Pessimism and Persistent Slowdowns: How Can Policy Help?*

by

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* Partly based on joint research with George W. Evans, Kaushik Mitra and Jess Benhabib. (Key references on the final slide.)

1. Introduction

- The sluggish macro performance of many market economies in the aftermath of the Great Recession has raised interest in the possibility of a distinct stagnation state associated with the interest-rate zero lower bound (ZLB).

- See Figure 1 for GDP per capita for the US, Japan and the Euro area 2001-2015.

- Figure 2 considers the policy interest rates for these countries/regions.

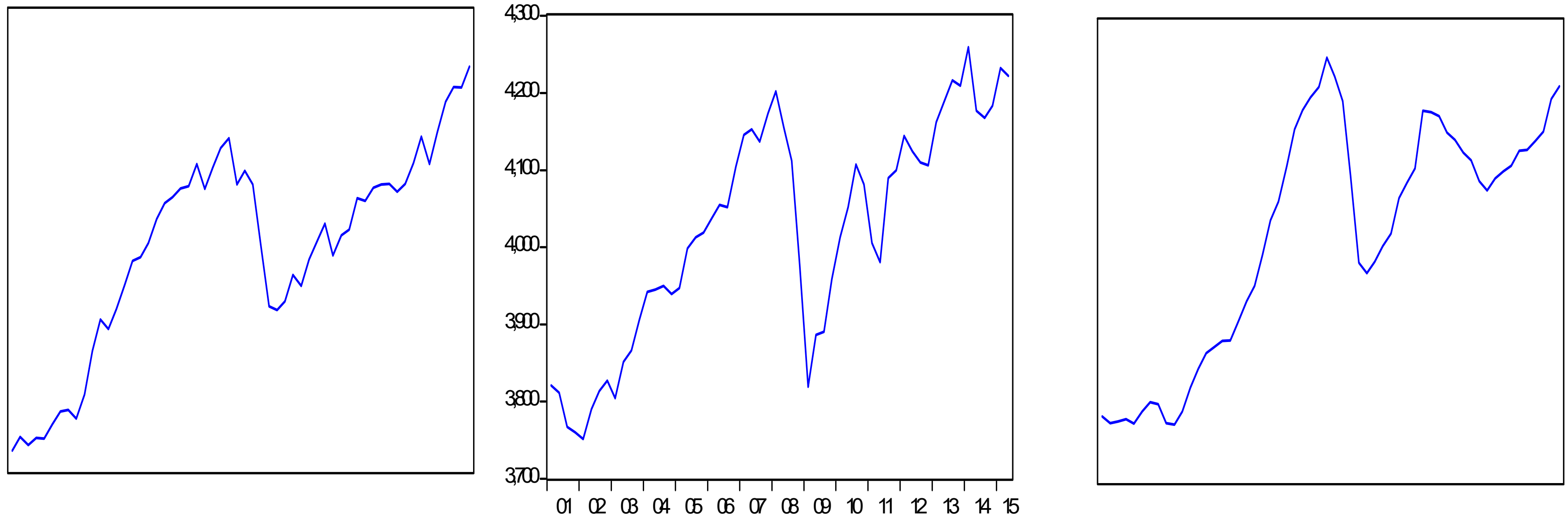

Figure 1: Real GDP per capita in local currency. US, Japan and Euro area.

- Explanation for Figure 2:
  - monetary policy is conducted using an interest rate rule

$$R_t = 1 + f(\pi_t),$$

where R_t is the gross interest rate and π_t is the gross inflation rate. $\pi^* > 1$ denotes the positive inflation target and β the subjective discount factor.
- In many standard models the Fisher equation

$$R_t = \pi_t/\beta.$$

holds in the steady state (π, R), see the straight line in Figure 2.
- If monetary policy is "active", i.e. $f'(\pi^*) > 1/\beta$, then ZLB implies that there are multiple steady states (Reifschneider & Williams 2000, Benhabib et al 2001).

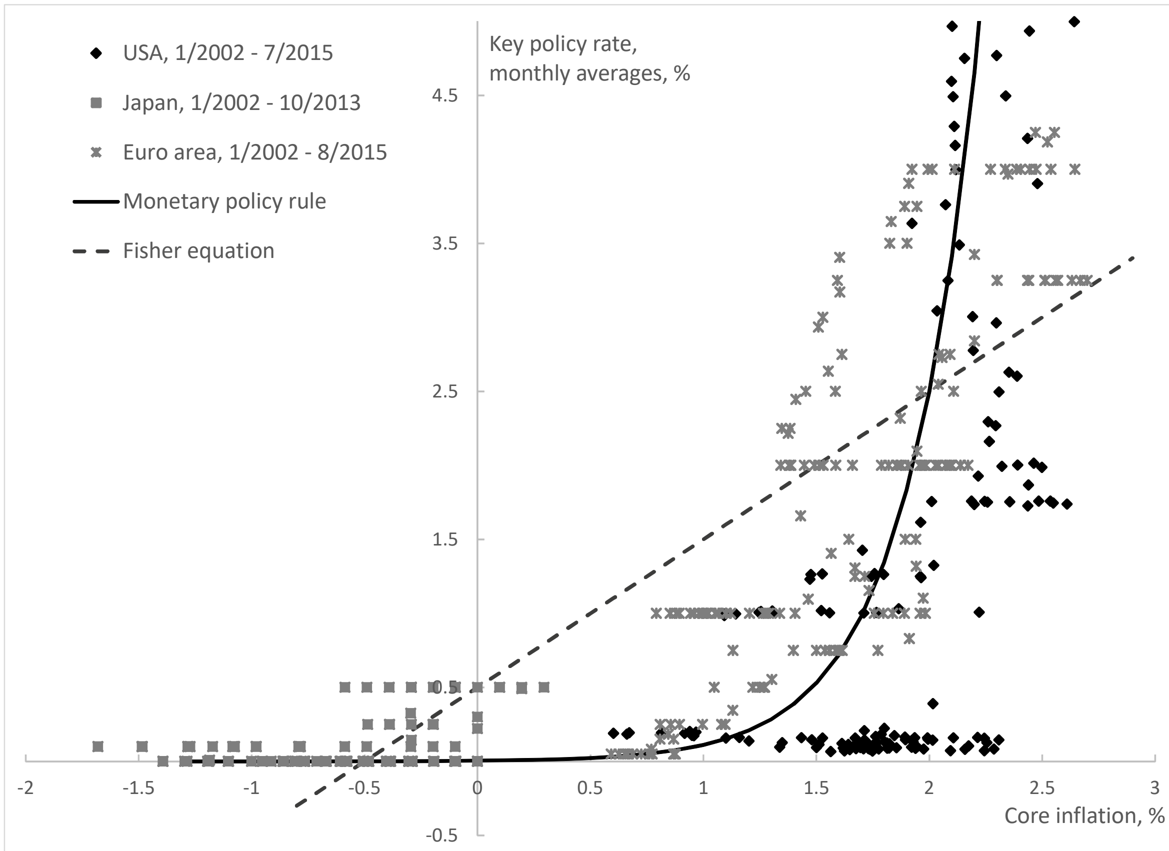

Figure 2: Interest rate vs inflation in Japan, US and euro area

The Approach

- I develop an extension of the New Keynesian (NK) model that allows existence of a stagnation trap.
  – This is a lack of confidence story of stagnation.
  – Pricing friction in the NK model provides a role for expectations to affect GDP via aggregate demand.

- I assume agents make forecasts using adaptive learning (AL) instead of rational expectations (RE).
  – There are multiple steady state equilibria. Targeted steady state only locally stable under learning.
  – The unintended low inflation/deflation steady state is not locally stable under learning; it creates deflation trap with falling output over time.

– Central intuition: zero interest rate + expected deflation $\rightarrow$ high real interest rate $\rightarrow$ lower consumption, output and greater deflation.

- I consider fiscal and monetary policies to combat possible stagnation:
  – a large temporary fiscal stimulus can be effective in avoiding stagnation,
  – the success rate for a fiscal stimulus is higher if done earlier.
  – At the ZLB asset purchases can be effective, if they are introduced early.

- The preceding issues can arise just from interaction from expectations and the real economy. What about financial market problems?

Remarks on the Financial System in China

- Chinese financial system has become more market oriented.
  – Banking sector assets are over $3 \times GDP$, and financing outside the traditional banking has grown very rapidly.
  – Liberalization of financial markets has continued, and all key interest rates are now officially market-determined.
  –Monetary policy by the PBoC has become more market -oriented and moved away from direct credit guidance.

- Rapidly rising indebtedness in China has increased the risks to financial stability.
  – Financial markets have become an important source of shocks also in China.
  – Large shocks to financial markets can affect aggregate demand and inflation expectations.

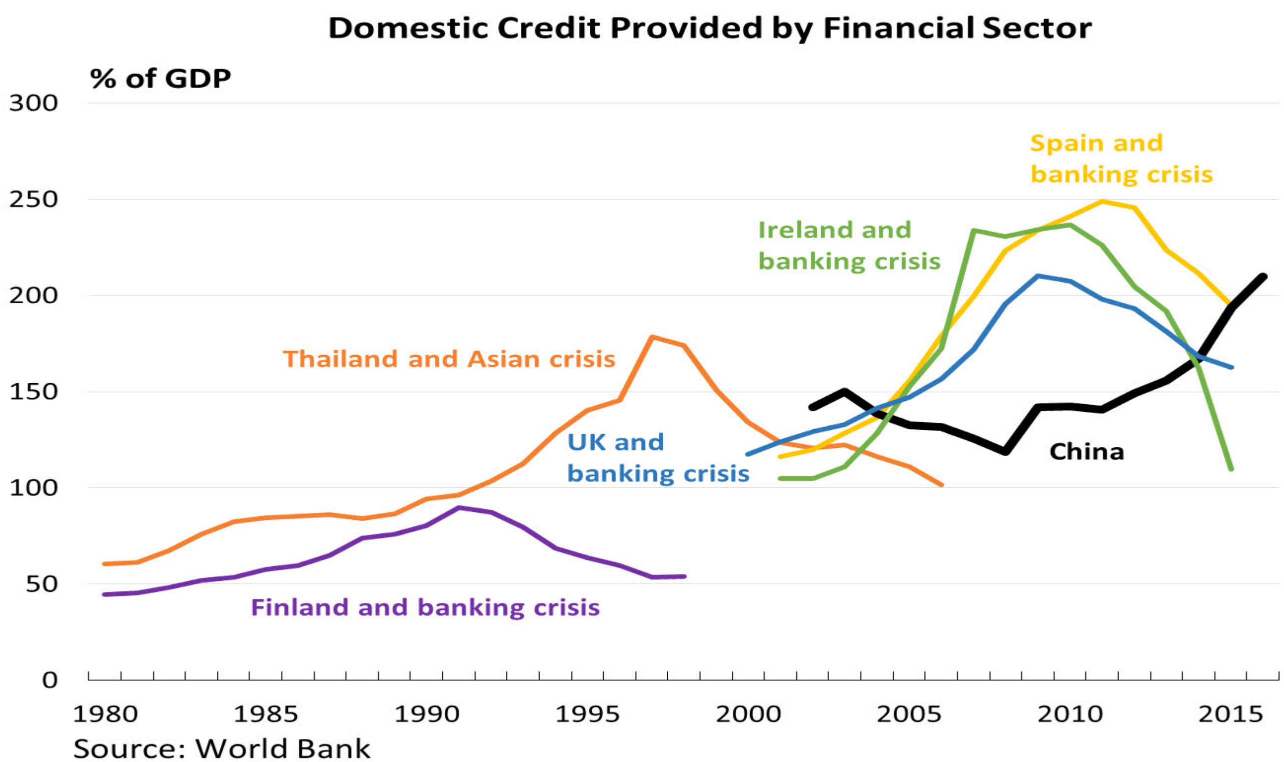

Figure 3: Credit development and financial crises

- Simple model of financial market problems: an exogenous, persistent credit-spread shock appears.

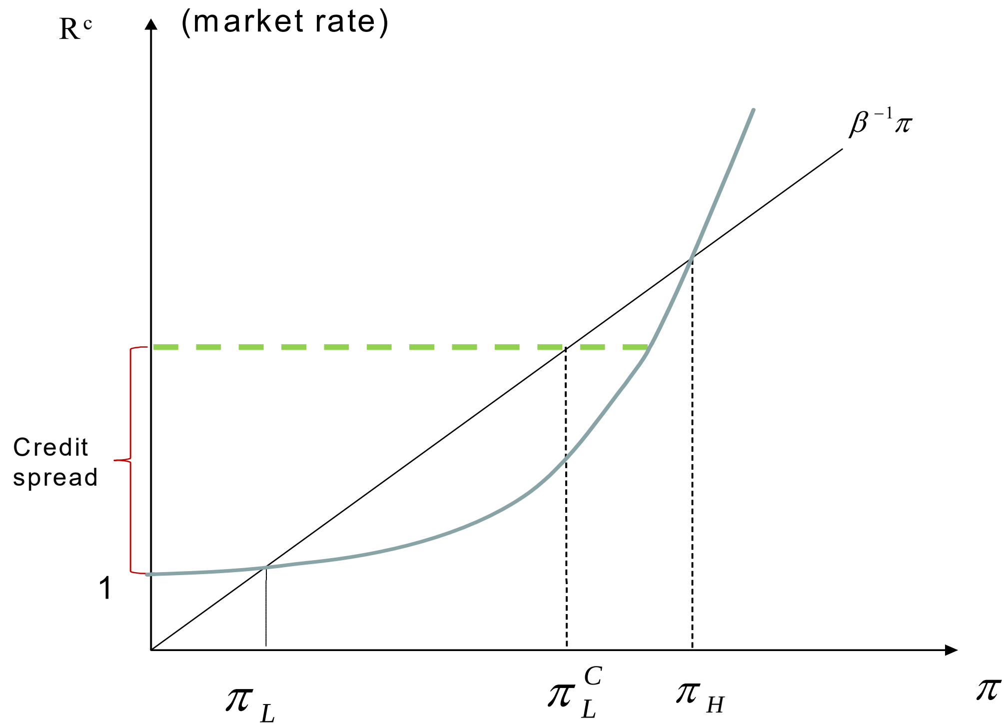

Figure 4: Credit spread shock

2. NK Model Without Lower Bounds

Households are indexed by i and firms by j but in equilibrium agents make the same respective decisions.

Households

Household i chooses consumption, labor supply and bond holdings.
- We assume **Ricardian households**. Government spending is exogenous and financed by **lump-sum taxes**.

- We get **the linearized consumption function**

$$\hat{C}_{t,i} = (1-\beta)\left[\frac{\hat{Y}_{t,i}}{\left(\bar{C}/\bar{Y}\right)} - \frac{\hat{G}_{t,i}}{\left(\bar{C}/\bar{G}\right)} + \sum_{s=1}^{\infty}\beta^s \hat{E}_{t,i}\left(\frac{\hat{Y}_{t+s,i}}{\left(\bar{C}/\bar{Y}\right)} - \frac{\hat{G}_{t+s,i}}{\left(\bar{C}/\bar{G}\right)})\right)\right]$$
$$-\hat{E}_{t,i}\sum_{s=1}^{\infty}\beta^s \hat{r}_{t+s},$$

where variables are in proportional deviation form and $\hat{r}_{t+1} = \hat{R}_t - \hat{\pi}_{t+1}$.

Firms

Standard NK set-up with monopolistic competition and Rotemberg price adjustment costs.

- One can derive **the linearized NK Phillips curve**

$$
\begin{aligned}
(1-a_1)\hat{\pi}_t - a_2\hat{Y}_t \;=\;& a_1 \sum_{s=1}^{\infty} (\beta\gamma_1)^s \hat{E}_t \hat{\pi}_{t+s} + a_2 \sum_{s=1}^{\infty} (\beta\gamma_1)^s \hat{E}_t \hat{Y}_{t+s} \\
& - a_3 \sum_{s=0}^{\infty} (\beta\gamma_1)^s \hat{E}_t \hat{A}_{t+s} - a_4 \sum_{s=0}^{\infty} (\beta\gamma_1)^s \hat{E}_t \hat{G}_{t+s} \\
& + a_5 \sum_{s=0}^{\infty} (\beta\gamma_1)^s \hat{E}_t \hat{\mu}_{t+s}, \text{ where } 0 < \gamma_1 < 1,
\end{aligned}
$$

and $a_1 = 1 - \gamma_1$. Here $\mu_t = \theta_t \left(\theta_t - 1\right)^{-1}$ is the mark-up shock.

Temporary equilibrium and learning

Combining market clearing $Y_t = C_t + G_t + (\psi/2)(\pi_t - \pi^*)^2$ with the consumption function gives **the IS-curve**

$$\begin{aligned}\hat{Y}_t \;&=\; \bar{g}\hat{G}_t + (1-\beta)\left[\hat{Y}_t - \bar{g}\hat{G}_t + \sum_{s=1}^{\infty} \beta^s \hat{E}_t \left(\hat{Y}_{t+s} - \bar{g}\hat{G}_{t+s}\right)\right] \\ &\quad -(1-\bar{g})\hat{E}_t \sum_{s=1}^{\infty} \beta^s \hat{r}_{t+s},\end{aligned}$$

The interest-rate rule is

$$R_t = \beta^{-1}\left(\pi^* + \chi_\pi(\pi_t - \pi^*) + \chi_y(Y_t - \bar{Y})\right).$$

In log-linearized form, and assuming $\chi_y = 0$,

$$\hat{R}_t = \chi_\pi \hat{\pi}_t.$$

- Agents know the policy rule, so to forecast $\hat{r}_{t+s}$ and $\hat{R}_{t+s}$ they need to forecast $\hat{\pi}_{t+s}$ and $\hat{Y}_{t+s}$.
- For simplicity, assume agents know the form of the exogenous productivity and mark-up shocks:

$$\hat{A}_t = \rho_A \hat{A}_{t-1} + \upsilon_{At},\ \hat{\mu}_t = \rho_\mu \hat{\mu}_{t-1} + \upsilon_{\mu t}.$$

- Given agents' forecasts $\hat{E}_t \hat{\pi}_{t+s}, \hat{E}_t \hat{Y}_{t+s}, \hat{E}_t \hat{G}_{t+s}, \hat{E}_t \hat{A}_{t+s}, \hat{E}_t \hat{\mu}_{t+s}$ and the shocks $\hat{G}_t, \hat{A}_t, \hat{\mu}_t$ we can solve for **temporary equilibrium** $\hat{Y}_t, \hat{\pi}_t, \hat{R}_t$, $\hat{C}_t$.

- Forecasts are obtained using statistical methods.

Expectations and learning

When $G_t = \bar{G}$ is constant, the REE around π^* takes the form

$$\hat{\pi}_t = f_\pi + d_{\pi A}\hat{A}_t + d_{\pi\mu}\hat{\mu}_t \text{ and } \hat{Y}_t = f_Y + d_{YA}\hat{A}_t + d_{Y\mu}\hat{\mu}_t.$$

Including f_π, f_Y allows agents to track changes in π and Y.

Using **recursive least-squares** (LS), agents estimate the coefficients f_π, $d_{\pi A}$, ...and update the coefficients over time. Forecasts at time t are

$$\hat{E}_t\hat{\pi}_{t+s} = f_\pi + d_{\pi A}\rho_A^s\hat{A}_t + d_{\pi\mu}\rho_\mu^s\hat{\mu}_t \text{ and } \hat{E}_t\hat{Y}_{t+s} = f_Y + d_{YA}\rho_A^s\hat{A}_t + d_{Y\mu}\rho_\mu^s\hat{\mu}_t.$$

- The REE at π^* is **stable under LS learning** if for constant $G_t = \bar{G}$ estimates converge over time to RE values.

3. Model with Multiple Equilibria

We now allow for lower bounds to R, C and π. We start with R.

- For the interest rate ZLB $R \geq 1$ i.e. $R-1 \geq 0$, we write the lower bound, for $\eta \geq 0$ small, as

$$R_t = \max\left\{(\chi_\pi/\beta)(\pi_t - \pi^*) + \pi^*/\beta, 1+\eta\right\}, \text{ where } \chi_\pi > 1.$$

- The consumption Euler equation in a steady state gives the Fisher equation

$$R = r\pi, \text{ where } r = \beta^{-1}.$$

- Two steady states at π_L and π^*. From the PC $Y_L < \bar{Y}$ but numerically $Y_L \approx \bar{Y}$.

Lower bounds on π and C

- The large negative output gap in the US (and elsewhere), starting 2008-9, led to a smaller drop in inflation than is consistent with the Phillips curve.
  - This was also noticed in the US in the 1930s.
  - In Japan since the mid 1990s inflation became stuck at a mild deflation rate despite stagnation.

- Various explanation are possible, e.g. downward wage rigidity or money illusion. Simply impose a exogenous lower bound at some $\underline{\pi} < \pi^*$.

- We also impose a lower bound on consumption $\underline{C}$, arising from a socially determined subsistence level. (e.g. Stone-Geary preferences).

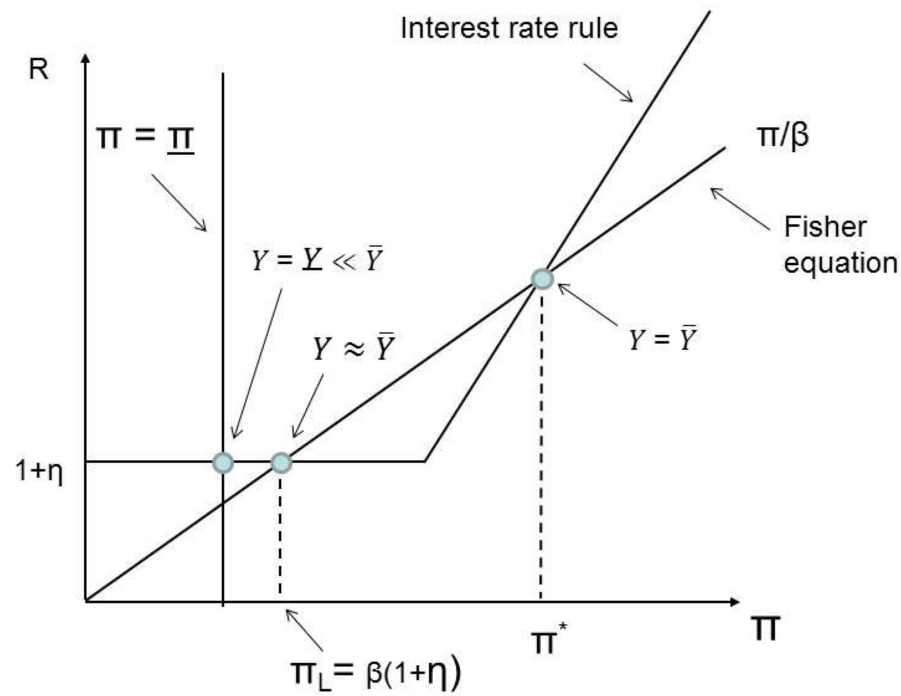

Figure 5: Existence of multiple steady states.

Multiple steady states and local stability under learning

- If $\underline{\pi} < \pi_L$ then there are three steady states, with a stagnation steady state at $(\underline{\pi}, \underline{C})$.

- π^* and $\underline{\pi}$ are locally stable under learning and π_L is unstable.

- The learning dynamics are mainly driven by the intercepts $f' = (f_\pi, f_Y)$ of the perceived law of motion.
  - Learning stability dynamics using the E-stability techniques of Evans and Honkapohja (2001).
  - Figure 5 shows global expectation dynamics.

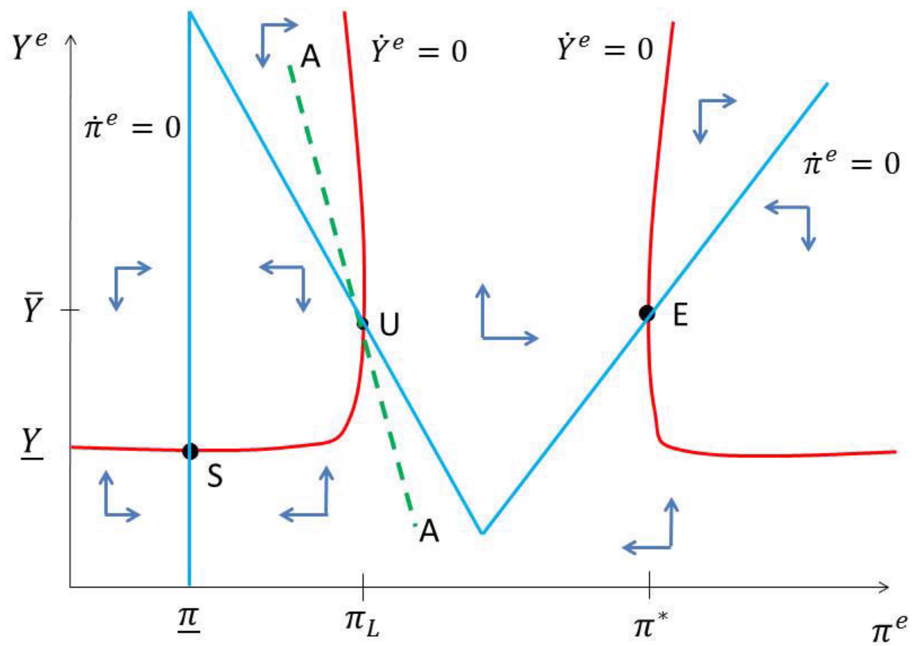

Figure 6: E-stability dynamics when there are three steady states. π^e and Y^e are expected inflation and output.

4. Fiscal Policy

- There is a large recent literature on fiscal policy and government spending multipliers. The renewed interest reflects the US and other fiscal stimulus programs during the Great Recession.

- Most of this literature has assumed RE. We will instead assume AL.

- Consider a temporary fiscal stimulus, starting from $G_t = \bar{G}$ for $t \leq 0$, with $G_t = \tau_t = \begin{cases} \bar{G}', t = 1, ..., T \\ \bar{G}, t \geq T+1 \end{cases}$, and $\bar{G}' > \bar{G}$.
  - This is financed by lump-sum tax.

- Assume the announcement is **fully credible and actually implemented**.

- We compute both distributed lag and (discounted) cumulative multipliers ym_t and ycm_t for $t = 1, 2, 3, \ldots$
  - Because of discounting the cumulative multiplier will be finite even if which policy leads to a permanent change in the level of output.

- Agents can compute $\sum_{s=0}^{\infty} \beta^s \hat{E}_t \hat{G}_{t+s}$, but they do not know the general equilibrium effects of these changes. They forecast future Y, π using AL.

Policy simulations with large pessimistic shocks

- We now consider fiscal policy taking into account the ZLB and the lower bounds $\underline{\pi}$ and $\underline{C}$.

- The impact of fiscal policy will depend on the non-stochastic components $f_\pi(0)$ and $f_y(0)$ of initial expectations $\pi^e(0)$ and $y^e(0)$.

- We use the conventional $\beta = 0.99$ so $\pi_L \approx -0.99\%$ per quarter (deflation around 4% per year).
  - Set the lower bound at $\underline{\hat{\pi}} = -0.017$ per quarter (deflation around 4.8% per year). Also set $\underline{C}$ low, at about 30% below the normal steady state. In the stagnation steady state Y is 24% below the targeted steady state value.

- These values are extreme (Great Depression levels) but they allow us to look at the effectiveness of fiscal policy in extreme cases.

- **First example:** pessimistic expectations shock:

$$\pi^e \approx -1.0\% \text{ per quarter and } \hat{y}^e \approx -1.5\%,$$

  and we look at the path with and without policy if $\bar{G}$ is increased 10% from $\bar{G} = 0.20$ to $\bar{G} = 0.22$ for $T = 40$ periods.
  - Without policy the economy sinks to the stagnation steady state.
  - With policy, output is temporarily raised but again goes to the stagnation state.

- The next Fig. starts with the same pessimistic shock and considers a large increase from $\bar{G} = 0.20$ to $\bar{G}' = 0.28$ for $T = 4$ periods.
  -Top: mean of paths converging to π^* under policy.
  - Middle: mean of paths converging to trap despite policy.
  - Bottom: multipliers across all paths.

- Now in 99.6% of simulations the economy escapes the trap and returns to the targeted steady state.
  - Cumulative multipliers are very large due to the stimulus usually pushing the economy out of the deflation trap.

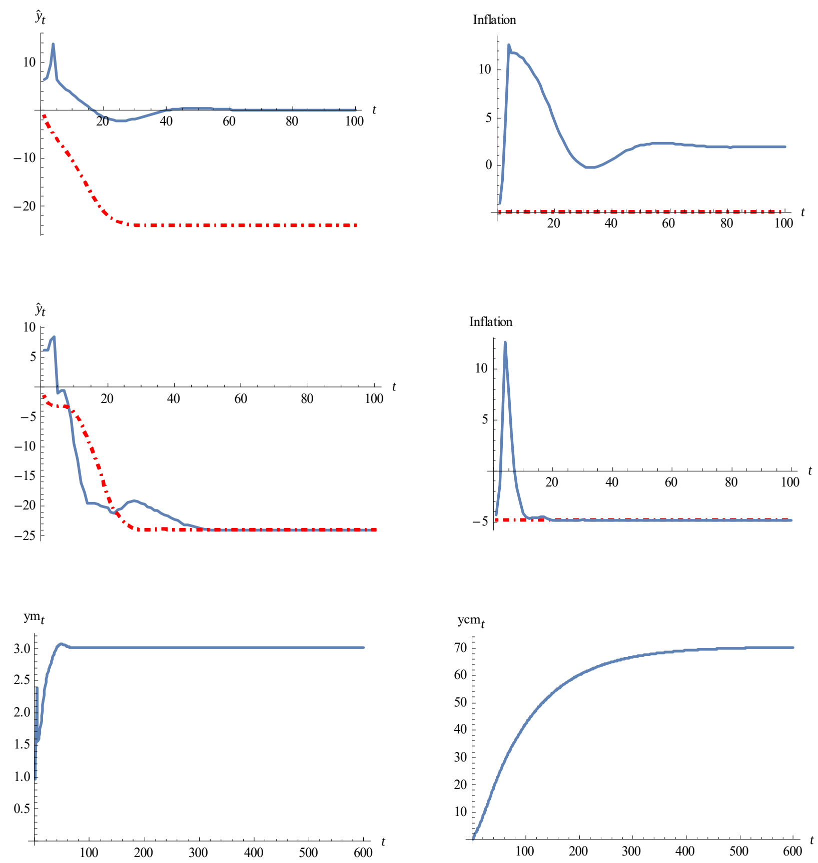

Figure 6: Large policy change $T = 4$. Top: paths under learning with (solid line) and without (dashed line) policy change escaping the trap with policy. Middle: paths for other cases. Bottom: multipliers.

- One can study the effectiveness of fiscal policy for different initial expectations, size of spending increase and the length of policy.

Escape from stagnation

- Suppose fiscal policy is not implemented until, following a large pessimistic shock, the economy has already converged to a stagnation steady state at the level of the 1930s Great Depression in the US.

- Can a suitable fiscal stimulus still return the economy to the targeted steady state?

$G\backslash T$	1	2	3	4	5	6	7	8	12	16	20
0.4	0	0	0	0	0	0	0	0	0	0	0
0.5	0	0	0	0	0	0	0	0	0	3	43
0.7	0	0	0	1	6	19	47	60	82	60	37
0.8	0	0	1	13	53	77	86	89	63	33	25
0.9	0	1	29	68	85	90	88	81	36	17	11
1.0	0	14	66	87	90	91	80	60	20	9	5
1.2	0	73	91	88	79	61	44	31	4	4	3
1.5	58	89	84	62	33	22	11	9	1	2	1
1.7	76	88	72	32	16	10	6	6	2	1	0
2	83	66	30	13	6	5	4	2	3	0	0
2.5	81	33	8	3	1	4	3	4	1	0	0

Table 1: Percentage of simulations in which fiscal policy successfully results in convergence to the targeted steady state starting from stagnation expectations. Based on 100 simulations.

Credit frictions

- Recall that credit frictions increases the critical inflation rate, below which stagnation can occur, is the existence of .

- Curdia and Woodford (2010, 2015) model this using a heterogeneous agents setup. We use the Woodford (2011) shortcut and set $R = i + \varphi$ with $\varphi > 0$.

- For β near one and $\varphi > 0$ the critical inflation rate can be zero or positive. (For large $\varphi > 0$ only the stagnation steady state exists).

- We set $\beta = 0.9975$ and $\varphi = 0.0025$, a spread of 1.08% per year, a little above setting by Curdia and Woodford (2015). The critical inflation rate is 0.03%.

- In Figure 7 we consider initial expectations

$$\text{net } \pi^e \approx 0.1\% \text{ per year and } \hat{y}^e \approx -5\%.$$

- Without fiscal policy over 73% of the paths converge to the stagnation steady state (while 25% go to the targeted steady state).

- Increasing G from 0.20 to 0.38 for $T = 2$ periods $\longrightarrow$ 86% of the paths go to the targeted steady state (11% go to the stagnation state).

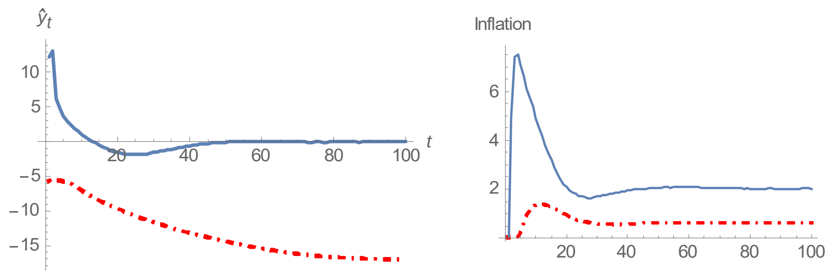

Figure 7: High β and credit spread. Paths under learning with policy change (solid line) and without policy change (dashed line). Means of paths with eventual convergence to targeted steady state under policy.

6. Monetary Policy, Remarks

Monetary policy actions

- Monetary policy has relied on unconventional measures in major western economies (USA, Japan, UK, and Euro area):
  - **large scale asset purchase programs** (APP) in Japan, Great Britain and United States of America.
  - ECB first introduced special loan facilities to banks, then specific asset purchase programs during the sovereign debt crisis and APP since March 2015.

Unconventional monetary policy

- Theoretical analysis using a variant of the above model: Significant shocks can result in unstable expectation dynamics.
  - Pigou 1943 and Patinkin 1965 argued for **real-balance and wealth effects** as a stabilizing mechanism.
  - With **non-Ricardian consumers** there is convergence back to target steady state (Benhabib, Evans and Honkapohja 2014).

- **Ricardian case**: Under a interest rate rule above, the money stock is determined endogenously by money demand. Bond dynamics are determined as residual.
  - Bond purchases by the CB financed by new money:

- With Ricardian consumers, the **effects of asset purchases can be studied as injections of new nominal money**.
At low inflation, the policy-maker introduces an asset purchase program with money supply starts to grow at constant rate (Friedman's rule).

- **Question**: Will the introduction of asset purchases / money growth avoid the liquidity trap?

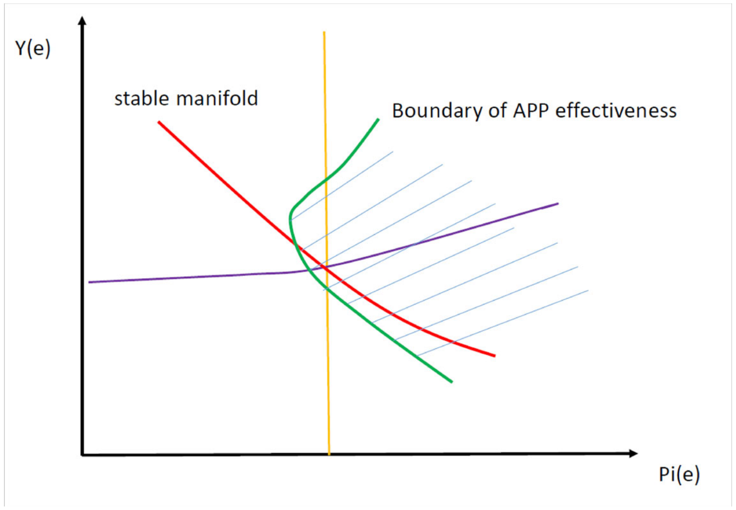

Figure 8: Effectiveness region of APP near the liquidity trap steady state.

- Figure 7 shows that an asset purchase program is effective, provided that inflation has not gotten to very low level.
  - The shaded area to the right of the green curves would yield convergence to the targeted steady state.

7. Discussion and Conclusions

- Crisis of confidence was studied: a large pessimistic shock to π^e, Y^e triggered by events like those arising from the 2007-9 financial crisis.
  - **Monetary policy**: aggressive monetary easing should be followed if there is a large pessimistic shock.
  - Reduce interest rates to ZLB. If needed, introduce an asset purchase program. Introduce it early.

- The main messages for fiscal policy:
  - An aggressive fiscal stimulus may be needed to avoid the stagnation steady state or to facilitate recovery.
  - Persistently below target inflation and inflation expectations can raise the possibility of a stagnation trap.
  - An early fiscal stimulus can be *much* better than waiting.

Key References

Benhabib J., G.W. Evans & S. Honkapohja (2014): Liquidity traps and expectations dynamics: fiscal stimulus or fiscal austerity?, *Journal of Economic Dynamics and Control*, vol. 45, 220-238.

Evans, G.W., S. Honkapohja & K. Mitra (2016): Expectations, stagnation and fiscal policy, CEPR DP11428.

Honkapohja S. (2016), Monetary policies to counter the zero interest rate: an overview of research, *Empirica* 43, 235-256.

Supplements

Large scale asset purchase programs (APP):

- **Japan** had a program in the beginning of 2000's. A new program in 2010 with extensions, latest started in 2014. Ongoing. BOJ balance sheet about 70% of GDP (2015 summer).
- **United States of America**: three programs 2008-2010, 2010-2011 and 2012-2014. Federal Reserve balance sheet about 25% of GDP.
- **Great Britain**: a program 2009-2012. BOE balance sheet about 22% of GDP.
- **Euro area**: ECB program in 2009 (covered bonds) and in 2010 (SMP). A new program in 2014 (some private assets) and 2015 with government and "institution" bonds. Extended in March 2016. ECB balance sheet about 25% of GDP.