Great Expectations and the End of the Depression

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Overview

- US recovery from the Great Depression was driven by a shift in expectation.
- This shift was caused by President Roosevelt's policy actions

✓ *Abolish the gold standard*

✓ *Announce the explicit objective of inflating the price level to pre-depression levels*

✓ *Expand real and deficit spending*

- All these actions violated prevailing policy dogmas, thus initiated a policy regime change.
- The regime change is formally modeled a repeated game in a DSGE framework and evaluated quantitatively.

Model: Private Sectors

- A representative household maximizes:

$$E_t\left\{\sum_{T=t}^{\infty}\beta^{T-t}[u(C_T - H_T^c;\xi_T) + g(G_T;\xi_T) - v(L_T - H_T^l;\xi_T)]\right\},$$

with

$$P_tC_t + B_t + M_t = (1 + i_{t-1})B_{t-1} + M_t + P_tZ_t + P_tn_tL_t - P_tT_t$$

- A representative firm:
  - Technology is linear in labor; Monopoly power;
  - Maximizes expected discounted profits
  - Face a cost of price changes $d(\Pi)$, where $\Pi_t \equiv P_t/P_{t-1}$

IS and AS

- IS:

$$u_{c,t} = (1 + i_t)\beta f_t^e,$$

where

$$f_t^e \equiv E_t u_{c,\,t+1} \Pi_{t+1}^{-1}$$

- AS:

$$\Pi_t d'(\Pi_t) u_{c,t} = \theta[v_{y,t} - u_{c,t}]Y_t + \beta S_t^e,$$

where

$$S_t^e \equiv E_t \Pi_{t+1} d'(\Pi_{t+1}) u_{c,t+1}$$

Government

- Total government spending: $F_t = G_t + s(T_t) + A_t$
- Government budget constraint: $w_t = (1 + i_t)[w_{t-1}\Pi_t^{-1} + F_t - T_t]$

  with $w_t \equiv [B_t(1 + i_t) + M_t]/P_t$.
- Excluding Ponzi Scheme: $w_t \leq w^b$
- Market Clearing: $Y_t = C_t + F_t + d(\Pi_t)$
- Assumption of habit formation: $H_t^c = H_t^l = \gamma Y_{t-1}$
- Zero bound on the short-term nominal interest rate: $i_t \geq 0$
- Government takes the expectation functions as given:

$$f_t^e = \bar{f}^e(w_t, Y_t; \xi_t),$$

$$S_t^e = \bar{S}^e(w_t, Y_t; \xi_t).$$

Government's Problem:

$$J(w_{t-1}, Y_{t-1}; \xi_t)$$

$$= \max_{G_t, T_t, i_t} \{[u(C_t - H_t^c; \xi_t) + g(G_t; \xi_t) - v(Y_t - H_t^l; \xi_t) + \beta E_t J(w_t, Y_t; \xi_{t+1})\}$$

such that all the constraints on the previous page are satisfied.

The Hoover Regime: Policy Dogmas must hold
The Roosevelt Regime: Policy Dogmas are dropped
What are the Policy Dogmas?

- "Small Government" dogma

$$F_t = \bar{F} = \bar{G} + s(T_t) + A_t$$

- "Blanced Budget" dogma

$$w_t = w_{t-1} = \bar{w}$$

- "Gold Standard" dogma

Exogenous Shocks

Key Features in the data in 1929-1933:

a. short-term nominal interest rate close to 0

b. output dropped

c. prices declined

Can common shocks in the business cycle literature generate such features?

- Productivity shocks
- Markup shocks
- Money demand shocks

Intertemporal Shocks

- Intertemporal shocks: exogenous shocks that imply a lower real interest rate is required for demand to remain unchanged. (banking problem, stock market crash).
- Formally,

$$\text{A1a} \quad R_t^e = \frac{u_c(C_t^e - H_t^{c,e}; \xi_t)}{\beta E_t u_c(C_{t+1}^e - H_{t+1}^{c,e}; \xi_{t+1})} - 1 = R_L^e < 0 \text{ for } 0 \leq t < \tau$$

$$\text{A1b} \quad R_t^e = 1/\beta - 1 \text{ for } t \geq \tau.$$

Purely intertemporal shock:
The efficient level of output and government spending remains constant.

$$\text{P1} \quad u_c(C_t^e - H_t^{c,e};\xi_t) - v_y(Y_t^e - H_t^{l,e};\xi_t) - \beta\gamma E_t u_c(C_{t+1}^e - H_{t+1}^{c,e};\xi_{t+1})$$

$$- \beta\gamma E_t v_y(Y_{t+1}^e - H_{t+1}^{l,e};\xi_{t+1}) = 0,$$

$$\text{P2} \quad - u_c(C_t^e - H_t^{c,e};\xi_t) + g_G(G_t^e,\xi_t)(1 - s'(T_t^e)) = 0,$$

where $Y_t^e = \bar{Y}$, $C_t^e = \bar{C}$, $G_t^e = \bar{G}$, and $H_t^{c,e} = H_t^{l,e} = \gamma\bar{Y}$.

The Hoover Regime

$$L_t = u(Y_t - \gamma Y_{t-1} - \bar{F} - d(\Pi_t); \xi_t) \; + g(\bar{G}; \xi_t) - v(Y_t - \gamma Y_{t-1}; \xi_t) \; + \beta E_t V(Y_t, \bar{w}; \xi_{t+1})$$

$$+ \phi_{2t} \{\beta \bar{f}^e(Y_t, \bar{w}; \xi_t) \; (1 + i_t) - u_c(Y_t - \gamma Y_{t-1} - \bar{F} - d(\Pi_t); \xi_t)\}$$

$$+ \phi_{3t} \{\Pi_t \, d'(\Pi_t) u_c(Y_t - \gamma Y_{t-1} - \bar{F} - d(\Pi_t); \xi_t)$$

$$- \theta [v_y(Y_t - \gamma Y_{t-1}; \xi_t) \; - u_c(Y_t - \gamma Y_{t-1} - \bar{F} - d(\Pi_t); \xi_t)] Y_t - \beta \bar{S}^e(Y_t, \bar{w}; \xi_t)\}$$

$$+ \gamma_{1t} \, i_t,$$

First Order Conditions

$$(66) \qquad \frac{\partial L}{\partial \Pi_t} = -u_c d' + \phi_{2t} d' u_{cc} + \phi_{3t}[d' u_c + \Pi_t d'' u_c - \Pi_t d'^2 u_{cc} - \theta u_{cc} d' Y_t] = 0,$$

$$(67) \qquad \frac{\partial L}{\partial Y_t} = u_{c,t} - v_{y,t} + \beta E_t V_y(Y_t, \bar{w}; \xi_{t+1}) + \phi_{2t}[\beta \bar{f}^e_Y (1 + i_t) - u_{cc}]$$
$$+ \phi_{3t}[\Pi_t d' u_{cc} - \theta v_{yy} + \theta Y_t u_{cc} - \theta(v_y - u_c)] - \phi_{3t} \beta \bar{S}^e_Y = 0,$$

$$(68) \qquad \frac{\partial L}{\partial i_t} = \phi_{2t} \beta \bar{f}^e (Y_t, \bar{w}; \xi_t) + \gamma_{1t},$$

and the complementary slackness conditions

$$(69) \qquad \gamma_{1t} i_t = 0, i_t \geq 0, \gamma_{1t} \geq 0,$$

and the envelope condition

$$(70) \qquad V_Y(Y_{t-1}, \bar{w}; \xi_t) = -\gamma u_{c,t} + \gamma v_{y,t} + \phi_{2t} \gamma u_{cc} + \phi_{3t} \gamma [\theta v_{yy} Y_t - \Pi_t d' u_{cc} - \theta Y_t u_{cc}].$$

Log-linearization

- IS Equation:

$$\tilde{Y}_t = E_t\tilde{Y}_{t+1} - \sigma\delta_c(i_t - E_t\pi_{t+1} - r_t^e) + \hat{F}_t - E_t\hat{F}_{t+1}$$

- NKPC:

$$\pi_t = \kappa\tilde{Y}_t - \kappa\psi\hat{F}_t + \beta E_t\pi_{t+1}$$

- Policy Dogmas:

$$\hat{w}_t = \hat{F}_t = \hat{G}_t = 0,$$

$$\hat{T}_t = -\frac{1}{s'}\hat{A}_t = \overline{w}\beta(i_t - \overline{r}) - \overline{w}\,\pi_t.$$

Two Complications

- Two Unknown Values: $\bar{f}_Y^e$ nd $\bar{S}_Y^e$

$$f_t^e \equiv E_t u_{c,\,t+1} \Pi_{t+1}^{-1} \qquad S_t^e \equiv E_t \Pi_{t+1} d'(\Pi_{t+1}) u_{c,t+1}$$

⇨ $\bar{f}_Y^e = \bar{S}_Y^e = 0$

- Complementary slackness condition due to the zero bound

⇨ Two Steps

Two Steps

1). Solve it for $t \geq \tau$

$$\tilde{Y}_t = \pi_t = 0 \text{ for } t \geq \tau$$

2). Solve it for $t < \tau$, taking the solution in part 1) as given.

$$\tilde{Y}_{t,L} = (1-\alpha)E_{t,L}\tilde{Y}_{t+1} - \sigma\delta_C(i_{t,L} - (1-\alpha)E_{t,L}\pi_{t+1} - r_L^e)$$

$$\tilde{Y}_t = E_t\tilde{Y}_{t+1} - \sigma\delta_c(i_t - E_t\pi_{t+1} - r_t^e) + \hat{F}_t - E_t\hat{F}_{t+1}$$

$$\pi_{t,L} = \kappa\tilde{Y}_{t,L} + (1-\alpha)\beta E_{t,L}\pi_{t+1}$$

$$\pi_t = \kappa\tilde{Y}_t - \kappa\psi\hat{F}_t + \beta E_t\pi_{t+1}$$

Characterizing the Hoover Regime:

(i) Fiscal policy:

(36) $$\hat{F}_t = \hat{G}_t = \hat{w}_t = 0 \quad \forall\, t,$$

(37) $$\hat{T}_t = -\frac{1}{s'}\hat{A}_t = -\,\overline{w}\beta\,(i_t - \overline{r}) + \overline{w}\pi_t \quad \forall\, t.$$

(ii) Monetary policy:

(38) $$i_t = r_t^e \text{ so that } \pi_t = 0 \text{ when } t \geq \tau,$$

(39) $$i_t = 0 \text{ when } 0 \leq t < \tau.$$

(iii) Outcomes:

(40) $$\tilde{Y}_L = \phi_y^H r_L^e < 0 \text{ if } t < \tau \text{ and } \tilde{Y}_t = 0 \text{ when } t \geq \tau,$$

(41) $$\pi_L = \phi_\pi^H r_L^e < 0 \text{ if } t < \tau \text{ and } \pi_t = 0 \text{ when } t \geq \tau,$$

where $\phi_y^H, \phi_\pi^H > 0$ *are given by* (34) *and* (35).

Characterizing the Roosevelt Regime

(i) Fiscal policy:

$$\hat{F}_t = \eta_F^1 w_{t-1} < 0 \text{ for } t \geq \tau,$$

$$\hat{T}_t = \eta_T^1 w_{t-1} \geq 0 \text{ for } t \geq \tau,$$

$$\hat{F}_t = \eta_F^2 w_{t-1} + \phi_F^{FDR}(r_t^e - \overline{r}) > 0 \text{ for } t < \tau,$$

$$\hat{T}_t = \eta_T^2 w_{t-1} + \phi_T^{FDR}(r_t^e - \overline{r}) \leq 0 \text{ for } t < \tau, \quad (51)$$

where $(\eta_F^1, \eta_T^1, \eta_F^2, \eta_T^2, \phi_F^{FDR}, \phi_T^{FDR}) = (-0.0360, 0.1800, -0.0225, 0.1668, -0.8600, 1.9295)$.

(ii) Monetary policy:

$$i_t < r_t^e \text{ so that } \pi_t = \eta_\pi^2 w_{t-1} > 0 \text{ when } t \geq \tau, \quad (52)$$

$$i_t = 0 \text{ when } 0 \leq t < \tau,$$

where $\eta_\pi^2 = 0.0081$

(iii) Outcomes:

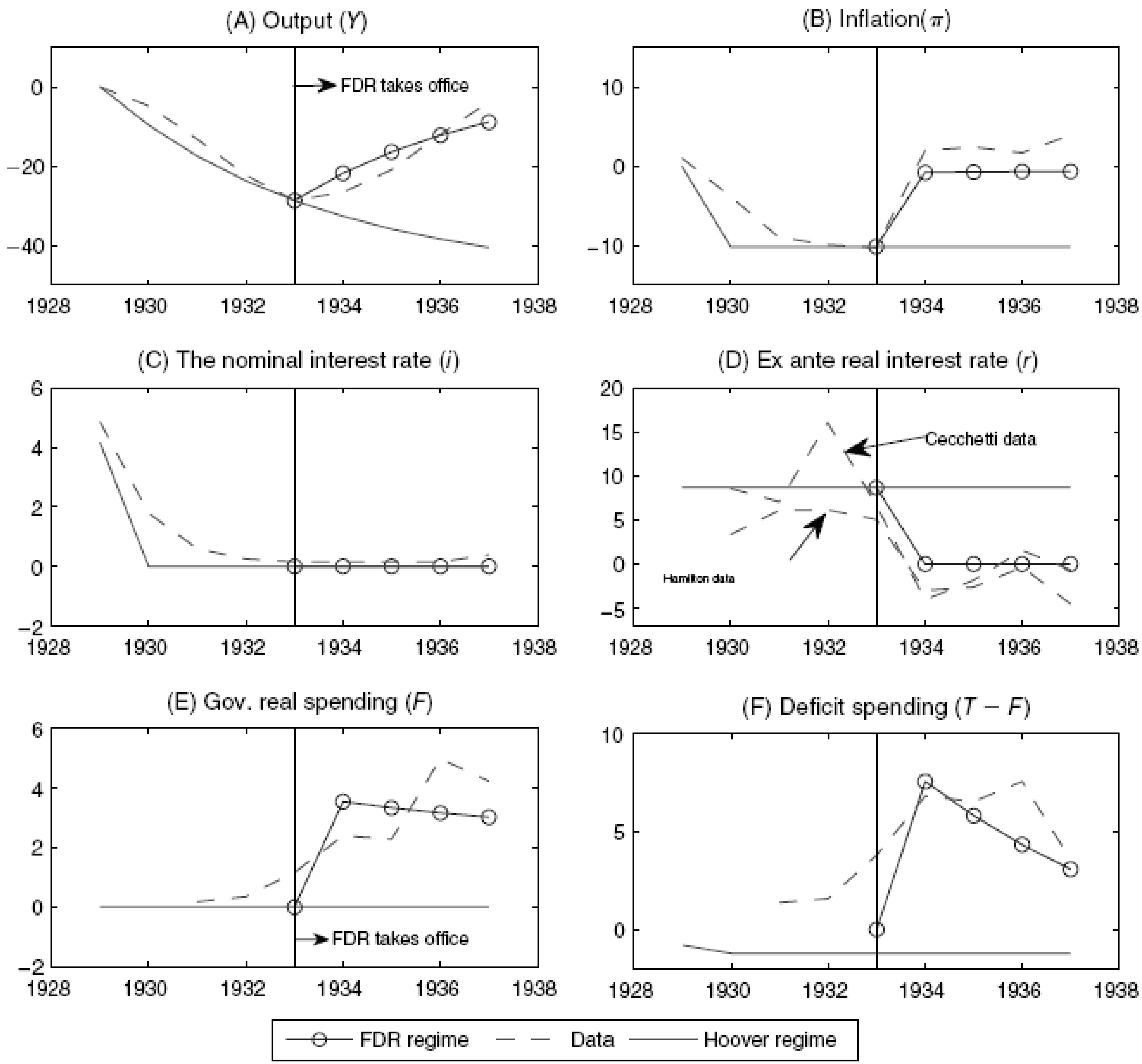
$$\hat{Y}_t^{FDR} \geq \hat{Y}_t^H \text{ for all } t,$$

$$\pi_t^{FDR} \geq \pi_t^H \text{ for all } t.$$

A Calibrated Example: Calibration

Parameters	Value
σ^{-1}	1
ω	1
γ	0.8
β	0.96
F/Y	0.1
θ	11
s'	0.1516
s''	1.5160
$1/(1-\zeta)$[a]	3
Shocks	**Value**
r_L^e	−0.0497
α	0.1406

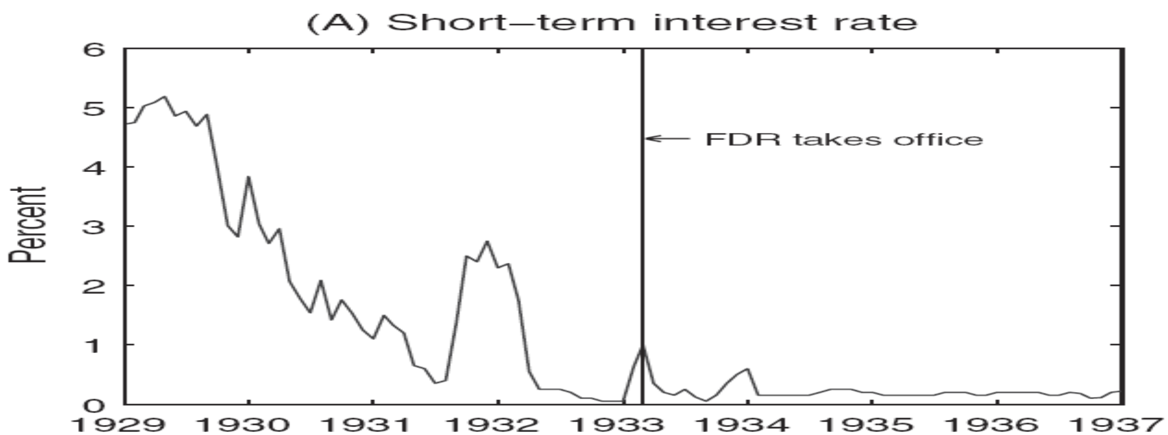
[a] Expected duration of a newly set price in quarters.


(A) Output (Y)
FDR takes office
(B) Inflation(π)
(C) The nominal interest rate (i)
(D) Ex ante real interest rate (r)
Cecchetti data
Hamilton data
(E) Gov. real spending (F)
FDR takes office
(F) Deficit spending (T − F)
FDR regime
Data
Hoover regime

An interesting question to ask:

Could it be that the real rate reverts back to steady state at 1933, thus the turning point and Roosevelt's inauguration coincided?

⇒ No!



Conclusions:

- What separates the regime of Hoover and Roosevelt: elimination of several policy dogmas.
- This elimination accounts for about 70 to 80 percent of recovery of output and prices in 1933 to 1937.
- In the absence of the regime change, would have continued the free fall, output would have been 30 percent lower in 1937 then in 1933 (in data: 39 percent increase).

Thank You!