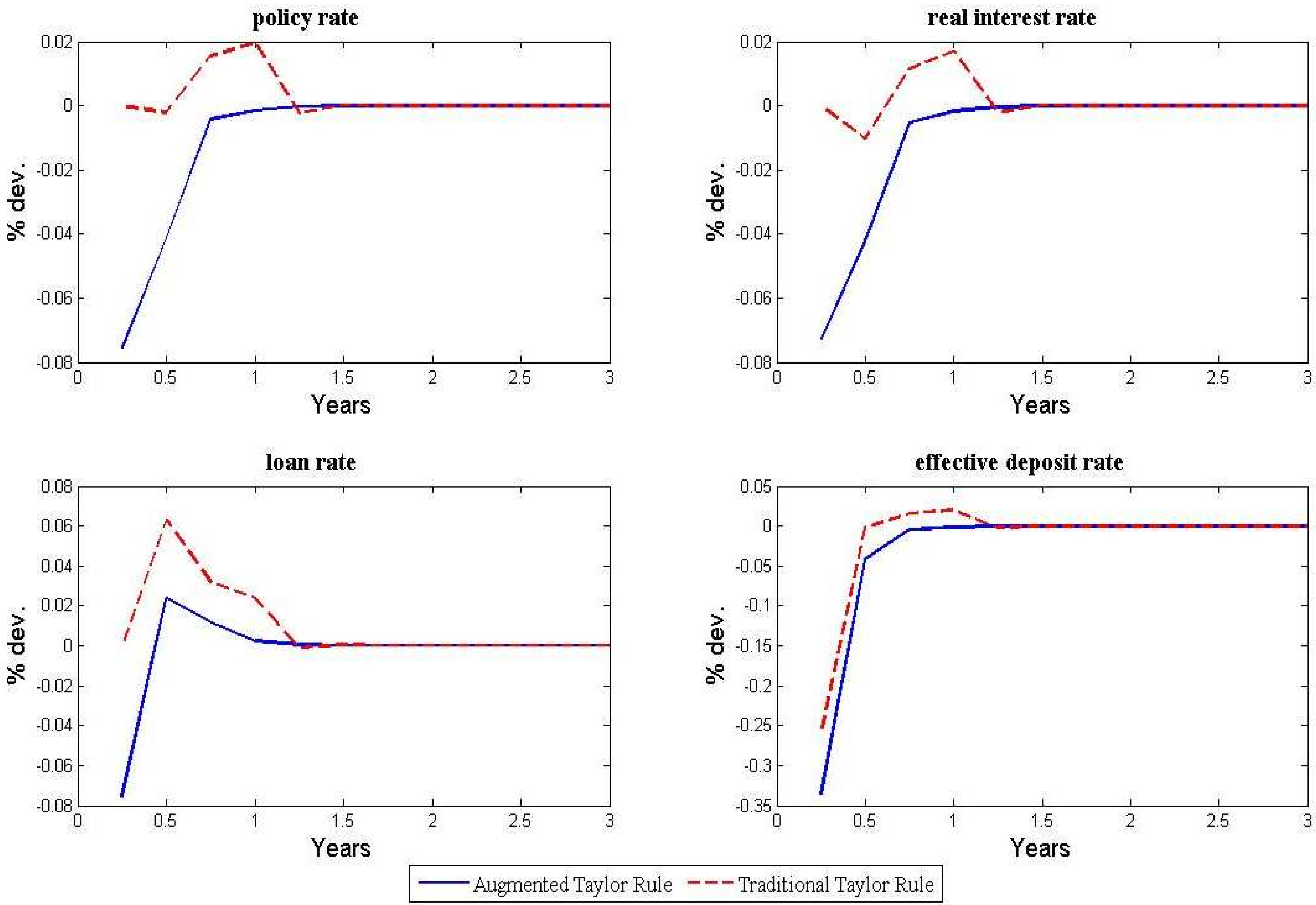
The main finding

- The central bank trades off more instability today for a faster return to the trend path tomorrow

Shock to probability of default



Shock to probability of default



Welfare calculations

- Lucas (1987) measure of welfare: var(cons)
  - welfare differential = ½ x risk aversion coeff. x difference in variance of the CES consumption (100 peteritions)
  - S.D. of consumption are practically identical for both rules
  - Robust to the weight of financial instability in the policy rule
- Robustness: quadratic loss function (output, infl.)
- No major long-term welfare differences between the traditional and augmented Taylor rule
- Faster stabilization under the augmented rule, but more initial volatility of output and consumption
- Marginally larger welfare gain under the forward-looking rule

5. Conclusions

Conclusions

- Faced with a financial instability shock, a forward looking CB can prop up the banking system with monetary easing
- The easing limits the short term fall in output and consumption compared to the traditional Taylor rule
- Works only for short-lived shocks of reasonable magnitude

Conclusions

- The central bank following the “augmented rule” trades off more output and inflation instability today for a faster return to the trend path tomorrow
- The nature of monetary policy remains unchanged → the policymakers cannot avoid the effects of financial crises
- The long run welfare impact appears small