Structural Reforms in a Debt Overhang

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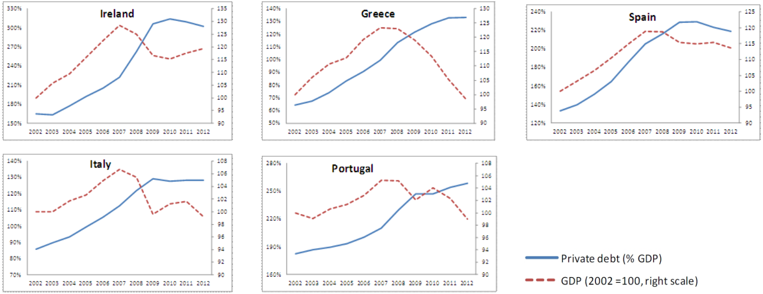
Motivation (I)

- Periphery EMU countries suffer from low/negative growth
- High levels of private debt and need to deleverage act as a drag on growth



Motivation (II)

- In the short term, little room for
  - fiscal policy (large deficits)
  - (conventional) monetary policy (ZLB).
- Much of the focus is on **structural reforms**, mainly in product and labor markets.
  - Most official views (e.g. OECD, IMF, ECB) support reforms.
- Reforms are clearly positive in the long run, but their **short/medium term** impact is less well understood.
- EMU periphery conditioned by high debt *cum* **slow private-sector deleveraging**
- **This paper**: study impact of structural reforms in an environment of slow deleveraging

Framework

- DSGE model, small open economy inside monetary union
- Lenders & borrowers, collateral constraints *à la* Kiyotaki & Moore (1997)
- Key point of departure: **long-term debt** $\Rightarrow$ double debt regime:

  a) debt restricted by value of collateral
  b) no new credit, debt amortized slowly

- Baseline deleveraging scenario: negative shock to LTV ratios ('credit crunch')

  $\Rightarrow$ economy enters regime (b): slow and protracted deleveraging
- Time of change from regime (b) to (a), i.e. end of deleveraging phase, is *endogenous*

Preview of results

- Structural reforms (reductions in desired price & wage markups) boost output in long run (as expected), but *also* in short run.
- Particularly true for product market reform
  - Brings forward the (endogenous) end of deleveraging phase/recession
- Labor market reform creates modest short-run gains
  - Double layer of nominal rigidities (wages and prices) delays improvement in price competitiveness
  - Broader reform (including higher wage flexibility) generates sizable short-run gains
- Long-run debt weakens negative Fisherian debt deflation effect (becomes *second order*)

Recent literature

Some recent work on the impact of reforms:

- Eggertsson, Ferrero & Raffo (2014):
    - if monetary policy is at ZLB, deflationary structural reforms increase real interest rate $\longrightarrow$ depress aggregate demand
    - this channel may dominate positive income effect (from long-run gains) in the short run
- Galí & Monacelli (2013): short-run effects of wage moderation (through lower payroll taxes) is small if no monetary accommodation
- Fernández-Villaverde, Guerrón-Quintana & Rubio-Ramírez (2012):
    - credible *announcement* of future structural reforms triggers gains already in the short-run (positive income effect)
    - no deflationary effect on impact
- None of these papers study effects of reforms in a scenario of slow deleveraging

Model structure

- Small open economy in a monetary union
  $\Rightarrow$ monetary policy exogenous $\approx$ ZLB
- Three consumer types
  - Patient households (lenders)
  - Impatient households (borrowers)
  - (Impatient) entrepreneurs (borrowers)
- Three production sectors
  - Consumption goods (entrepreneurs + retailers)
  - Equipment capital producers
  - Construction
- Trade with rest of world: consumption goods and foreign debt
- Standard real and nominal frictions: investment adjustment costs, nominal price and wage rigidities

Financial frictions

- Collateral constraints on (i) impatient households and (ii) entrepreneurs
  - Real estate as collateral (Iacoviello, 2005)
- We assume *long-run debt* $\Rightarrow$ borrowing constraint is *asymmetric*:
  - In 'normal times', borrowing is constrained by value of collateral
  - If collateral values go down sufficiently, new credit freezes, borrowers pay back at contractual amortization rate
- I now focus on the debt-constrained agents

Impatient households

Maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \log\left(c_t\right) + \vartheta \log h_t - \chi \int_0^1 \frac{n_t^C\left(i\right)^{1+\varphi}}{1+\varphi} di \right\},$$

subject to

$$c_t + p_t^h \left[h_t - \left(1-\delta_h\right) h_{t-1}\right] = b_t - \frac{R_{t-1}}{\pi_t} b_{t-1} + \int_0^1 \frac{W_t\left(i\right)}{P_t} n_t^C\left(i\right) di.$$

and an *asymmetric debt constraint...*

Asymmetric debt constraint

- We assume *long run* debt
- A constant fraction $1-\gamma$ of nominal outstanding principal is amortized each period (Woodford, 2001)
- Dynamics of *real* outstanding debt,

$$b_t = \frac{b_{t-1}}{\pi_t} + b_t^{new} - \frac{1-\gamma}{\pi_t} b_{t-1} = \frac{\gamma}{\pi_t} b_{t-1} + b_t^{new}.$$

  b_t^{new}: gross new credit
- If collateral value $< \gamma \frac{b_{t-1}}{\pi_t}$, setting $b_t =$ collateral value would require $b_t^{new} < 0$ ...
- ... but debtor can*not* be forced to pay back faster than $1-\gamma$

Asymmetric debt constraint (cont'd)

- This implies a double *debt regime*:
  - in 'normal' times, borrowing is restricted by expected discounted value of collateral,
$$\frac{1}{R_t} m_t E_t \pi_{t+1} p^h_{t+1} h_t,$$
    m_t: exogenous loan-to-value (LTV) ratio
  - when collateral values fall below *contractual amortization path*, $\gamma b_{t-1}/\pi_t$, the latter becomes the effective debt limit
- Formally,

$$b_t \leq \begin{cases} \frac{1}{R_t} m_t E_t \pi_{t+1} p^h_{t+1} h_t, & \frac{1}{R_t} m_t E_t \pi_{t+1} p^h_{t+1} h_t \geq \gamma \frac{b_{t-1}}{\pi_t} \\ \gamma \frac{b_{t-1}}{\pi_t}, & \frac{1}{R_t} m_t E_t \pi_{t+1} p^h_{t+1} h_t < \gamma \frac{b_{t-1}}{\pi_t} \end{cases}$$

Entrepreneurs

Maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \log c_t^e,$$

subject to

$$c_t^e + p_t^h \left[h_t^e - (1-\delta_h)\, h_{t-1}^e\right] + q_t \left[k_t - (1-\delta_k)\, k_{t-1}\right]$$
$$= mc_t y_t^e - \frac{W_t}{P_t} n_t^e + b_t^e - \frac{R_{t-1}}{\pi_t} b_{t-1}^e + \sum_{s=r,h,k} \Pi_t^r,$$

$$y_t^e = A_t k_{t-1}^{\alpha_k} \left(h_{t-1}^e\right)^{\alpha_h} \left(n_t^e\right)^{1-\alpha-\alpha_k},$$

$$b_t^e \leq \begin{cases} \frac{1}{R_t} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e, & \frac{1}{R_t} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e \geq \gamma^e \frac{b_{t-1}^e}{\pi_t} \\ \gamma^e \frac{b_{t-1}^e}{\pi_t}, & \frac{1}{R_t} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e < \gamma^e \frac{b_{t-1}^e}{\pi_t} \end{cases}.$$

Calibration

- We target key ratios of the Spain in 2007:

Ratio	Data (%)	Model (%)
construction share of GDP	12.45	15.11
construction share of employment	13.39	15.44
labor share of GDP	61.59	64.84
corporate debt / annual GDP	125.36	128.85
household debt / annual GDP	80.22	79.94
net foreign debt / annual GDP	79.3	79.3
gross exports / GDP	26.9	26.9

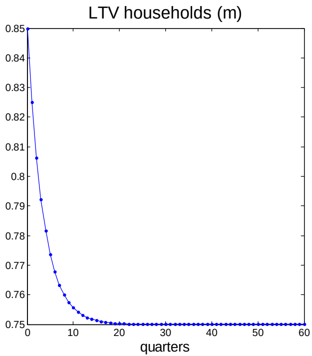
Calibration (2)

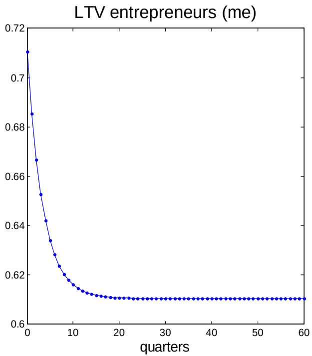
- Parameters not pinned down by targets are set to standard values within NK-DSGE literature
- Parameters affecting debt constraints
  - LTV ratios: households $m = 0.85$, entrepreneurs $m^e = 0.71$
  - Amortization rates: households $1 - \gamma = 0.02$, entrepreneurs $1 - \gamma^e = 0.04$
    $\Rightarrow$ average debt maturity: $1/\left(1 - \gamma\right) = 50$, $1/\left(1 - \gamma^e\right) = 25$ qrts

Baseline scenario: a deleveraging shock

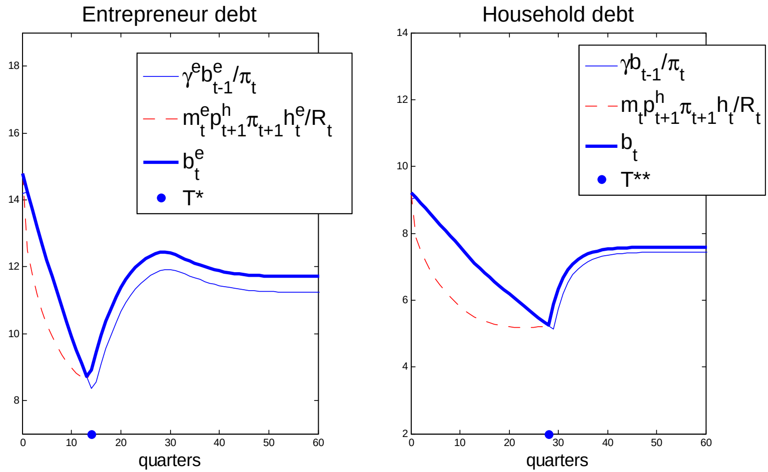
- We simulate a *deleveraging* shock for entrepreneurs and constrained households:
    - Gradual, permanent fall (10pp) in loan-to-value (LTV) ratios: m_t, m_t^e

Deleveraging shock: LTV ratios





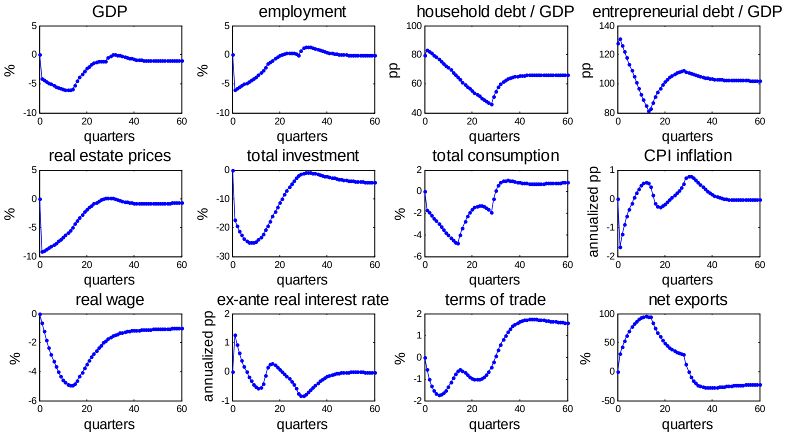
Deleveraging shock: regime changes



Baseline scenario: a deleveraging shock

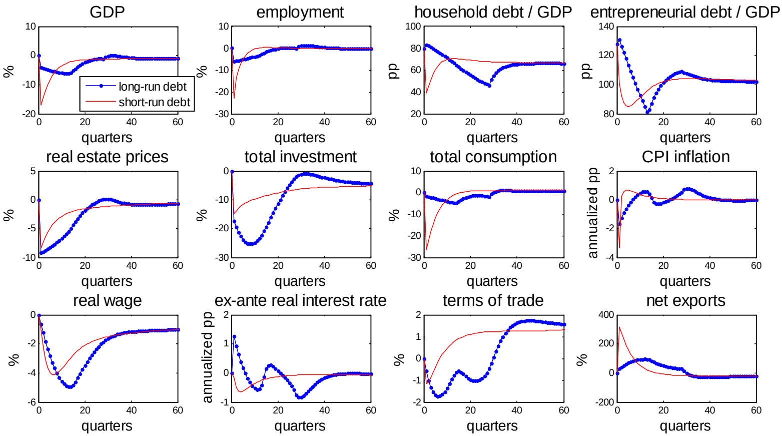
- Large initial shock and asymmetric debt limits produce a double *regime change*:
  - For $t = 1, ..., T^*$, value of entrepreneurs' collateral falls below $\gamma^e b^e_{t-1}/\pi_t$
  - For $t = 1, ..., T^{**}$, value of households' collateral falls below $\gamma b_{t-1}/\pi_t$
- $\gamma^e < \gamma \Rightarrow T^* < T^{**}$: faster amortization of entrepreneurial debt
- Dates of regime change T^* and T^{**} are solved endogenously

Deleveraging shock: macroeconomic effects



Deleveraging shock: long vs short-term debt

Long run debt produces a more realistic deleveraging path and (critically) allows for endogenous regime change



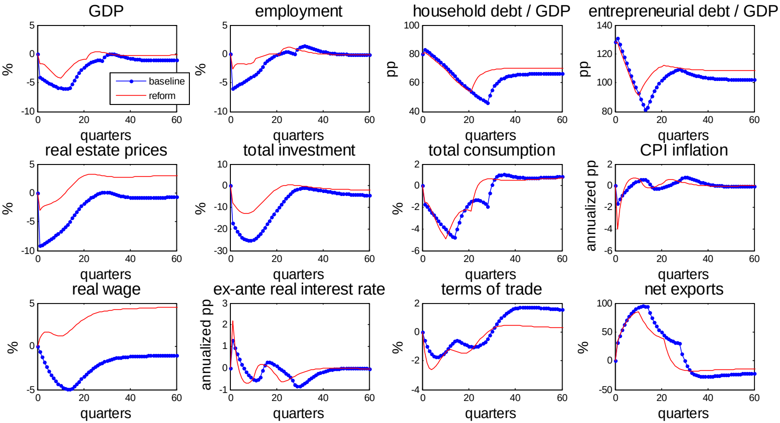
Debt, consumption and investment

- Two phases in the dynamics of debt:
  - Until T^* (T^{**}), smooth deleveraging at rate γ^e/π_t (γ/π_t)
  - After T^* (T^{**}), debt picks up quickly: real estate is again valuable as collateral $\Rightarrow$ asset prices, credit and investment "virtuous circle"
- Consumption follows a similar pattern to debt
- Investment recovers somewhat earlier than consumption and debt ('creditless recovery')

Product market reform

- We simulate a sudden, permanent fall in desired *price markups* (5%)

Product market reform



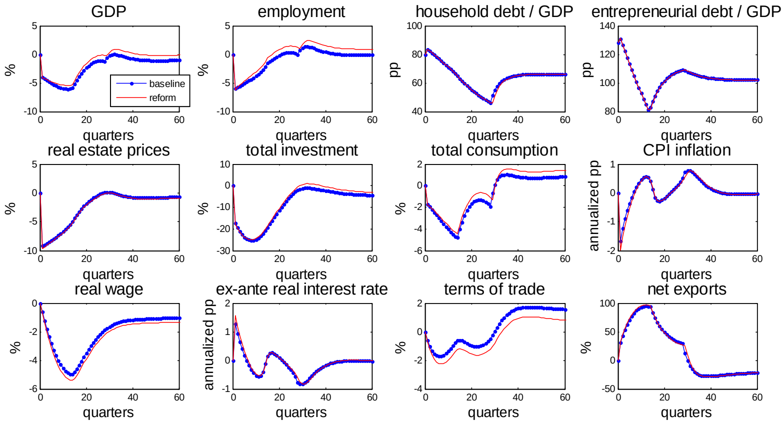
Product market reform: deleveraging ends earlier

- Reform brings *forward* the end of the deleveraging phase: T^* and T^{**} both go down.
- Focus on T^* (entrepreneurs):
  - Anticipating long-run gains, (forward-looking) real estate prices fall by less
  - Collateral values catch up earlier with contractual amortization path
  - Anticipation of earlier recovery feeds back to construction demand, higher asset price, etc.

Labor market reform

- We simulate a sudden, permanent fall in desired *wage markups* (5%).
  - Model proxy for unions' bargaining power.

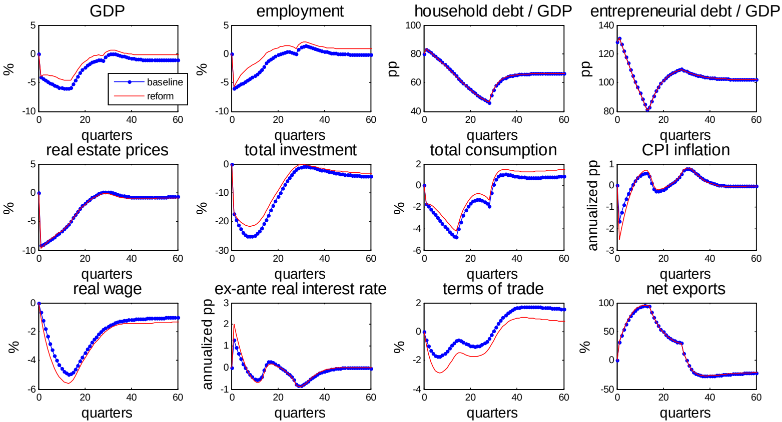
Labor market reform



Broader labor market reform

- Reduction in desired wage markups must overcome double layer of nominal rigidities (wages and prices) before affecting price competitiveness
- Typically, labor market reforms affect not only markups, but also speed of nominal wage adjustment
  - Spain's 2012 reform a clear example!
- Consider a *broader* labor market reform that also reduces **nominal wage rigidity**
  - Reduce Calvo parameter from 3/4 to 2/3 (average wage duration from 4 to 3 qrts)

Broader labor market reform



The role of debt maturity

- Net debt payments before $T^{*\prime}s$ $(b_t = \gamma b_{t-1}/\pi_t)$:

$$\begin{aligned}\frac{R_{t-1}}{\pi_t} b_{t-1} - b_t &= \frac{R_{t-1} - \gamma}{\pi_t} b_{t-1} \\ &= \frac{(R_{t-1} - 1) + (1 - \gamma)}{\pi_t} b_{t-1}.\end{aligned}$$

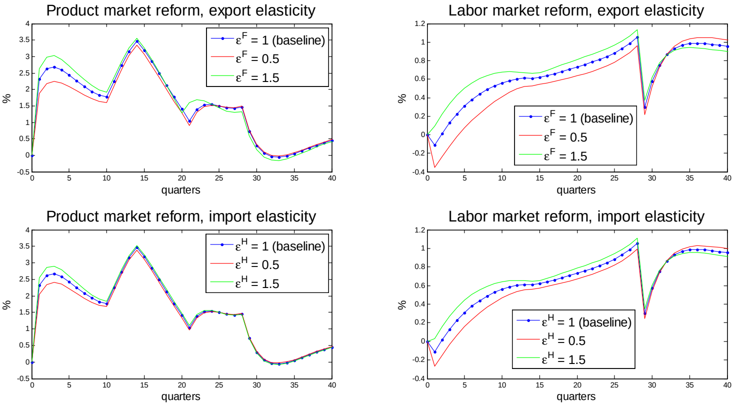
- Long-run debt $\Rightarrow$ amortization rate $1 - \gamma < 1$
- Under our calibration, $1 - \gamma$ is first order
  $\Rightarrow$ Given first order fall in inflation π_t, Fisherian debt deflation effect is *second order*!

Concluding remarks

- Structural reforms may boost GDP and employment already in the short run...
  - ... even without monetary accommodation
- Especially true for product market reform (brings forward end of deleveraging/recession)
- Also true for broad labor market reform (including higher wage flexibility)
- Long-run debt buffers short-term costs of reforms

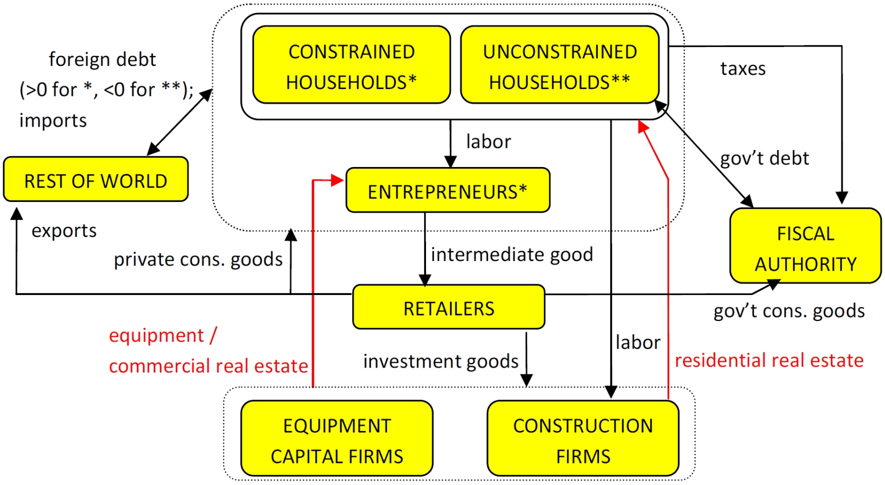
The role of the external sector

Responsiveness of net exports to reform-driven depreciation in terms of trade is key



Differential effect of reform on GDP

Model structure



Unconstrained households

Maximize

$$E_0 \sum_{t=0}^{\infty} \left(\beta^U\right)^t \left\{ \log\left(c_t^U\right) - \chi \int_0^1 \frac{n_t^U(i)^{1+\varphi}}{1+\varphi} di + \vartheta \log h_t^U \right\}$$

subject to

$$\begin{aligned}&(1+\tau_t^c)\, c_t^U + b_t^g + d_t^U + p_t^h \left[h_t^U - (1-\delta_h)\, h_{t-1}^U\right] \\ &= \frac{R_t}{\pi_t}\left(b_{t-1}^g + d_{t-1}^U\right) + (1-\tau^w) \int_0^1 \frac{W_t(i)}{P_t} n_t^U(i)\, di,\end{aligned}$$

where $R_t = R^* e^{-\psi(nfa_t/gdp_t)}$.

Constrained households

Maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \log\left(c_t\right) - \chi \int_0^1 \frac{n_t^C\left(i\right)^{1+\varphi}}{1+\varphi} di + \vartheta \log h_t \right\},$$

$\beta < \beta^U$, subject to

$$\left(1+\tau_t^c\right) c_t + \frac{R_t}{\pi_t} b_{t-1} + p_t^h \left[h_t - \left(1-\delta_h\right) h_{t-1}\right]$$
$$= b_t + \left(1-\tau^w\right) \int_0^1 \frac{W_t\left(i\right)}{P_t} n_t^C\left(i\right) di + s_t.$$

and *asymmetric debt constraint*,

$$b_t \leq \begin{cases} \frac{1}{R_t} m_t E_t \pi_{t+1} p_{t+1}^h h_t, & \frac{1}{R_t} m_t E_t \pi_{t+1} p_{t+1}^h h_t \geq \gamma b_{t-1} \\ \gamma b_{t-1}, & \frac{1}{R_t} m_t E_t \pi_{t+1} p_{t+1}^h h_t < \gamma b_{t-1} \end{cases}.$$

Entrepreneurs

Maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \log c_t^e,$$

subject to

$$\left(1+\tau_t^c\right) c_t^e + p_t^h \left[h_t^e - \left(1-\delta_h\right) h_{t-1}^e\right] + q_t \left[k_t - \left(1-\delta_k\right) k_{t-1}\right]$$
$$= mc_t y_t^e - \frac{W_t}{P_t} n_t^e + b_t^e - \frac{R_t}{\pi_t} b_{t-1}^e + \Pi_t + \Pi_t^h + \Pi_t^k,$$

$$y_t^e = A_t k_{t-1}^{\alpha_k} \left(h_{t-1}^e\right)^{\alpha_h} \left(n_t^e\right)^{1-\alpha-\alpha_k},$$

$$b_t^e \le \begin{cases} \frac{1}{R_t} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e, & \frac{1}{R_t} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e \ge \gamma^e b_{t-1}^e \\ \gamma^e b_{t-1}^e, & \frac{1}{R_t} m_t^e E_t \pi_{t+1} p_{t+1}^h h_t^e < \gamma^e b_{t-1}^e \end{cases}.$$

Retailers

Retailer $z \in [0, 1]$ chooses $P_t(z)$ to maximize

$$\max_{P_t(z)} E_t \sum_{s=0}^{\infty} (\beta\theta)^s \frac{\lambda_{t+s}^e}{\lambda_t^e} \left[\frac{P_t(z)}{P_{t+s}} - mc_{t+s} \right] y_{t+s}^d (P_t(z)) = 0,$$

where $\lambda_t^e = c_t^e (1 + \tau_t^c)$, subject to

$$y_t^d (P_t(z)) = \left(\frac{P_t(z)}{P_t} \right)^{-\varepsilon} y_t.$$

Construction firms

Maximize

$$E_0 \sum_{t=0}^{\infty} \frac{\lambda_t^e}{\lambda_0^e} \left(p_t^h I_t^h - w_t n_t^h - i_t^h \right)$$

subject to

$$I_t^h = \left(n_t^h \right)^{\omega} \left\{ i_t^h \left[1 - \frac{\Phi_h}{2} \left(\frac{i_t^h}{i_{t-1}^h} - 1 \right)^2 \right] \right\}^{1-\omega}.$$

Equipment capital producers

Maximize

$$E_0 \sum_{t=0}^{\infty} \frac{\lambda_t^e}{\lambda_0^e} \Pi_t^k = E_0 \sum_{t=0}^{\infty} \frac{\lambda_t^e}{\lambda_0^e} \left(q_t I_t - i_t \right)$$

subject to

$$I_t = i_t \left[1 - \frac{\Phi}{2} \left(\frac{i_t}{i_{t-1}} - 1 \right)^2 \right]$$

Wage setting

Union representing type-i workers chooses W to maximize

$$\sum_{x=C,U} E_t \sum_{s=0}^{\infty} (\beta^x \theta_w)^s \left[\lambda_{t+s}^x \left(1 - \tau_{t+s}^w\right) \frac{W}{P_{t+s}} n_{t+s}^{d,x}(W) - \chi \frac{\left(n_{t+s}^{d,x}(W)\right)^{1+\varphi}}{1+\varphi} \right]$$

with $\beta^C = \beta$, subject to

$$n_t^{d,x}(W) = \left(\frac{W}{W_t}\right)^{-\varepsilon_w} \left(n_t^{e,x} + n_t^{h,x}\right)$$

for $x = C, U$.

Fiscal authority

Government budget constraint,

$$b_t^g = \frac{R_t}{\pi_t} b_{t-1}^g + g_t + s_t - \tau_t^c \left(c_t + c_t^U + c_t^e \right) - \tau_t^w w_t \left(n_t^C + n_t^U \right).$$

Fiscal rule,

$$\frac{b_t^g}{gdp_t} = \left(1 - \gamma_g\right) \bar{b}_y + \gamma_g \frac{b_{t-1}^g}{gdp_{t-1}}.$$

International linkages

- Export demand,

$$x_t = \zeta \left(\frac{P_t}{P_t^*} \right)^{-\sigma} y_t^*.$$

- Current account identity,

$$nfa_t \equiv d_t^U - b_t - b_t^e = \frac{R_t}{\pi_t} \left(d_{t-1}^U - b_{t-1} - b_{t-1}^e \right) + x_t,$$

Aggregation and market clearing

Final goods market,

$$y_t = \left(c_t + c_t^U + c_t^e\right) + i_t + i_t^h + g_t + x_t.$$

Real estate market,

$$h_t + h_t^U + h_t^e = I_t^h + (1 - \delta_h)\left(h_{t-1} + h_{t-1}^U + h_{t-1}^e\right).$$

Equipment capital market,

$$k_t = (1 - \delta_k)\, k_{t-1} + I_t.$$

Labor market,

$$n_t^C + n_t^U = n_t^e + n_t^h.$$

Definition of GDP (in terms of final goods basket),

$$\begin{aligned} gdp_t &\equiv \left(c_t + c_t^U + c_t^e\right) + i_t + g_t + x_t + p_t^h I_t^h \\ &= \left(y_t - i_t^h\right) + p_t^h I_t^h. \end{aligned}$$

Product market reform: deleveraging ends earlier (II)

- Counterfactual reform scenario: $T^{*\prime}s$ fixed at their no-reform values