Bank Capital in the Short and in the Long Run

Caterina Mendicino (ECB/DGR)
Kalin Nikolov (ECB/DGR)

Javier Suarez (CEMFI)
Dominik Supera (Wharton School)

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Introduction

- Since GFC min TCR rose from 8% in Basel II to 10.5% in Basel III
- Debate between opposing views of higher capital ratios (CRs)

  - Needed to strengthen banks and improve incentives

  - Cut credit provision to an already weak real economy
- This paper discusses the issues that determine how the above trade off should be resolved

  - Our previous work focused on the long term costs and benefits

  - This paper adds short term real economy costs

  - Analyse what determines the size of these costs and how they should change the design of a capital increase

Main Questions

- How large are the short run costs of increasing capital requirements?

- How does the conduct of monetary policy affect the size of short term costs?

- Should the (zero) lower bound on the policy interest rate be a concern for the implementations of capital requirement policies?

How?

- To address these questions we extend the "3D" model (Clerc et al, 2015; Mendicino et al. 2016a) to include nominal debt and price rigidities.

- To provide quantitative results, the model is estimated to match the salient features of EA macro, financial and banking variables.

Main Conclusions

- Higher bank capital ratios reduce excessive leverage and defaults $\Longrightarrow$ long-run benefits!
- The short-run effects of higher capital ratios:
  - resemble a negative demand shock
  - can be sizable
  - can offset the long-run welfare benefits for Borrowers

Main Conclusions (cont.)

- Short-run real and welfare effects of higher CRs depend on the speed of implementation:

  - a slower speed of implementation can mitigate the short-run costs for Borrowers

- ... on the conduct of monetary policy:
  - smaller when monetary policy is strongly responsive to inflation
  - very large when the ZLB is binding!

- ... and on the fragility of the banking system
  - more fragile banks increase the long term benefits of higher CRs
  - ... while reducing the short term costs

Related Literature

- Macroprudential policy to correct pecuniary externalities

  Lorenzoni (2008), Bianchi and Mendoza (2011, 2015), Korinek and Jeanne (2010)

- Capital requirements in a macro-banking framework

  van den Heuvel (2008), Martinez-Miera and Suarez (2014), Nguyen (2014), Clerc et al (2015), Kiley and Sim (2015), Christiano and Ikeda (2017)

- Macroprudential-monetary policy interactions in DSGE

  De Paoli and Paustian (2017), Collard et al (2017)

- Impact of policies at the ZLB

  - Fiscal policy: Christiano, Eichenbaum, Rebello (2011), Erceg and Linde (2014)
  - Structural reform: Eggertson, Ferrero and Raffo (2014)

Brief Model Description

Model Players

- Households:
  - Dynasty of Patient HH (3 type of members)
    - Workers/Savers
    - Entrepreneurs
    - Bankers
  - Dynasty of Impatient HH: Workers/Borrowers
- Financial Intermediaries s.t. capital regulation
- (Standard) Goods, Capital and Housing Producing Firms
- Macroprudential Authority sets capital requirements for banks
- Monetary Policy Authority sets the short-term interest rate - Taylor rule

Key Distortions

(1) **Bank debt is not priced efficiently**: $\Longrightarrow$ *banks have an incentive to take excessive risk (benefits of Higher CRs)*

- Limited liability

- Part of bank debt = insured deposits

- Uninsured bank debt priced according to aggregate (rather than individual) bank risk

(2) **Limited participation in the equity market**. $\Longrightarrow$ *equity more expensive than debt (cost of Higher CRs)*

(3) **Nominal debt and nominal price rigidities** *(important for short term costs of Higher CRs)*

Calibration

- Based on linearly detrended quarterly data for EA (2001:1-2015:4)
- Reproduces salient features of macro, financial and banking data
- Implemented in two stages:
  1. Parameters tightly linked to long-run targets or fixable by convention
  2. Rest of parameters found so as to match targeted moments

[by minimizing equally weighted sum of distances between empirical & model-based moments]

Calibration: First Moments Matched

Description	Definition	Data	Model
Fraction of borrowers	$x_m/(x_s + x_m)$	0.437	0.437
Share of insured deposits	γ	0.54	0.54
Housing investment to GDP	I_h/GDP	0.058	0.058
Borrowers housing wealth share	$n_m h_m/h$	0.525	0.525
NFC loans to GDP	b_f/GDP	1.759	1.759
HH loans to GDP	$n_m b_m/GDP$	2.087	2.087
Write-off HH loans	$\Psi_m * 400$	0.316	0.407
Write-off NFC loans	$\Psi_f * 400$	0.686	0.692
Spread NFC loans	$(R_e - R_d) * 400$	1.13	1.12
Spread HH loans	$(R_m - R_d) * 400$	0.87	0.62
Banks' default	$\Psi_b * 400$	0.824	0.822
Equity return of banks	$\rho * 400$	8.139	8.384
Capital Share of Savers	K_s/K	0.22	0.22
LTV of Borrowers	$n_m b_m/q_h h_m$	0.552	0.552
Price to book ratio (banks)	υ_b	1.577	1.577
Risk Free Real Rate	$(R^f - \overline{\pi}) * 400$	1	1
Inflation Targeting	$\overline{\pi}$	2	2
Capital Requirement	ϕ	0.08	0.08
Risk Weight Corporate Loans	ϕ_F	1	1
Risk Weight Mortgage Loans	ϕ_M	0.5	0.5

Calibration: Second Moments Matched

Description	Definition	Data	Model
std(GDP)	$\sigma(GDP) * 100$	2.248	2.288
std(House prices)/std(GDP)	$\sigma(q_{ht})/\sigma(GDP)$	2.784	2.253
std(NFC loans)/std(GDP)	$\sigma(b_f)/\sigma(GDP)$	4.287	5.369
std(HH loans)/std(GDP)	$\sigma(n_m b_m)/\sigma(GDP)$	2.843	3.627
std(Spread NFC loans)/std(GDP)	$\sigma(R_f - R_d)/\sigma(GDP)$	0.044	0.061
std(Spread HH loans)/std(GDP)	$\sigma(R_m - R_d)/\sigma(GDP)$	0.056	0.030
std(Banks' default)	$\sigma(\Psi_b) * 100$	1.01	1.051
std(inflation)	$\sigma(\pi) * 100$	0.199	0.188
std(Write-offs NFC)/std(GDP)	$\sigma(\Psi_f)/\sigma(GDP)$	0.05	0.065
std(Write-offs HH)/std(GDP)	$\sigma(\Psi_m)/\sigma(GDP)$	0.013	0.013
std(Business Investment)/std(GDP)	$\sigma(I_k)/\sigma(GDP)$	2.445	2.165
std(Housing Investment)/std(GDP)	$\sigma(I_h)/\sigma(GDP)$	4.017	3.145

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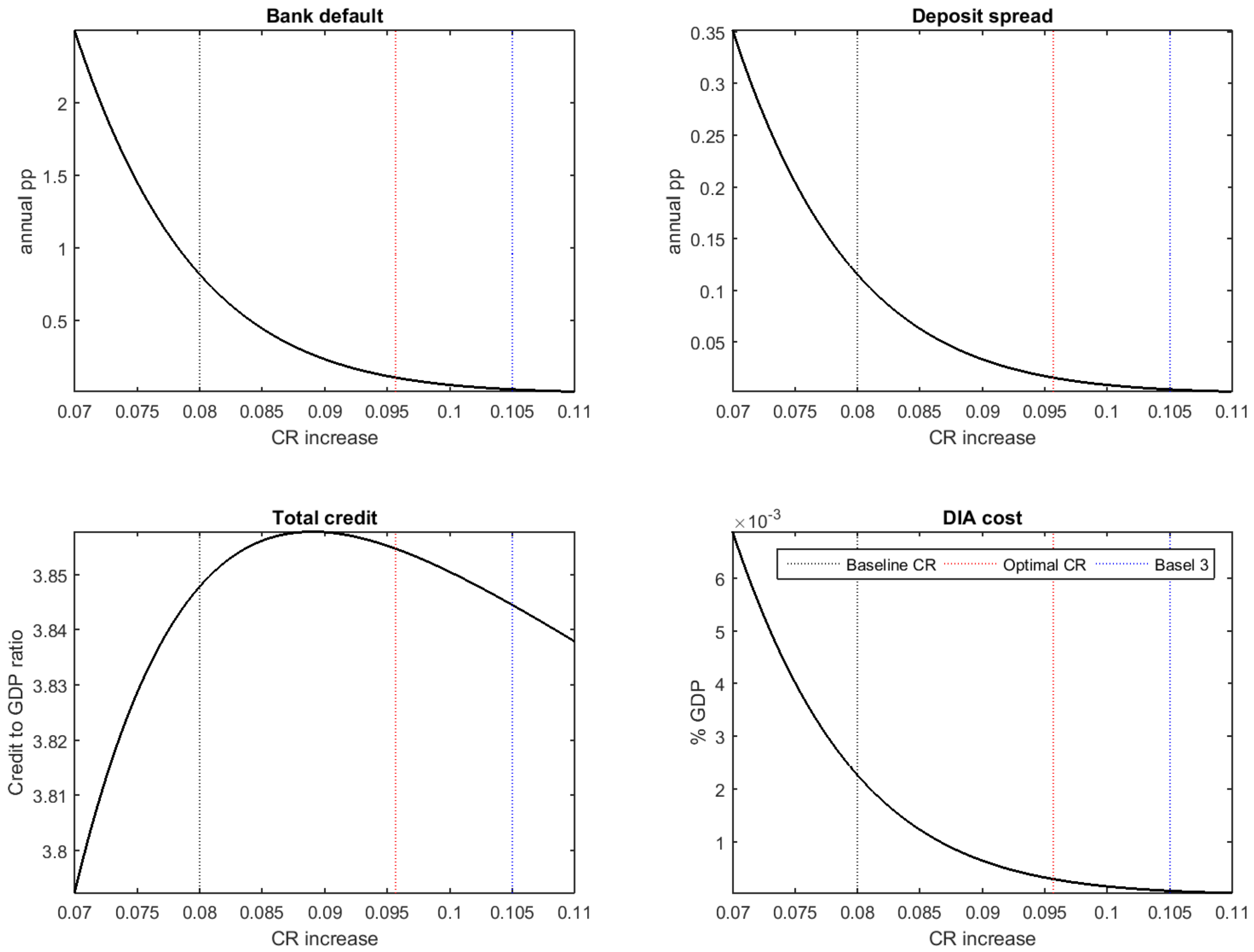
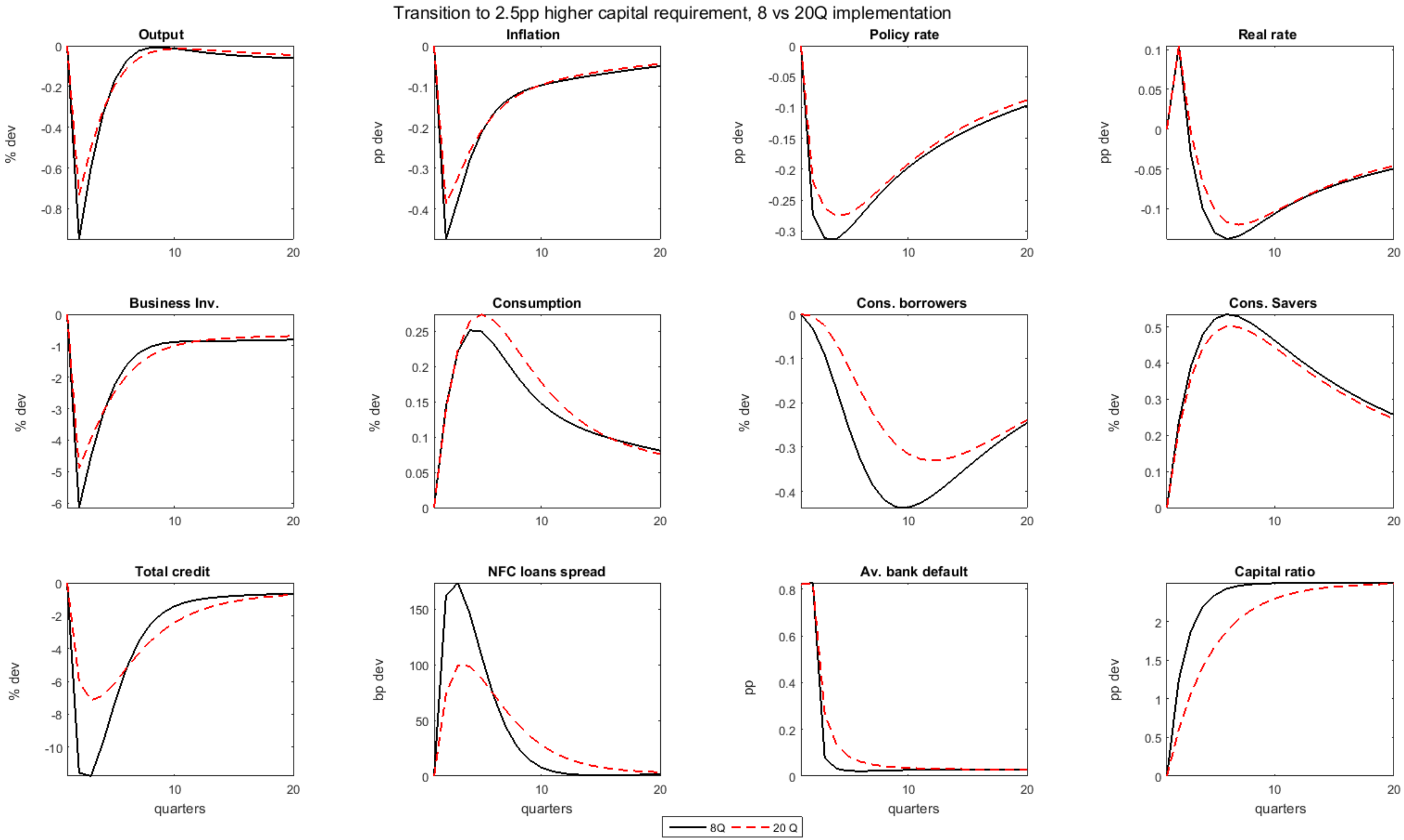
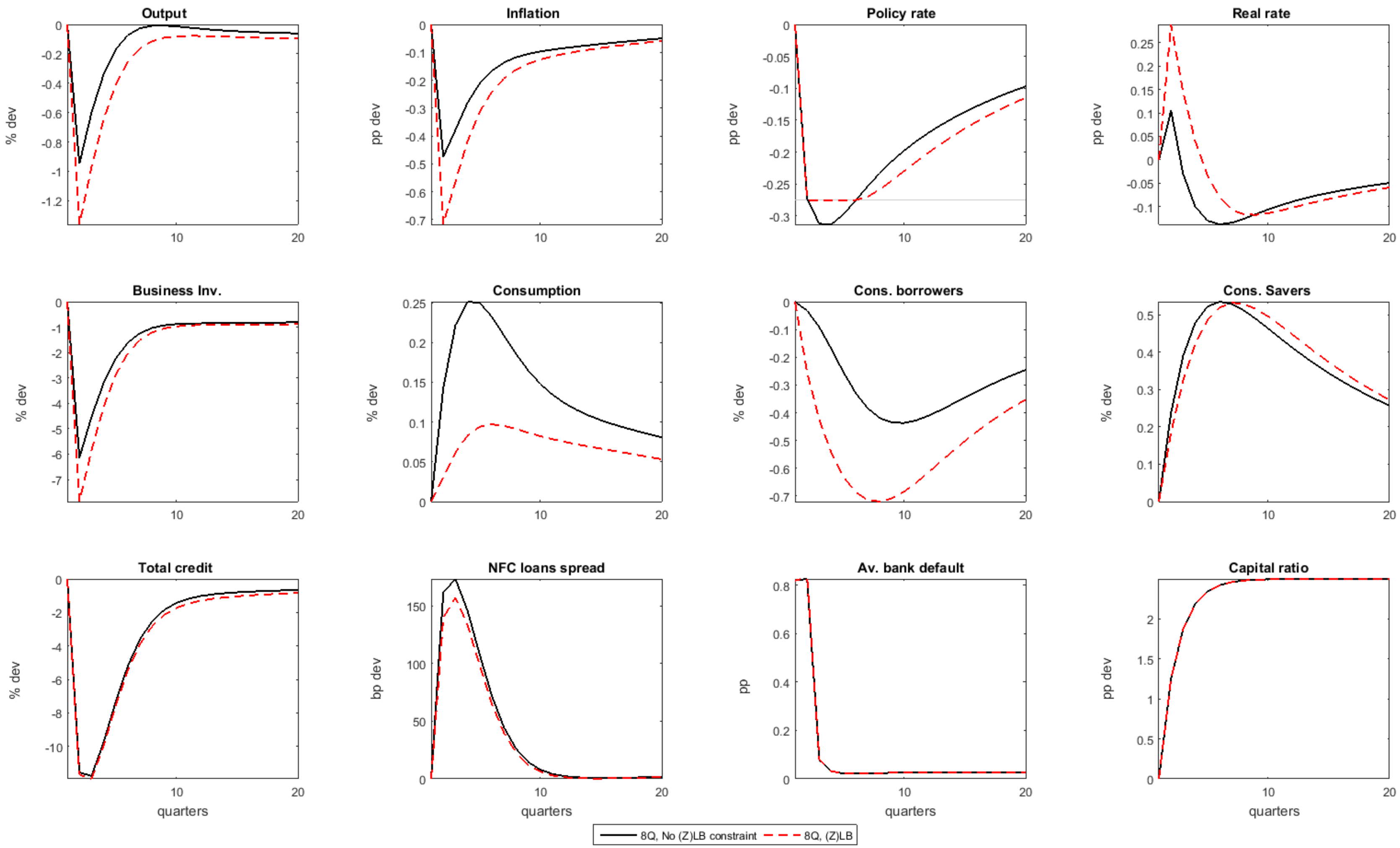
Long Run Impact of Bank Capital Requirements



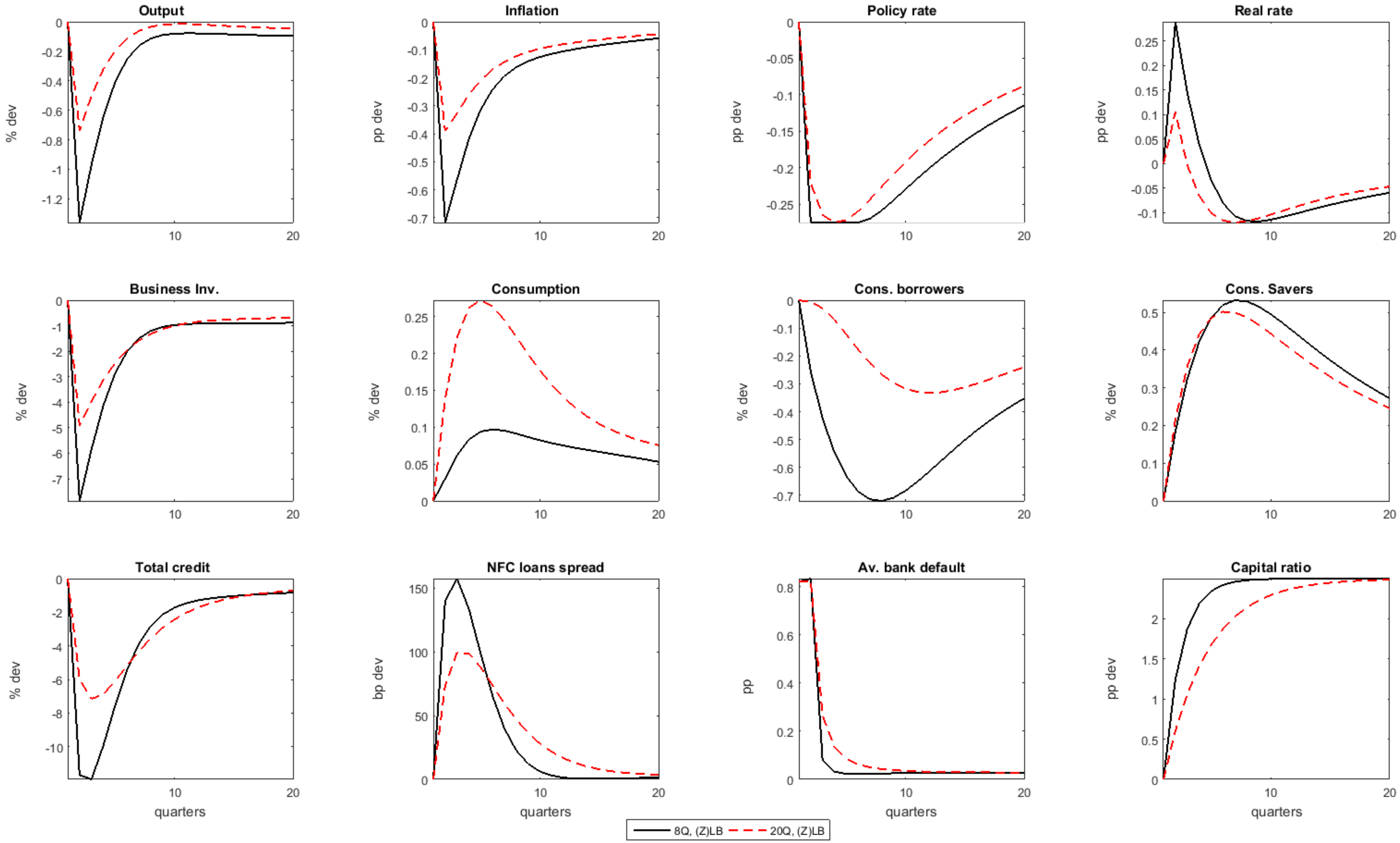
Transitions: Implementation Speed



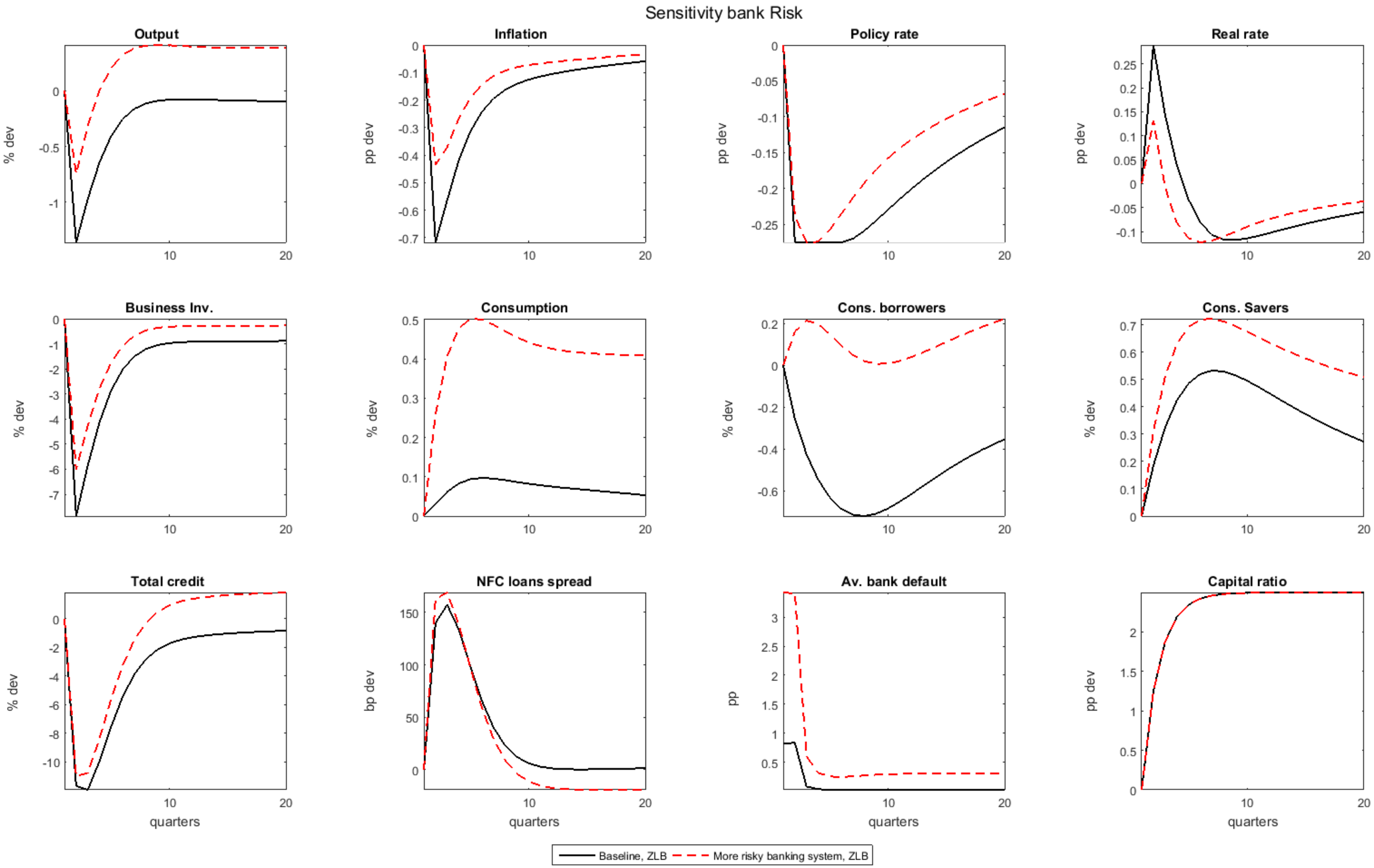
Transitions: Proximity of (Z)LB



Transitions: Proximity of (Z)LB: Implementation Speed



Transitions: Proximity of (Z)LB: Degree of Banking Fragility



Designing a Capital Requirement Increase

	A. NO (Z)LB Contraint				B. (Z)LB Constraint			
	Taylor rule (inflation target parameter)			Strict inflation targeting	Taylor rule (inflation target parameter)			Strict inflation targeting
	1.5	3	10		1.5	3	10	
Optimal CR increase	1.05%	1.14%	1.19%	1.27%	0.78%	1.13%	1.15%	1.15%
Optimal speed	40 Q	25 Q	11 Q	0 Q	40 Q	39 Q	34 Q	32 Q
Cons. Eq. Welfare								
Borrowers	0.31%	0.37%	0.41%	0.45%	0.30%	0.36%	0.39%	0.39%
Savers	0.24%	0.25%	0.26%	0.26%	0.18%	0.24%	0.25%	0.25%
Volatility Policy rate	1.84%	2.03%	4.03%	14.92%	1.27%	1.28%	1.38%	1.51%
Quarters of ZLB binding	NA	NA	NA	NA	3 Q	2 Q	3 Q	5 Q

Conclusions

- Capital requirement increases reduce aggregate demand and impose short term costs on the real economy
- Size of the short term costs depend on
  - Strength of monetary policy response to inflation
  - Speed of implementation
- Costs largest when ZLB binds
  - Slow implementation then appropriate
- Costs small when banking sector is fragile
  - Faster implementation optimal

BACKGROUND SLIDES

Calibration: Model Parameters

Description	Par.	Value	Description	Par.	Value
A) pre-set parameters					
Frisch elasticity of labor	η	1	HH bankruptcy cost	μ_m	0.3
Disutility of labor ($\varkappa = s, m$)	$\varphi_\varkappa$	1	NFC bankruptcy cost	μ_f	0.3
Habits formation	κ	0.6	Bank M bankruptcy cost	μ_M	0.3
Capital share in production	α	0.3	Bank F bankruptcy cost	μ_F	0.3
Survival rate of entrepreneurs	θ_e	0.975	GDP coeff. (taylor rule)	ϕ_y	0.1
Shocks Persistence (all ϱ)	ρ_ϱ	0.9	Inflation coeff. (taylor rule)	ϕ_π	1.5
Calvo probability	ξ	0.9	Smoothing parameter (taylor rule)	ρ_R	0.75
B) Calibrated parameters					
Fraction of borrowers	$\varkappa_m$	0.777	Capital requirement for banks	ϕ	0.08
Discount factor borrowers	β_m	0.9832	Corporate risk weight	ϕ_F	1
Shared of insured deposits	$\varkappa$	0.54	Mortgage risk weight	ϕ_M	0.50
Capital depreciation	δ_h	0.026	Capital managerial cost	ξ	0.001
Inflation Target	$\overline{\pi}$	2	Survival rate of bankers	θ_b	0.951
Discount factor savers	β_s	0.9975	Capital adjustment cost param.	ψ_k	6.02
Transfer from HH to entrepreneurs	χ_e	0.433	Housing adjustment cost param.	ψ_h	1.895
Housing weight in savers' utility	υ_s	0.181	STD NFC risk shock	$\sigma_\epsilon^{\sigma_f}$	0.059
Housing weight in borrowers' utility	υ_m	0.623	STD HH risk shock	$\sigma_\epsilon^{\sigma m}$	0.010
Housing depreciation	δ_k	0.008	STD bank risk shock ($\varkappa = M, F$)	$\sigma_\epsilon^{\sigma\varkappa}$	0.06
STD iid. risk for household borrower	σ_m	0.203	STD capital depreciation shock	$\sigma_\epsilon^{\delta_k}$	0.001
STD iid. risk for entrepreneurs	σ_f	0.391	STD housing depreciation shock	$\sigma_\epsilon^{\delta_h}$	0.001
STD iid. risk for mortgage lender	σ_M	0.014	STD TFP shock	σ_ϵ^A	0.009
STD iid. risk for corporate lender	σ_F	0.029	STD preference shock	σ_ϵ^J	0.137

The parameters in a) are set to standard values in the literature, whereas in b) are calibrated to match the data targets.

Households

- Two distinct dynasties that differ in their discount factors:
  - n_s patient households / *savers* $(\varkappa = s) \rightarrow \beta^s$
  - $n_m = 1 - n_s$ impatient households / *borrowers* $(\varkappa = m) \rightarrow \beta^m < \beta^s$
- Dynasties provide *risk-sharing* to their members:

$$\max \ E_t \left[\sum_{i=0}^{\infty} (\beta_{\varkappa})^{t+i} \left[\log(c_{\varkappa,t+i}) + v_{\varkappa,t+i} \log(h_{\varkappa,t+i}) - \frac{\varphi_{\varkappa}}{1+\eta} (l_{\varkappa,t+i})^{1+\eta} \right] \right]$$

where

- $\varkappa = s, m$
  $c_{\varkappa,t}$: consumption
  $h_{\varkappa,t}$: housing services
  $l_{\varkappa,t}$: hours worked

Savers

Patient household: 3 different types of members

- a mass x_w of **workers:** supply deposits to banks and labor to the production sector and transfer their wage income to the household

- a mass x_e and x_b of **entrepreneurs** (provide equity financing to good-producing firms) and **bankers (**provide equity financing to banks), respectively.

Both transfer their earnings back to the patient households once they retire.

(Although in each period the mass of patient household members who are active bankers and entrepreneus has constant size, in every period some bankers and entrepreneurs become workers and some workers become either bankers or entrepreneurs.)

Savers (cont.)

Budget constraint:

$$c_{s,t} + q_{h,t}\left(h_{s,t} - (1-\delta_{h,t})h_{s,t-1}\right) + \left(q_{k,t} + s_t\right)k_{s,t} + d_t + B_t \leq \left(r_{k,t} + \left(1-\delta_{k,t}\right)q_{k,t}\right)k_{s,t-1} + \\ + w_t l_{s,t} + \widetilde{R}_t^d \frac{d_{t-1}}{\pi_t} + R_{t-1}^{rf}\frac{B_{t-1}}{\pi_t} + \Omega_{s,t} + \Pi_{s,t} + \Xi_{s,t} \qquad (1)$$

- where

  d_t: portfolio of deposits; B_t : risk free asset (in zero net supply)

  $\widetilde{R}_t^d$: risky gross returns on deposits

  $k_{s,t}$ capital held by savers subject to a cost s_t (to match the share of *non-intermediated capital*)

  $\Omega_{s,t}$: lump-sum tax used to ex-post balance the DIA's budget

  $\Pi_{s,t}$: aggregate net transfers from entrepreneurs and bankers

  $\Xi_{s,t}$:dividends from firms that manage the capital stock on behalf of patient households

Savers (cont.)

To capture *bank debt liability in a broader sense*:

- A fraction κ is interpreted as **insured deposits** that always pay back the promised gross deposit rate R^d_{t-1}.
- The remaining fraction $1-\kappa$ is interpreted as **uninsured bank debt** that pays back the promised rate R^d_{t-1} if the issuing bank is solvent and a proportion $1-\kappa$ of the net recovery value of bank assets in case of default

$\Longrightarrow$ the gross return on bank debt is given by

$$\widetilde{R}^d_t = R^d_{t-1} - (1-\kappa)\Omega_t, \tag{2}$$

where Ω_t is the average default loss per unit of bank debt

For $\kappa < 1$, bank debt is overall risky and, thus, will carry a contractual gross interest rate R^d_{t-1} higher than the free rate R^{rf}_{t-1}.

Borrowers

- Returns of levered asset (housing, capital and loan portfolio) affected by $\omega_{j,t}$: i.i.d shock (mean=1)
- **Default decision** depends on both iid and aggregate reasons

$$\omega_{m,t}\left(1\text{–}\delta_{h,t}\right)q_{h,t}h_{m,t\text{-}1} \;<\; R_{m,t\text{-}1}\frac{b_{m,t\text{-}1}}{\pi_t} \;\Leftrightarrow\; \omega_{m,t} < \overline{\omega}_{m,t} = \frac{x_{m,t\text{-}1}}{R_{H,t}},$$

$$\text{where } R_{H,t} \;\equiv\; \frac{\left(1\text{–}\delta_{h,t}\right)q_{h,t}}{q_{h,t\text{-}1}},\; x^m_{t-1} \equiv \frac{R_{m,t-1}b_{m,t-1}}{q_{h,t}h_{m,t-1}}\frac{1}{\pi_t}$$

$b_{m,t}$: non-contingent debt charging agreed gross nominal rate R^m_t

- Budget constraint Dynasty

$$c_{m,t}+q_{h,t}h_{m,t} \leq w_t l_{m,t}+b_{m,t}+\int_{\overline{\omega}_{m,t}}^{\infty}\left(\omega_{m,t}q_{h,t}\left(1\text{-}\delta_{h,t}\right)h_{m,t\text{-}1}\text{-}R_{m,t\text{-}1}\frac{b_{m,t\text{-}1}}{\pi_t}\right)dF_m(\omega_{m,t})-\Omega_{m,t}$$

Borrowers (cont.)

- **Budget constraint** (using BGG notation) compactly written as:

$$c_{m,t} + q_{h,t}h_{m,t} - b_{m,t} \leq w_t l_{m,t} + \underbrace{(1 - \Gamma_m(\overline{\omega}_{m,t}))R_{H,t}q_{h,t-1}h_{m,t-1}}_{\text{NET HOUSING EQUITY}} - \Omega_{m,t}$$

- **Participation constraint** of the bank

$$E_t\Lambda_{b,t+1}[\underbrace{(1 - \Gamma_M(\overline{\omega}_{H,t+1}))}_{\text{LEVERED RETURNS}}\underbrace{(\Gamma^m(\overline{\omega}_{m,t+1}) - \mu_m G_m(\overline{\omega}_{m,t+1}))R_{H,t+1}}_{\text{NET RETURNS ON LOAN PORTFOLIO}}]q_{h,t}h_{m,t} \geq \overline{\rho}_{b,t}e_{M,t}$$

- where $G_m(\overline{\omega}_{m,t+1})$:housing share that end up in default;μ_m: repossession cost

  $\overline{\rho}_{b,t}$*required expected rate of return* on the equity $e_{M,t} = \phi_{M,t}b_{m,t}$

  $\Gamma_j(\overline{\omega}_{j,t}) = \int_0^{\overline{\omega}_{j,t}}\omega_{j,t}f_j(\omega_{j,t})d\omega_{j,t} + \overline{\omega}_{j,t}\int_{\overline{\omega}_{j,t}}^{\infty}f_j(\omega_{j,t})d\omega_{j,t}$: share of total returns of levered asset that accrues to lenders

Banks

Two types of competitive banks ($j = M, F$) supply loans $b_{j,t}$ using deposit funding $d_{j,t}$ & equity funding $e_{j,t}$

- Max expected equity pay-off:

$$\max_{b_{j,t},d_{j,t},e_{j,t}} \quad E_t \Lambda_{b,t+1} \max \left[\omega_{x,t+1} \widetilde{R}^x_{t+1} l_{x,t} - R^d_t d_{x,t}, 0 \right]$$

$$\begin{aligned} \text{s.t.:} \quad & e_{x,t} + d_{x,t} = b_{x,t} && \text{(balance sheet constraint)} \\ & e_{x,t} \geq \phi_{x,t} b_{x,t} && \text{(regulatory capital constraint)} \\ & E_t(\rho_{j,t+1}) e_{j,t} \geq \overline{\rho}_{j,t} e_{j,t} && \text{(bankers' participation constraint)} \end{aligned}$$

where: $\omega_{x,t+1}$: idiosyncratic portfolio return shock (mean=1)

$\widetilde{R}^x_{t+1}$: realized return on well diversified portfolio of loans of class x

$\overline{\rho}_{j,t}$: bankers' required rate of return on equity

$\Lambda_{b,t+1}$ is bankers' stochastic discount factor

Firms

The Final-Good-Producing Firms. The final good, Y_t, is produced by perfectly competitive firms using $y_t(i)$ units of each type of intermediate good i and a constant return to scale, diminishing marginal product, and constant-elasticity-of-substitution technology:

$$Y_t \leq \left[\int_0^1 y_t(i)^{\frac{\xi-1}{\xi}} di\right]^{\frac{\xi}{\xi-1}}, \tag{3}$$

where $\xi > 1$ is the constant-elasticity-of-substitution parameter.

The price of an intermediate good, $y_t(i)$, is denoted by $P_t(i)$ and is taken as given by the competitive final-good-producing firms. Solving for cost minimization yields a constant-price-elasticity demand function for each goods type i, which is homogeneous to degree one in the total final output, $y_t(i) = \left[\frac{P_t(i)}{P_t}\right]^{-\xi} y_t$, and the domestic price index $P_t = \left[\int_0^1 P_t(i)^{1-\xi} di\right]^{1/(1-\xi)}$.

Firms (cont.)

Intermediate Sector. There is a continuum of monopolistically competitive firms indexed by $i \in [0,1]$ that produce intermediate goods, $y(i)$, using the following technology

$$y(i)_t = z_t \left(L(i)_t\right)^{1-\alpha} k(i)_{t-1}^{\alpha} \ , \tag{4}$$

where $\gamma_{z,t}$ is an aggregate productivity shock, k is rented capital, L is labour supplied by patient and impatient agents.

Price rigidities as in the New Keynesian literature. At time t each intermediate firm is allowed to revise its price with probability $(1-\chi)$ as in Calvo (1983), leading to the following New Keynesian Phillips curve:

$$\log\left(\frac{P_t}{P_{t-1}}\right) = \beta_1 \left[E_t \log\left(\frac{P_{t+1}}{P_t}\right)\right] + \epsilon_\pi \log\left(\frac{X_t}{X}\right) \tag{5}$$

where $\epsilon_\pi = \frac{(1-\chi)(1-\beta_s\chi)}{\chi}$ and X_t represents the marginal cost of production. Intermediate firms are owned by the patient households.

Monetary Authority

As standard in New Keynesian models, we assume that, in the benchmark economy, the monetary authority follows a simple interest-rate rule

$$R_t = R_{t-1}^{\alpha_r} \pi_t^{(1-\alpha_r)\alpha_\pi} \left(\Delta \ln GDP_t\right)^{(1-\alpha_r)\alpha_y},$$

where the nominal policy interest rate is adjusted in response to deviations of inflation from its target and GDP growth.

Transitions: Taylor Rule Inflation Reaction Coefficient