Pessimism and Persistent Slowdowns: How Can Policy Help?*

by

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* Mostly 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 trap associated with the interest-rate zero lower bound (ZLB).
  - Of course the 2008-2009 financial crisis brought the liquidity trap to wide analysis and discussion.

- 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.

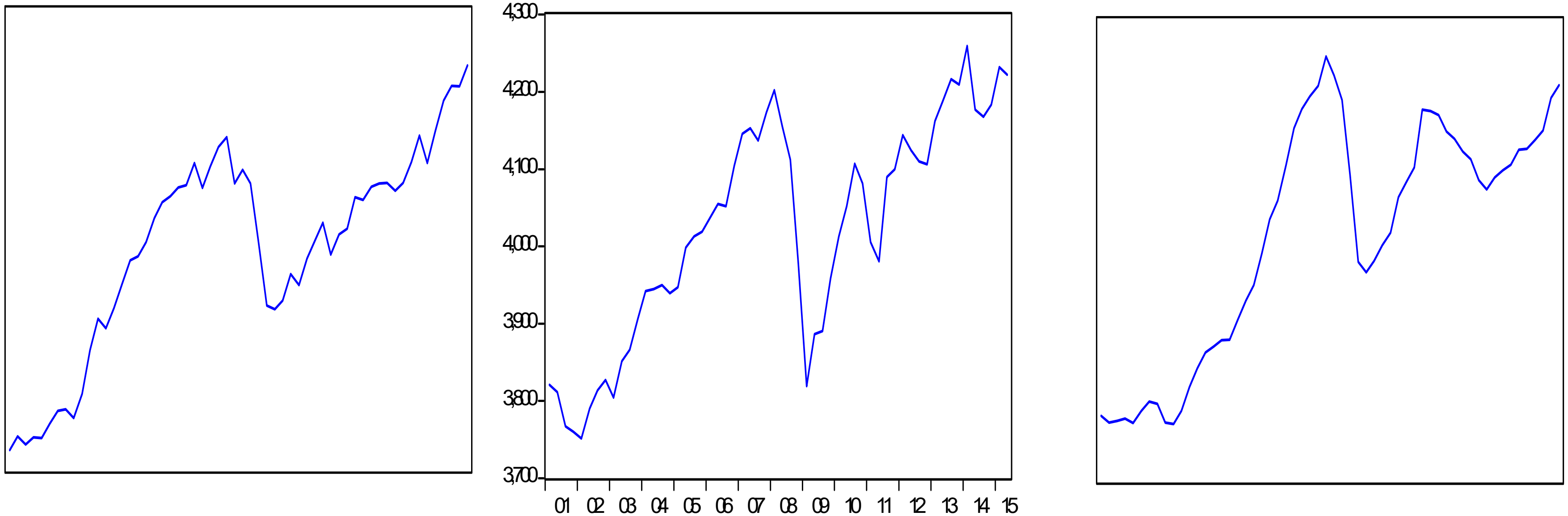

Figure 1: Real GDP per capita in local currency. US, Japan and Euro area.

- 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 etc.).

  - If there are multiple equilibria, expectations can play a big role in dynamics and policy making.

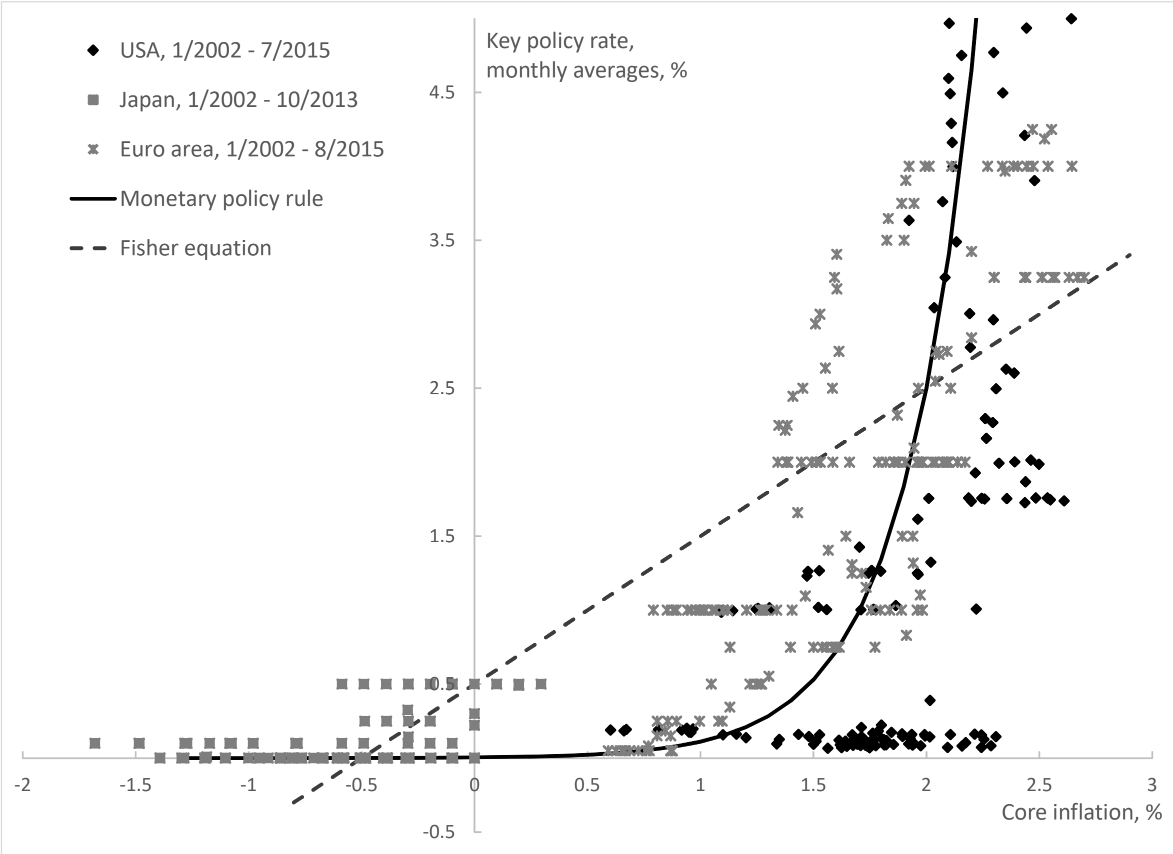

Figure 2: Interest rate vs inflation in Japan, US and euro area

The Approach

- The ZLB regime and sluggish macro development have generated a lot of macroeconomic research.
  - My work has focused on the role of expectations dynamics and possibly multiple equilibria due to ZLB.
  - I develop extensions of the New Keynesian (NK) model that allows for the existence of a stagnation trap.
  - I apologize for lack of scarcity of other references.
  - This is a **lack of confidence** story of crisis and 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). General observations:
  - **RE** presupposes that agents can forecast perfectly: some random shocks are unforecastable.
  - "Lucas critique" assumes that the effects of changes in policy rules on structure can be calculated.
  - **AL** assumes that agents do not know or know only a little about the structure of the aggregate economy. They forecast the future under their limited knowledge and employ statistical or other techniques in forecasting.
  - These forecasts input to their decision rules.

- Application to the NK model.
  - **RE**: There are multiple steady state equilibria. There are also nonlinear paths converging to the low inflation steady state.

- **AL** approach: targeted steady state in Figure 2 is only locally stable under AL.
- The low inflation steady state in Figure 2 is not locally stable under AL; 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.
- There might even exist a stagnation steady state depending on specific features of the model.

- I consider fiscal and monetary policies to combat possible stagnation under AL:
  – 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 by central bank can be effective, if they are introduced early.

- The preceding issues can arise just from interaction of expectations and the real economy. What about financial market problems?
  - Large shocks to financial markets can affect aggregate demand and inflation expectations.

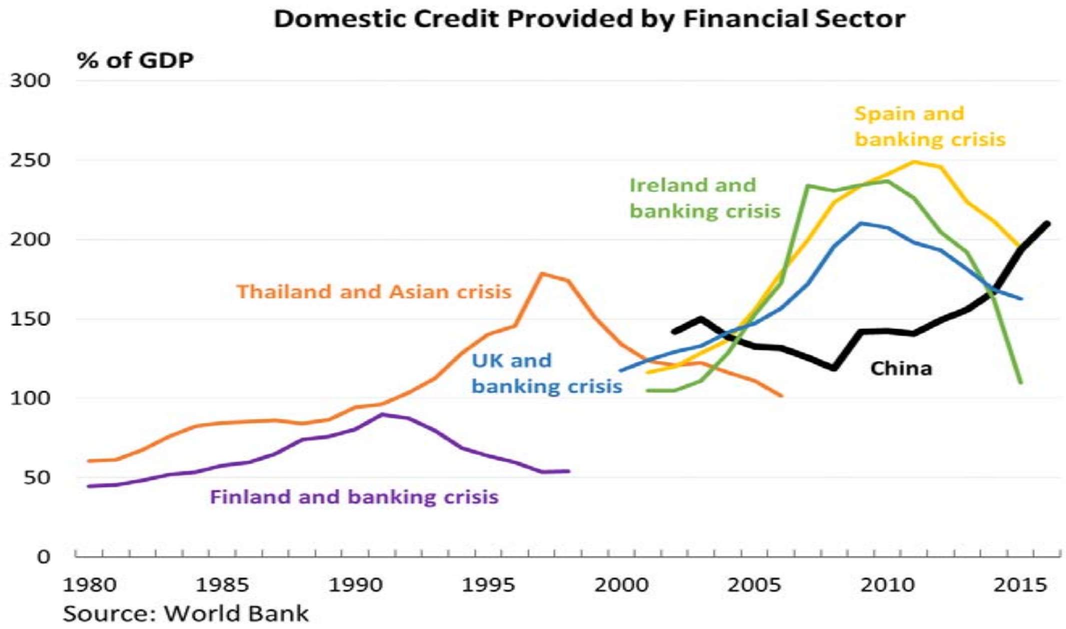

Figure 3: Credit development and financial crises

- Very simple model about financial market problems: an exogenous, persistent credit-spread shock appears.

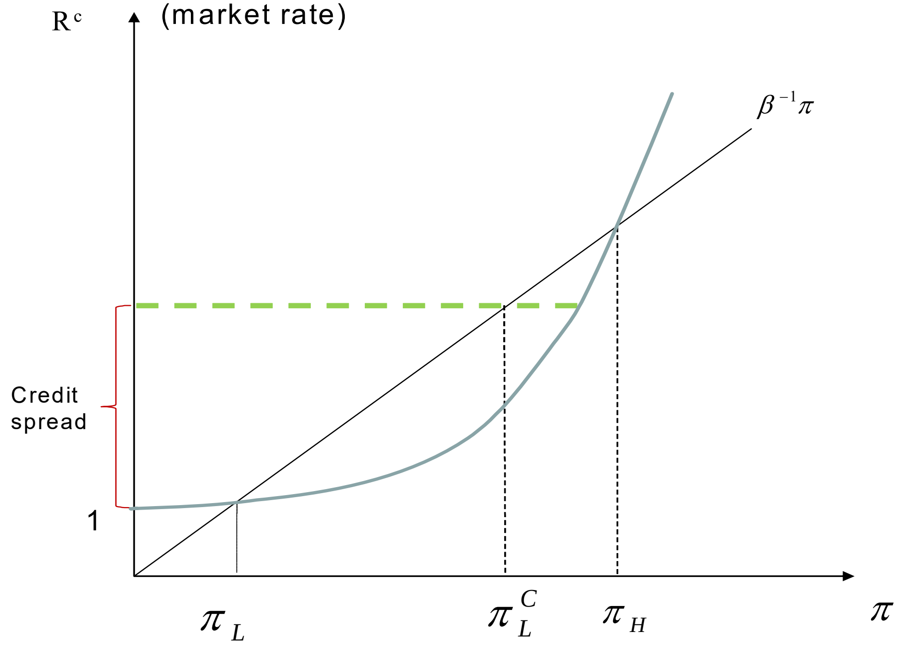

Figure 4: Credit spread shock

Some comments:

1) One could add further channels of influence from finance.

2) Different approaches exist:
- the preceding discussion emphasizes multiple equilibria.
- Another approach: a persistent shock has moved the target steady state to ZLB constraint.

3) My work focuses on the former approach.
- Some different varieties of the NK models have been used. General features and results remain the same.

2. A Linearized NK Model

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 that consume real resources.

- 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 $\mu_t = \theta_t\,(\theta_t-1)^{-1}$ 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 explanations are possible, e.g. downward wage rigidity or money illusion. Simplicity: 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.

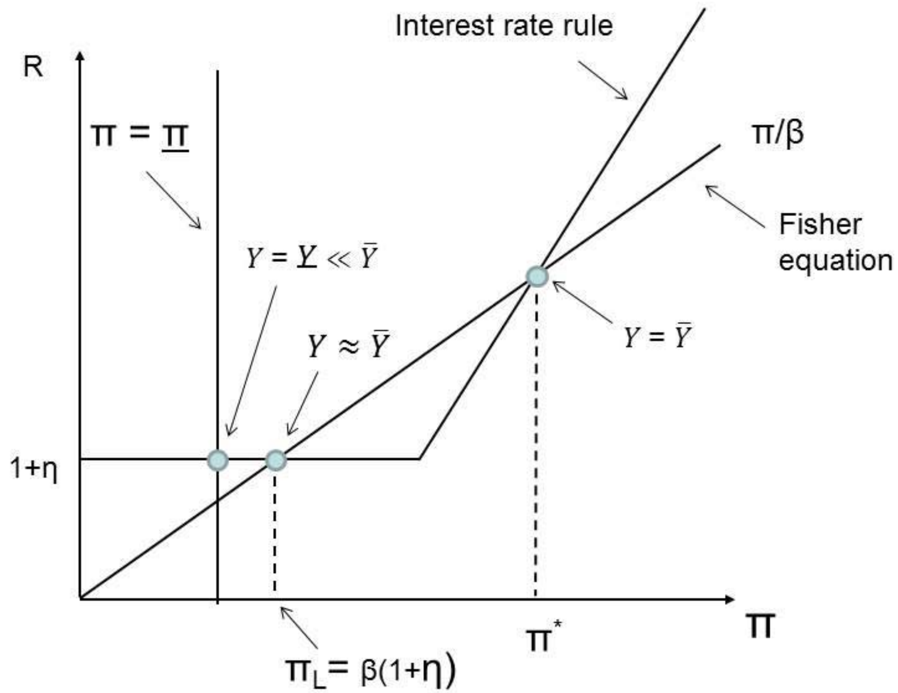

Figure 5: Existence of multiple steady states.

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.

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

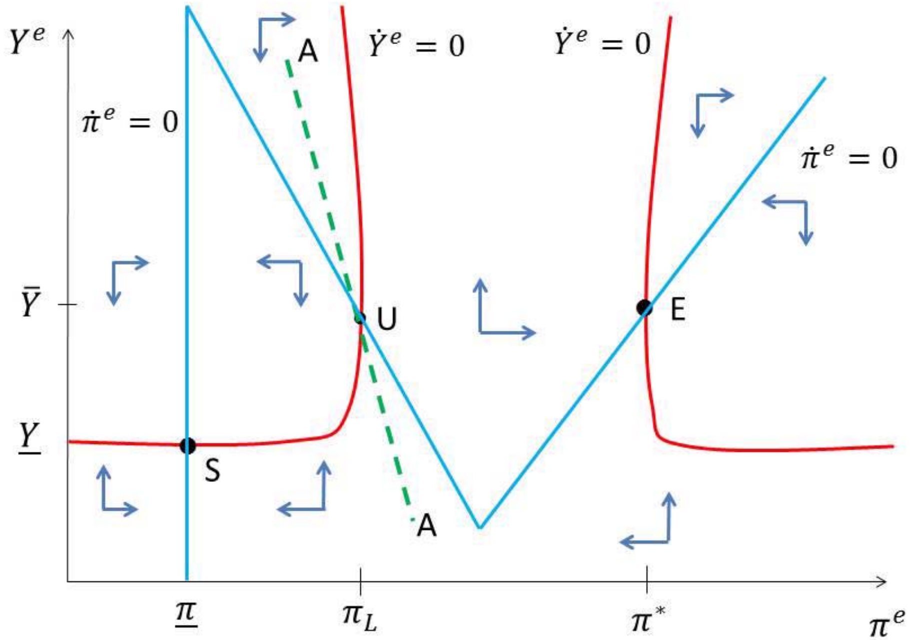

Figure 6: E-stability dynamics when there are three steady states. π^e and Y^e are expected inflation and output.

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 and a persistent shock to target steady state. 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 goes back to the stagnation state.

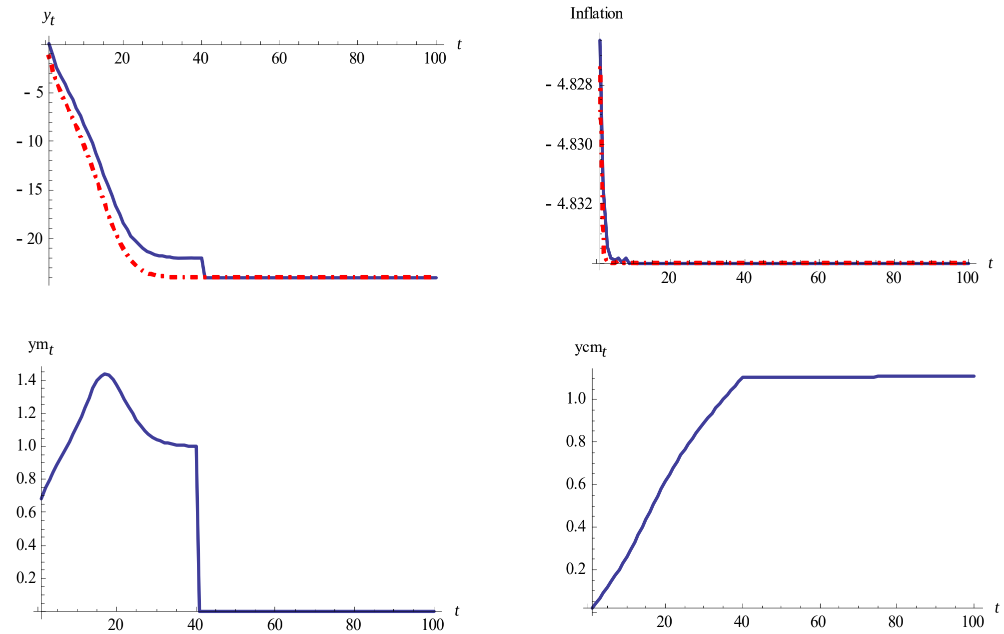

Figure 7: Small policy change. The upper panel: output and inflation paths under learning with policy change (solid line) and learning without policy change (dashed line). The lower panel shows the distributed lag and cumulative output multipliers.

- 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.

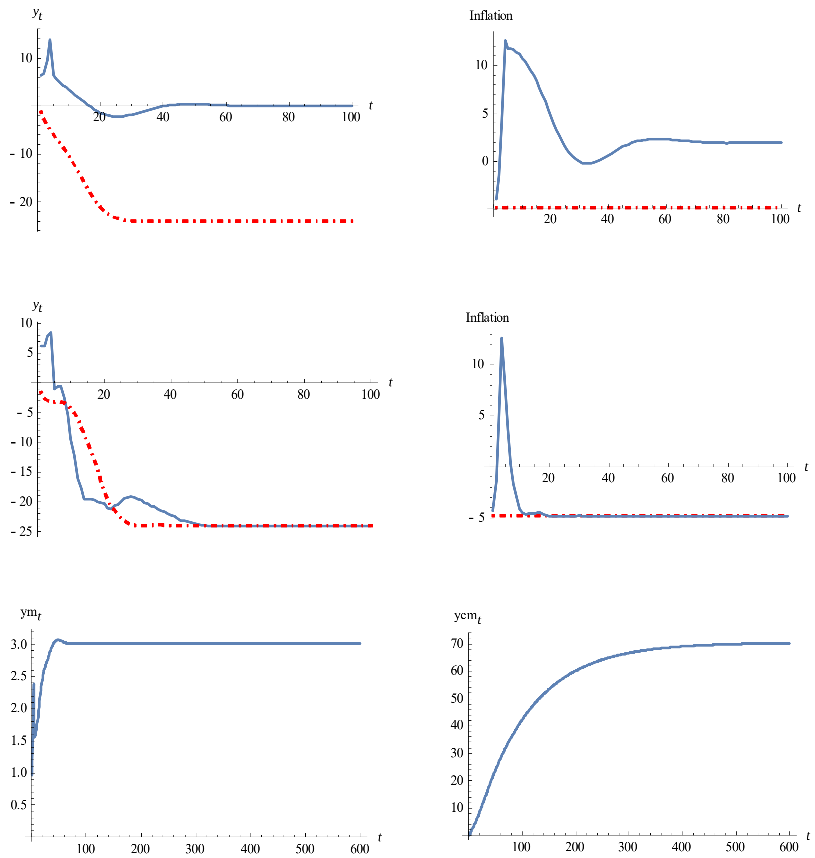

Figure 8: Large policy change $T = 4$. Top: paths under learning with (solid line) and without (dashed line) policy change escaping the trap with policy. Middle: paths for other cases. Bottom: multipliers.

Comment:

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

6. Monetary Policy

Monetary policy actions

- Monetary policy has relied on unconventional measures in major western economies (USA, Japan, UK, and Euro area):

- **Forward guidance**: CB informs the economy that it intends to keep the interest rates low for a longer period.
- Delphic vs. Odyssean forward guidance (Delphic is just telling about what will be done.)
- Modern version: FRB started in 2008 but details evolved; ECB introduced forward guidance in July 2013.
- **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.

- Also some discussion about changing monetary policy framework to combat ZLB:
  - For example, price-level targeting (Honkapohja and Mitra 2018).

Unconventional monetary policy

- **Forward guidance (FG) puzzle** is about its effectiveness. In REE this policy should be very effective.
  - Empirically, effectiveness has been questioned. Credit-constrained or boundedly rational agents respond less to FG information.
  - Credibility of FG policy can be an issue, etc.

- Theoretical analysis of APP 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** (Honkapohja 2016): 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?

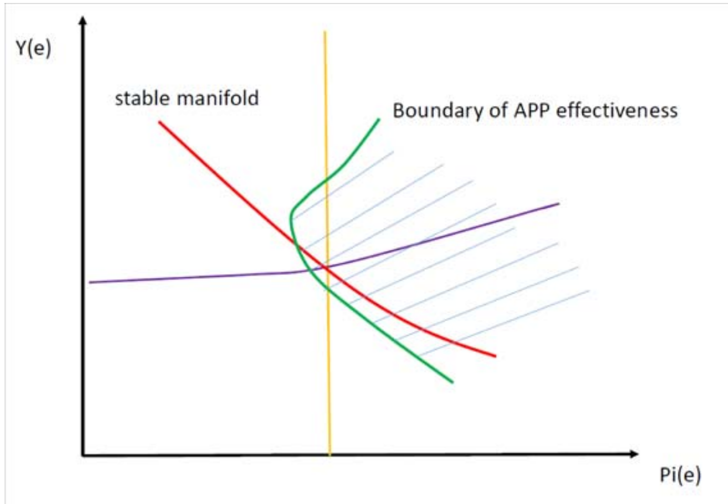

Figure 9: Effectiveness region of APP near the liquidity trap steady state π_L.

- Figure 9 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. Forward guidance can also be used.

- 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.

- The models used in the discussion are very stylised.
  - They provide only basic messages for policy.
  - Need for further work (1): more refined models to check robustness of the basic results and get further results.
  - Need for further work (2): sufficiently comprehensive models for actual assessments for policy making.

References to my research
(older papers not listed)

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.

Honkapohja, S. and K. Mitra (2018): Price-Level Targeting with Evolving Credibility, CEPR DP 12739.

Supplementary material

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.