LECTURE 8
Monetary Policy at the Zero Lower Bound

October 19, 2011

I. Paul Krugman, "It's Baaack: Japan's Slump and the Return of the Liquidity Trap"

Krugman's Baseline Model – Assumptions (I)

- Discrete time.

- Identical, infinitely-lived agents.

- Representative agent has $U = \sum_t D^t \ln c_t$, $0 < D < 1$.

- Each agent receives an endowment y of the consumption good each period.

- Can sell endowment for money, and buy goods with money.

- Economy is competitive and prices are perfectly flexible (!).

- Perfect foresight.

Krugman's Baseline Model – Assumptions (II)

- Cash-in-advance constraint. Within period t:

    - Agents start with some holdings of money and bonds (from period t-1).

    - There's then a market for trading money and bonds.

    - Call the representative agent's holdings <u>after</u> these trades M_t and B_t.

    - The cash-in-advance constraint is $c_t \leq M_t/P_t$.

    - After the agent has bought and sold goods, it receives interest on its bond holdings, and any lump-sum taxes or transfers are implemented.

- The cash-in-advance constraint and perfect foresight imply that $c_t = M_t/P_t$ or $i_t = 0$ (or both).

Households' First-Order Condition

- Suppose the economy is in equilibrium, and consider an agent thinking of spending $1 less on c_t and using the proceeds to increase c_{t+1}.

- $MC = (1/P_t)(1/y)$

- $MB = [(1+i_t)/P_{t+1}](D/y)$

- => ... => $i_t = (1/D)(P_{t+1}/P_t) - 1$ $(*)$

- Note that this holds even if $i_t = 0$.

The Steady State with Constant M

- Suppose M is constant at some level (denoted M*).

- If there is a steady state, P is constant. Call this P*.

- Then equation (*), $i_t = (1/D)(P_{t+1}/P_t) - 1$, simplifies to $i_t = (1/D) - 1$ for all t, or $i* = (1-D)/D$.
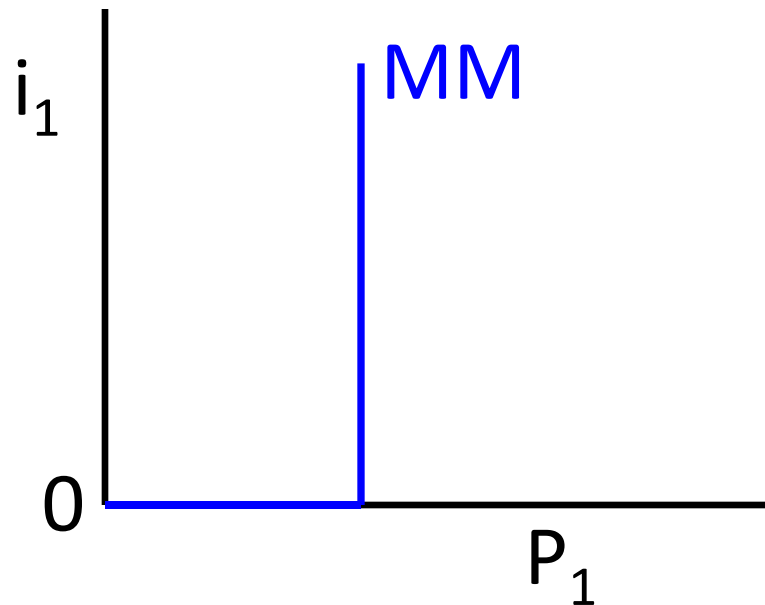
- Note that i* > 0.

The Possibility of a "Liquidity Trap"

- Assume that starting in Period 2, the economy is in steady state.

- So $P_2 = P^*$, $i_2 = i^* > 0$.
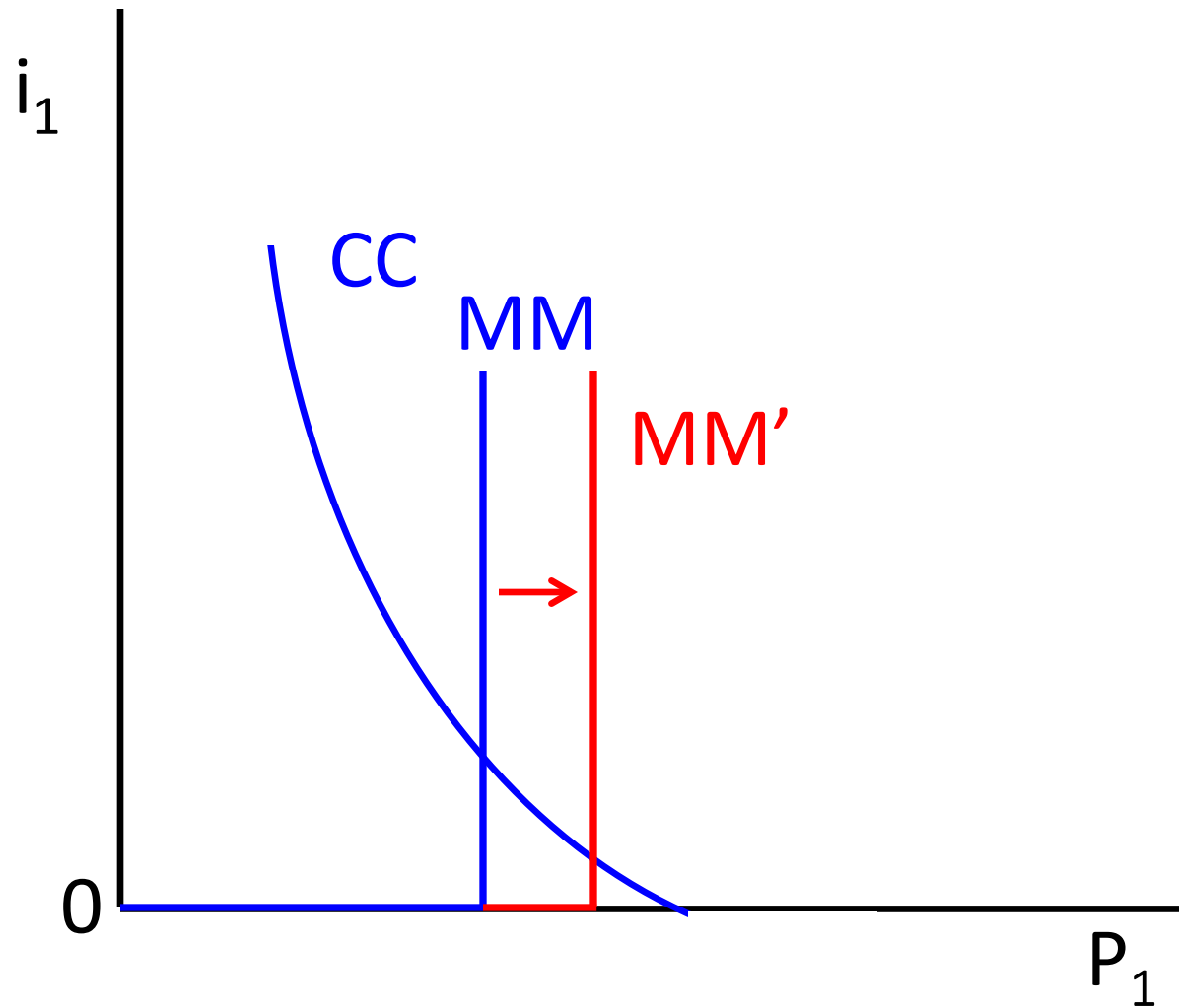
- So (*) becomes $i_1 = (1/D)(P^*/P_1) - 1$
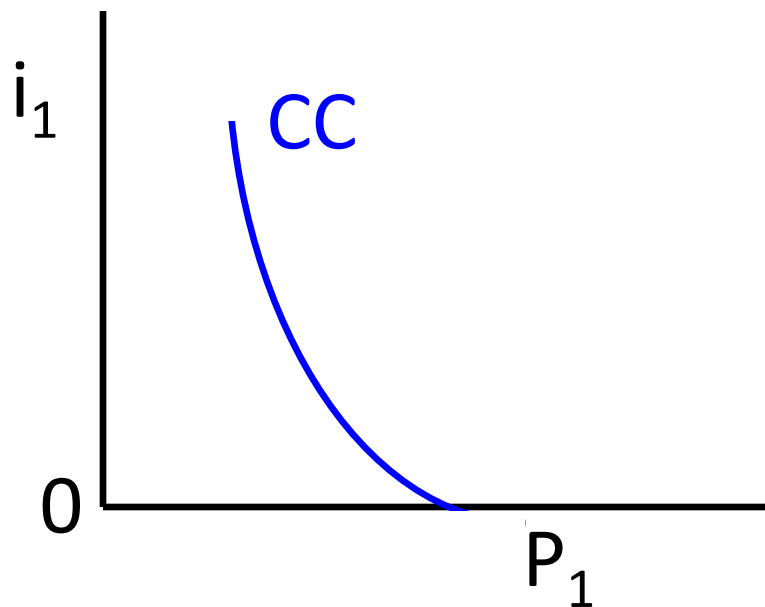
The Possibility of a "Liquidity Trap" (cont.)

- Households' allocation of wealth between money and bonds in period 1:

- If $i_1 > 0$: $M_1/P_1 = y$ => $P_1 = M_1/y$.

- If $i_1 = 0$: $M_1/P_1 \geq y$ => $P_1 \leq M_1/y$.
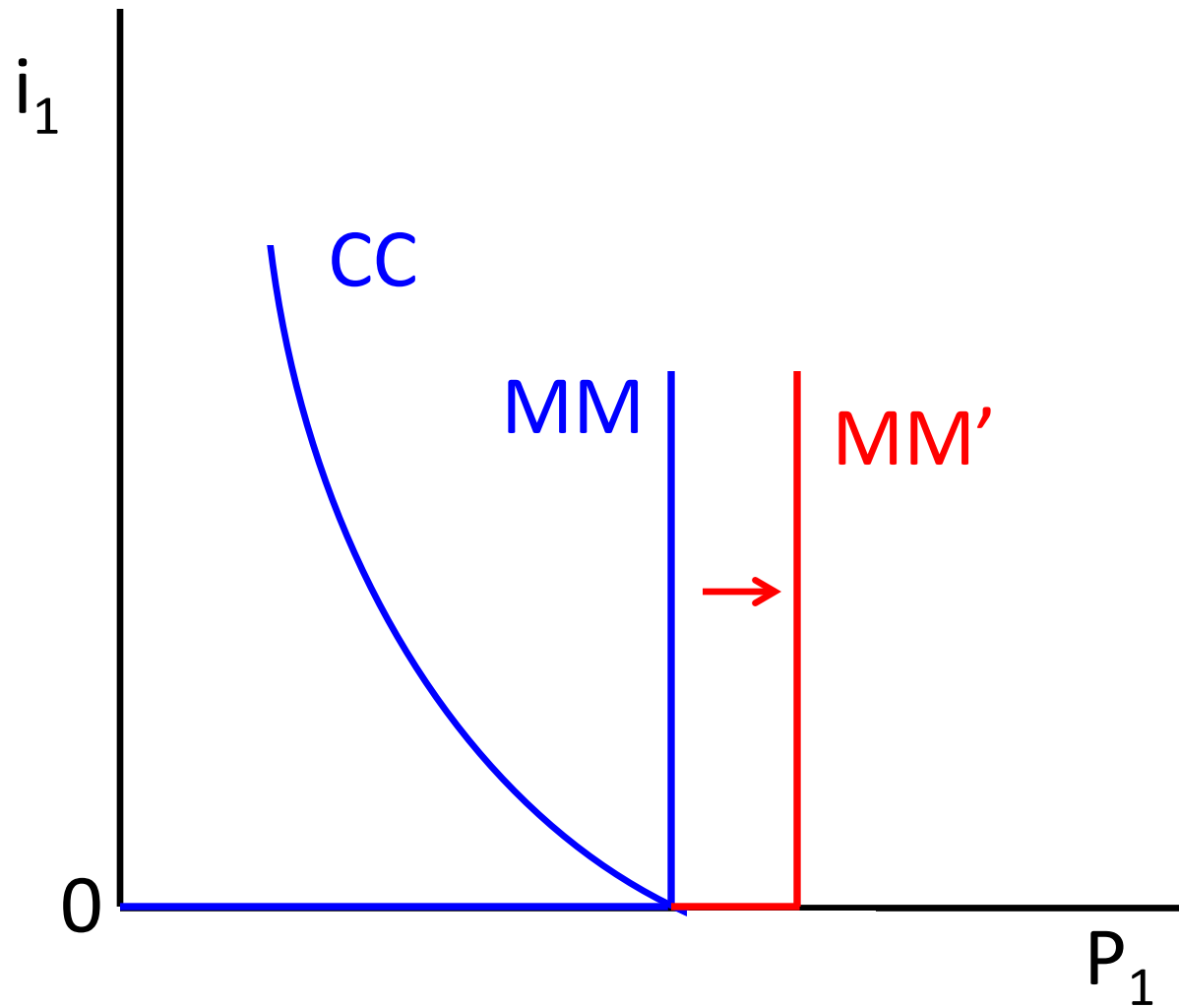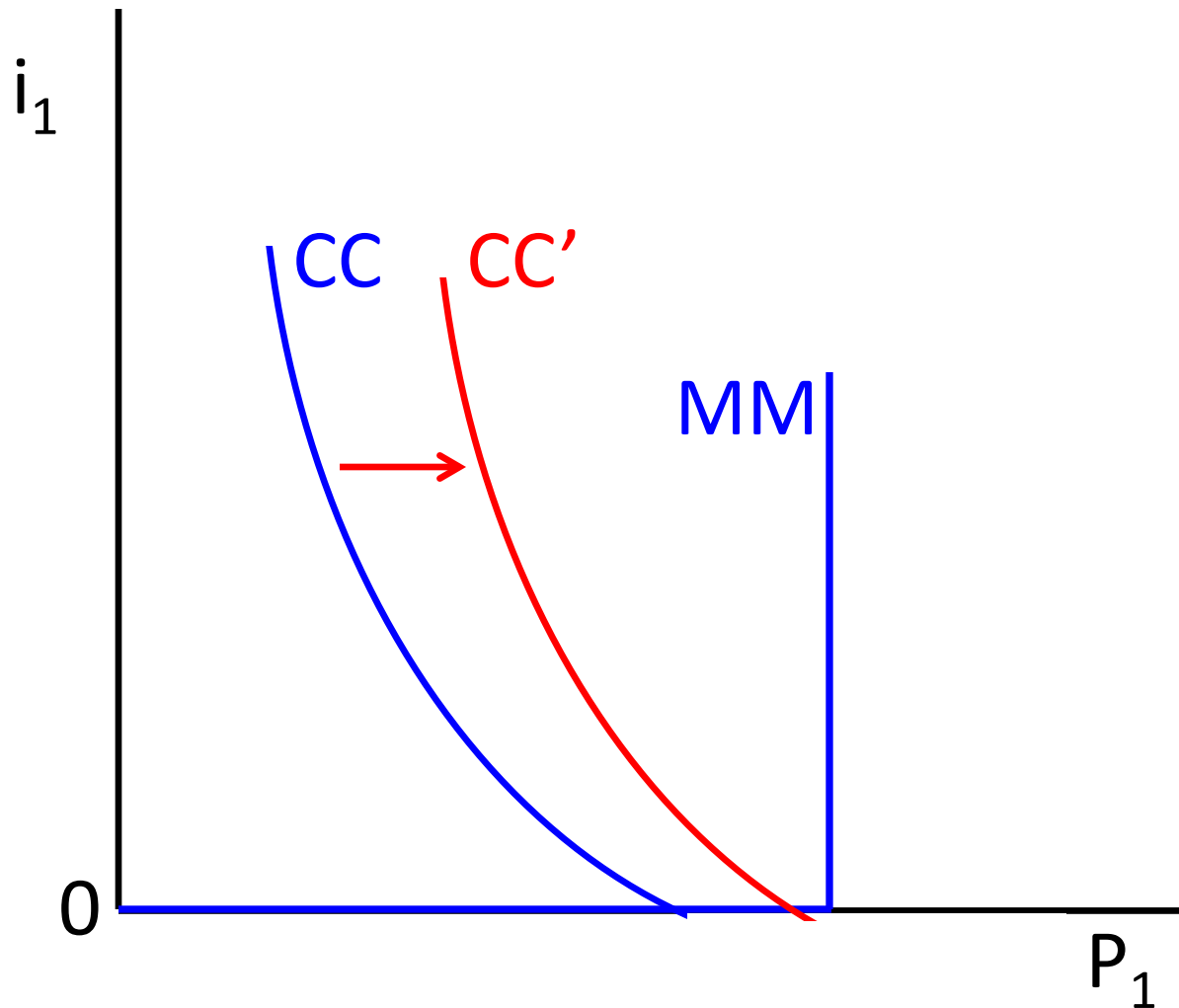
The Effects of an Increase in M_1 when $i_1 > 0$

The Effects of an Increase in M_1 when $i_1 = 0$

The Effects of an Increase in M* when $i_1 = 0$

Recall CC equation: $i_1 = (1/D)(P^*/P_1) - 1$

i_1

CC   CC'

MM

0

P_1

Some More Experiments (I)

- Suppose the economy is in a liquidity trap in periods 1 and 2, then in steady state with $i = i^* > 0$. Raising M_1 or M_2 has no effect on aggregate demand in any period. But raising M^* raises aggregate demand in period 2 <u>and</u> in period 1.

- Continue to assume a liquidity trap in period 1 and steady state starting in period 3. Suppose initially $i_2 > 0$. Raising M_2 to the point where $i_2 = 0$ raises aggregate demand in period 1. That is, when the economy is in a liquidity trap, promising to stay in the trap longer rises aggregate demand.

Some More Experiments (II)

- Consider raising M by the same proportion in all periods. Then P rises by the same proportion in all periods.

- Suppose the economy is in steady state starting in period 2, and suppose the central bank targets a zero inflation rate from period 1 to period 2. Thus its choice of M* moves one-for-one with movements in P_1. Then if something pushes the equilibrium real rate in period 1 below 0, there is no equilibrium: P_1 falls without limit. Inflation targeting eliminates any nominal anchor for the economy.

FOMC Statement, Aug. 12, 2003

"The Committee judges that, on balance, the risk of inflation becoming undesirably low is likely to be the predominant concern for the foreseeable future. In these circumstances, the Committee believes that policy accommodation can be maintained for a considerable period."

II. BEN BERNANKE, "JAPANESE MONETARY POLICY: A CASE OF SELF-INDUCED PARALYSIS?"

Channels of Monetary Policy Transmission

- Nominal interest rates.

- Expected inflation.

- Asset prices.

- The extent of credit-market imperfections.

- The real exchange rate (and expectations about the real exchange rate).

- Expectations abut future output.

- The price level (and expectations about the price level).

Tools of Monetary Policy at the Zero Lower Bound

- Communication about objectives, or the formal adoption of new objectives.

- Communication about future path of safe short-term interest rate (or of supply of high-powered money).

- Communication about the channels of monetary policy (such as the exchange rate or future output).

- Purchases of assets other than short-term government debt.

- Conventional open-market operations?

- Money-financed fiscal expansions (helicopter drops)?

Some Important Questions

- Could some of the tools be counterproductive?

- Could the mix of outcomes (especially, in terms of output and inflation) be different for these tools than for conventional open-market operations in normal times?

The Overnight Call Rate in Japan

Overnight Call Rate 1990-2010

The Monetary Base in Japan, 1994–2011
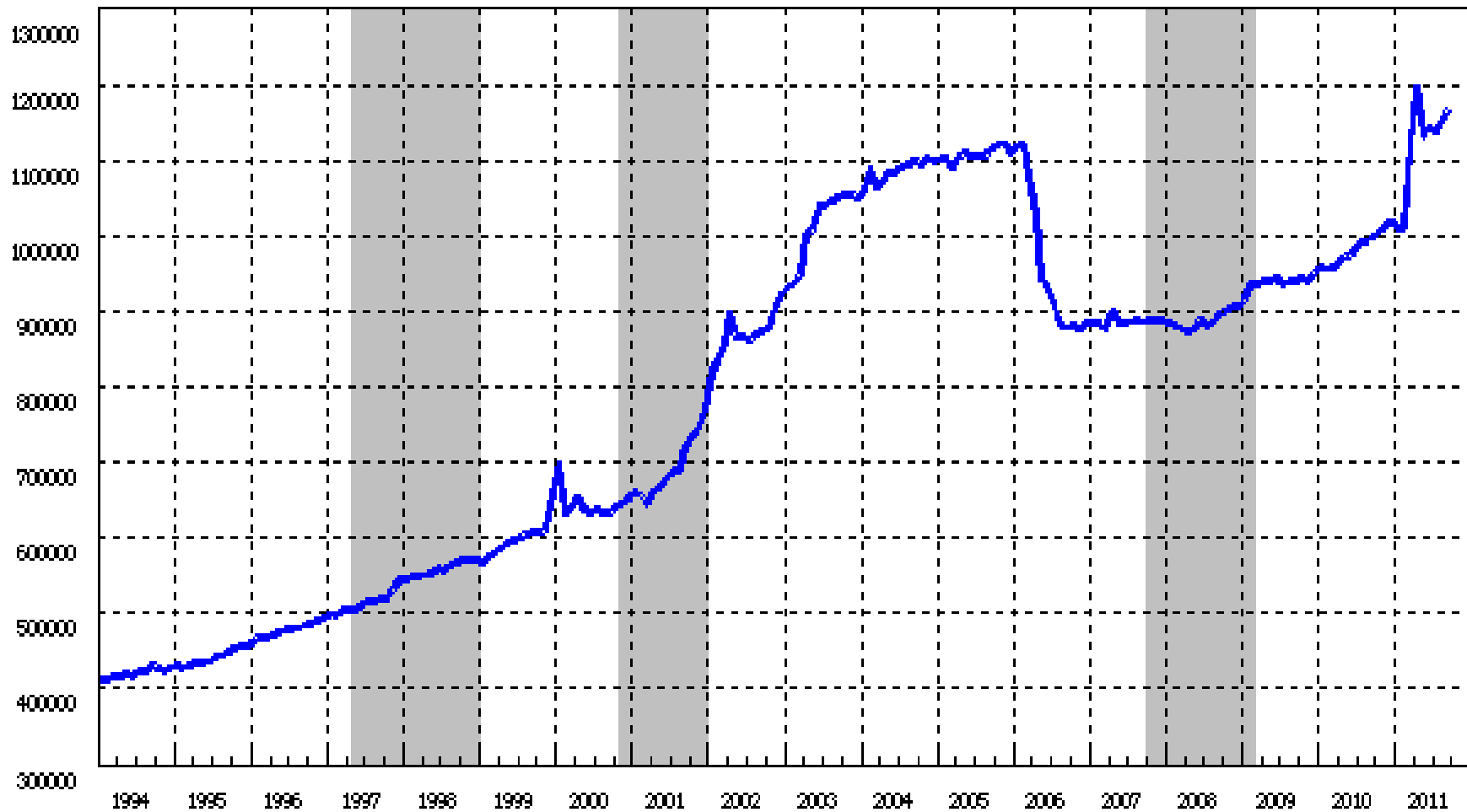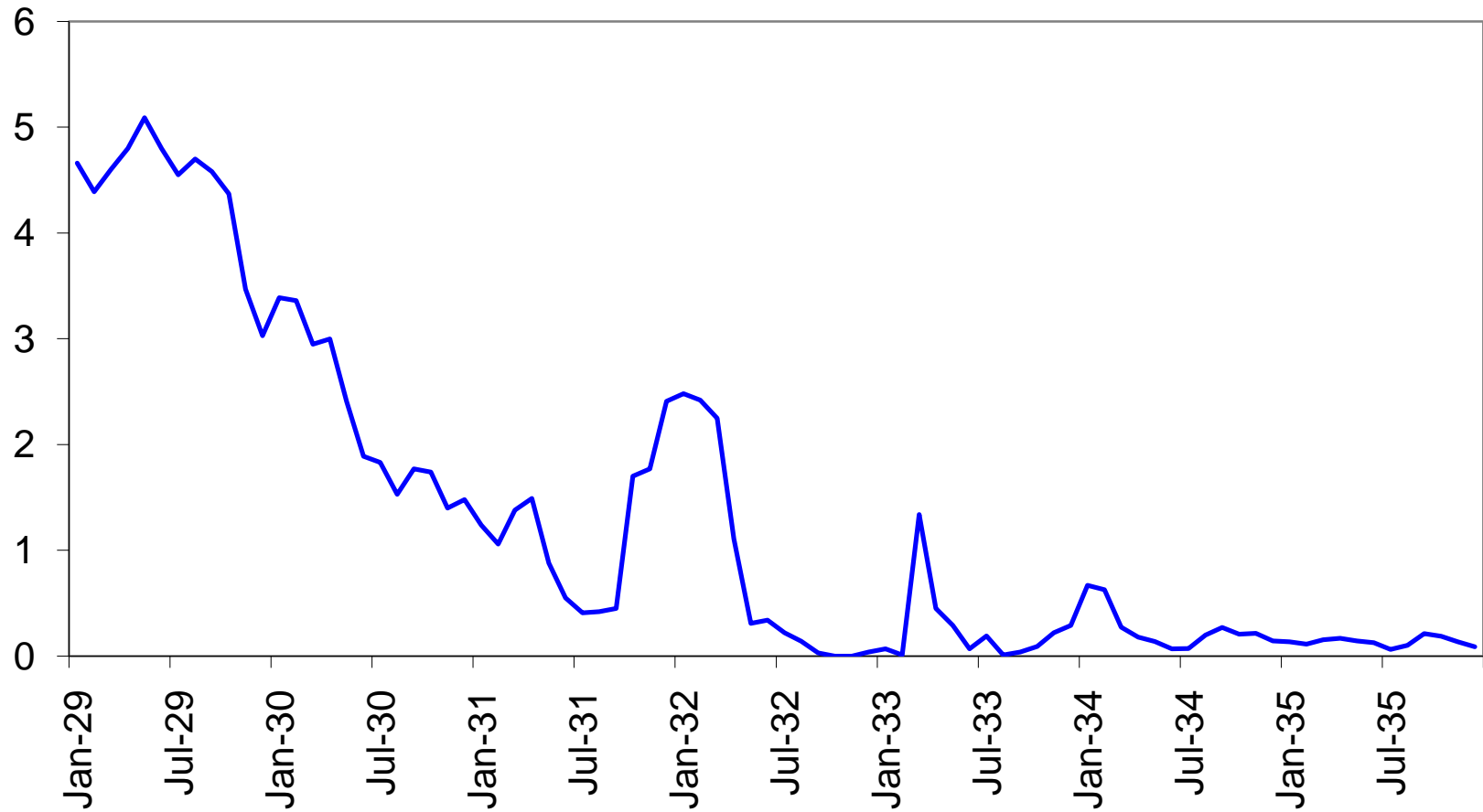

From: Bank of Japan

III. OVERVIEW
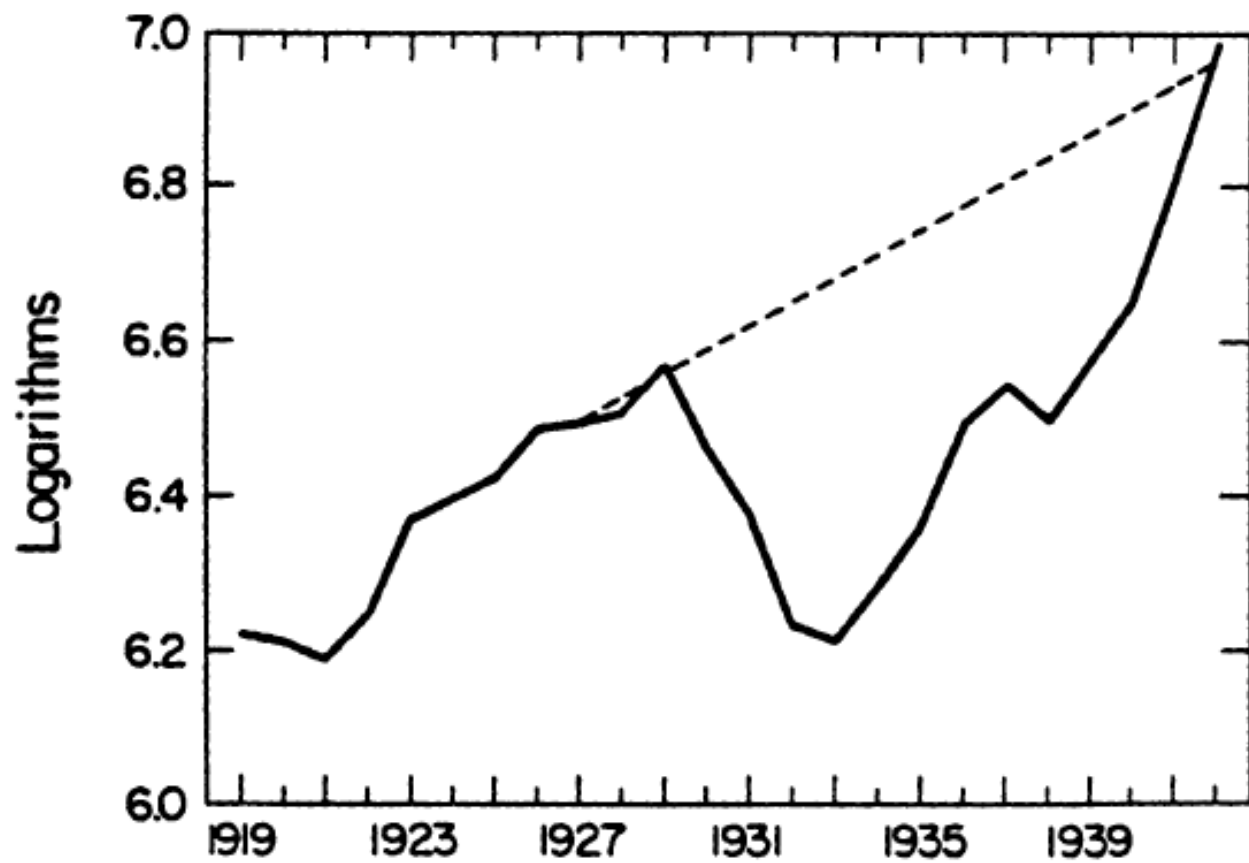
FIGURE 2

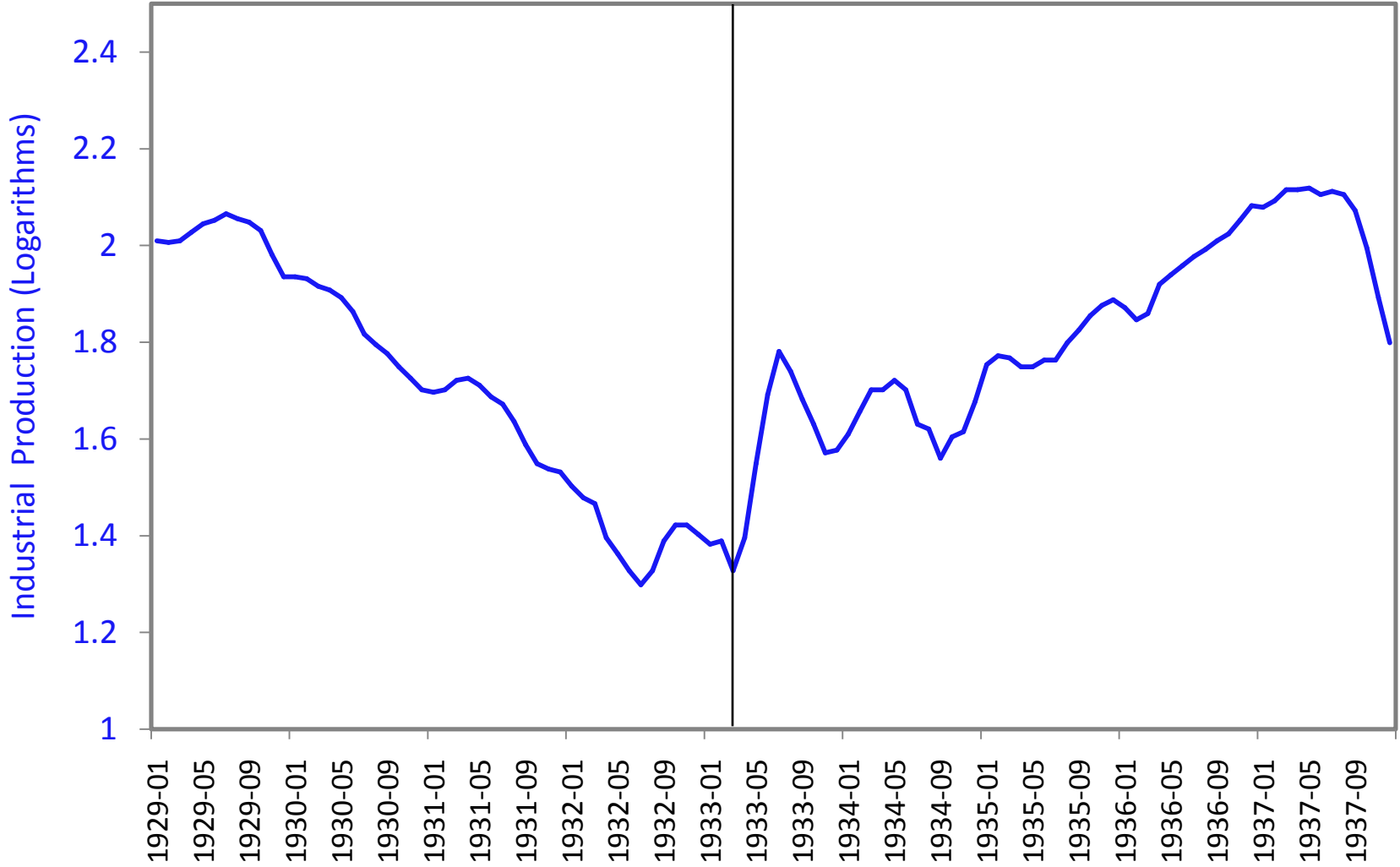ACTUAL AND TREND REAL GROSS NATIONAL PRODUCT, 1919–1942

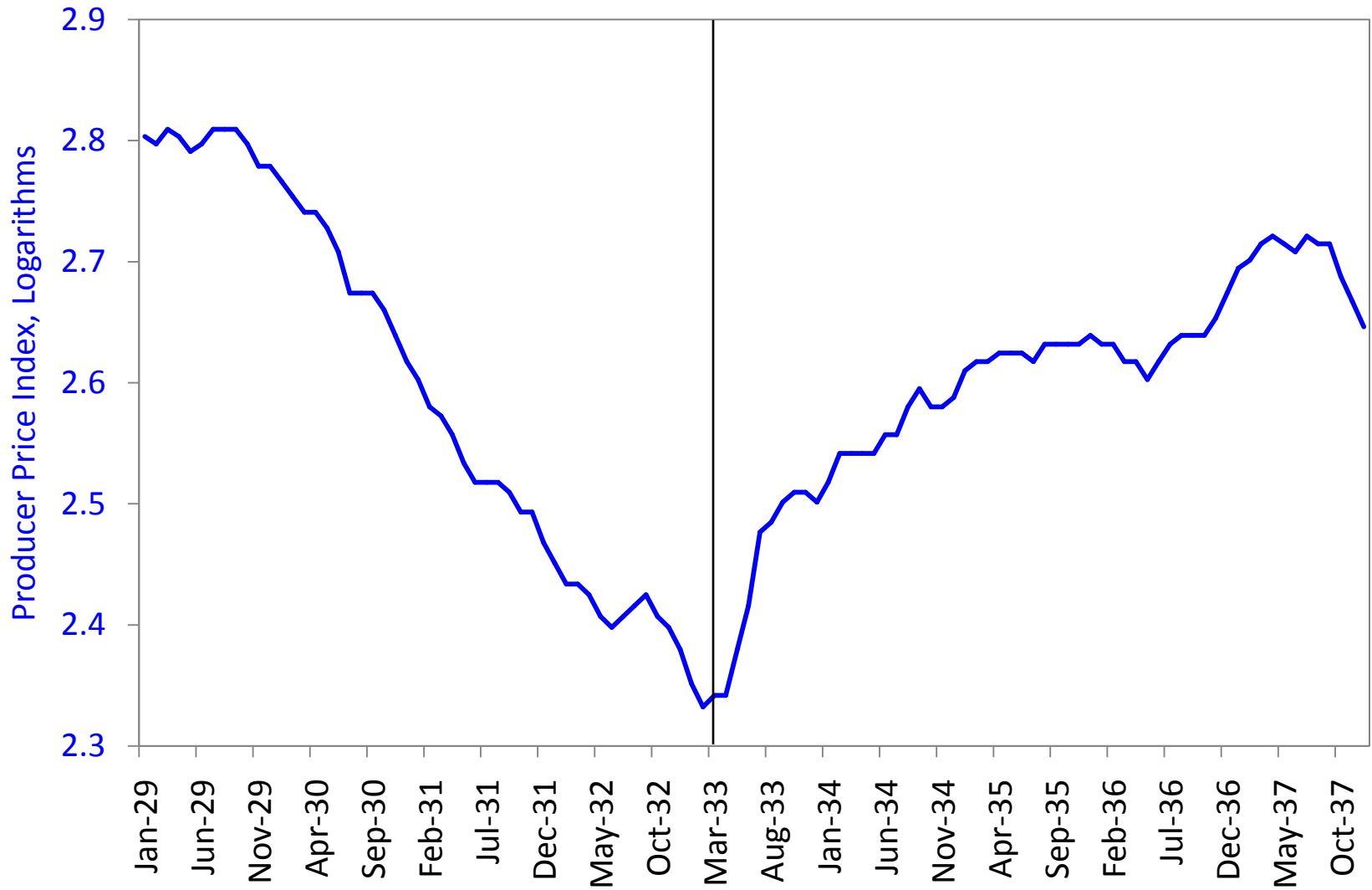# Nominal Interest Rate on
3- to 6-month Treasury Notes

IV. Gauti Eggertsson, "Great Expectations and the End of the Depression"

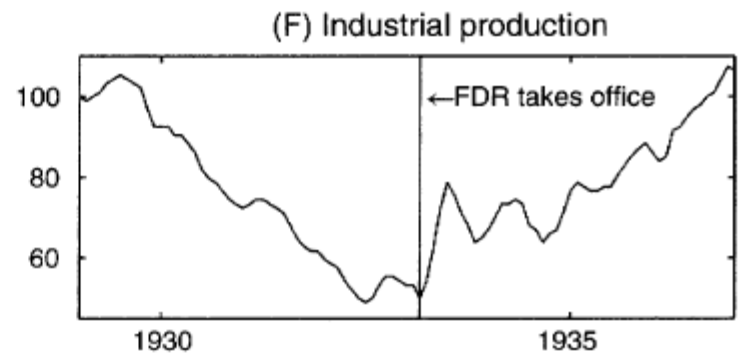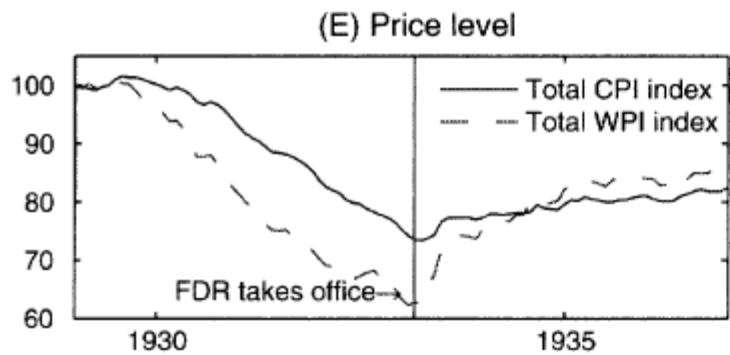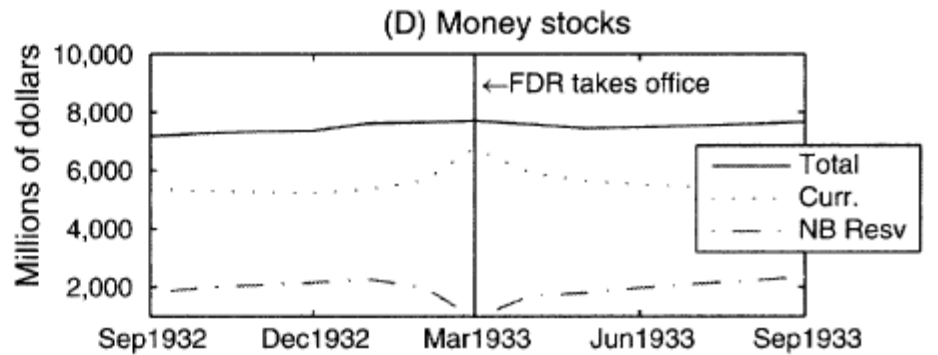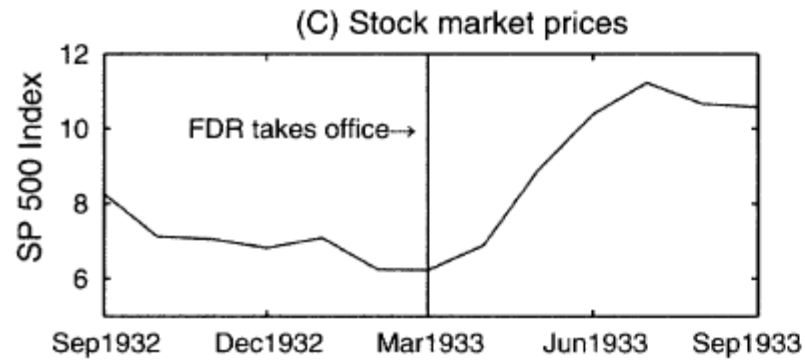# Industrial Production

Producer Price Index, All Commodities

(A) Investment — *Index*, Sep1932–Sep1933. FDR takes office→

(B) Commodity prices — *Index*, Sep1932–Sep1933. ←FDR takes office. Wheat, Cotton, Corn, Cattle, Copper, Gasoline

(C) Stock market prices — *SP 500 Index*, Sep1932–Sep1933. FDR takes office→

(D) Money stocks — *Millions of dollars*, Sep1932–Sep1933. ←FDR takes office. Total, Curr., NB Resv

(E) Price level — Total CPI index, Total WPI index. FDR takes office→

(F) Industrial production — ←FDR takes office

FIGURE 1

FIGURE 2

M1

What are the key elements of the regime?

- Gold standard

- Commitment to a balanced budget

- Belief in small government

What is the mechanism by which the regime change affected inflationary expectations?

- Fiscal expansion gives the government an incentive to inflate.

- So, fiscal expansion leads to monetary expansion.

What is Eggertsson's evidence of regime change?

- Narrative: Roosevelt quotes.

- Actions

FIG. 3. The price of cotton and the exchange rate, 1930–1936. Solid line: cotton price; dotted line: value of the dollar in pounds.

From Temin and Wigmore, "The End of One Big Deflation"

Evaluation of Evidence

- Timing of actions

- What happened to spending?

Federal Receipts, Outlays, and Surplus

TABLE 1—MEASURES OF THE FEDERAL DEFICIT
(MILLIONS OF DOLLARS)

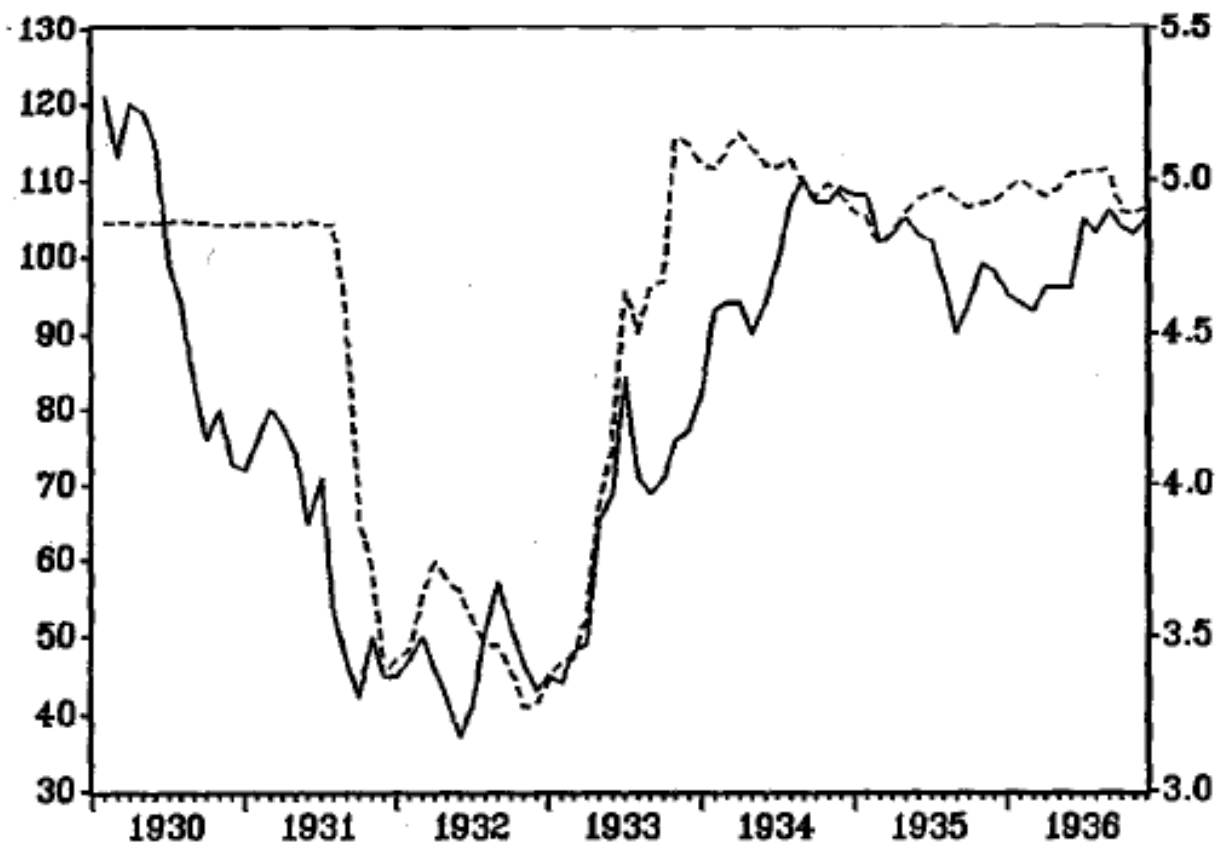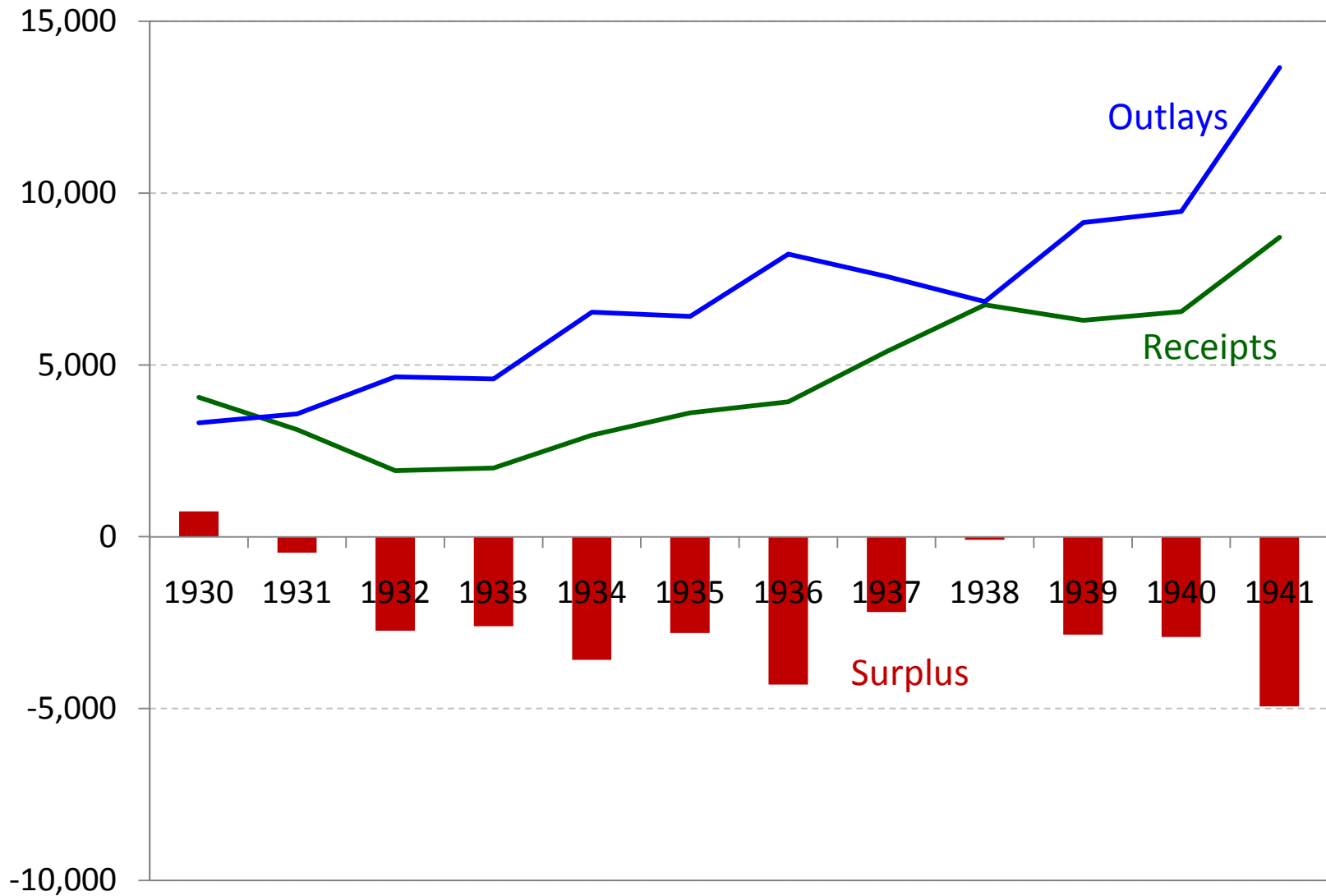| | Fiscal years ending June of: | | | | | | | | | | | |
	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941
Total GDP	97,400	83,800	67,600	57,600	61,200	69,600	78,500	87,800	89,000	89,100	96,800	114,100
Federal government consumption[1] and gross investment	1,830	1,879	1,892	2,286	3,278	3,374	5,565	5,092	5,719	6,018	6,472	17,973
Total expenditures	3,540	3,917	3,794	4,958	7,521	7,612	9,718	9,260	7,600	12,221	12,998	16,693
Federal expenditures (excl. gold)	3,320	3,577	4,659	4,598	6,541	6,412	8,228	7,580	6,840	9,141	9,468	13,653
Gold purchases[2]	220	340	−910	360	980	1,200	1,490	1,680	760	3,080	3,530	3,040
Total revenues	4,058	3,116	1,924	1,997	2,955	3,609	3,923	5,387	6,751	6,295	6,548	8,712
Total liabilities (stocks)	20,727	22,129	23,649	26,954	32,456	37,896	44,555	47,713	48,451	54,009	59,744	66,782
Monetary base	6,397	6,742	6,873	7,484	9,165	10,552	11,598	13,358	14,364	17,110	21,406	22,701
Currency in circulation	4,255	4,525	5,305	5,515	5,400	5,580	6,120	6,495	6,495	7,025	7,810	9,500
Nonborrowed reserves	2,142	2,217	1,568	1,969	3,765	4,972	5,478	6,863	7,869	10,085	13,596	13,201
Public debt[3]	14,330	15,387	16,776	19,470	23,291	27,344	32,957	34,355	34,087	36,899	38,338	44,081
Deficit measures (+)												
Expenditures excl. gold minus revenues	−738	461	2,735	2,601	3,586	2,803	4,305	2,193	89	2,846	2,920	4,941
Total expenditures minus revenues	−518	801	1,825	2,961	4,566	4,003	5,795	3,873	849	5,926	6,450	7,981
Change in total liabilities		1,402	1,520	3,305	5,503	5,440	6,659	3,158	738	5,558	5,735	7,038
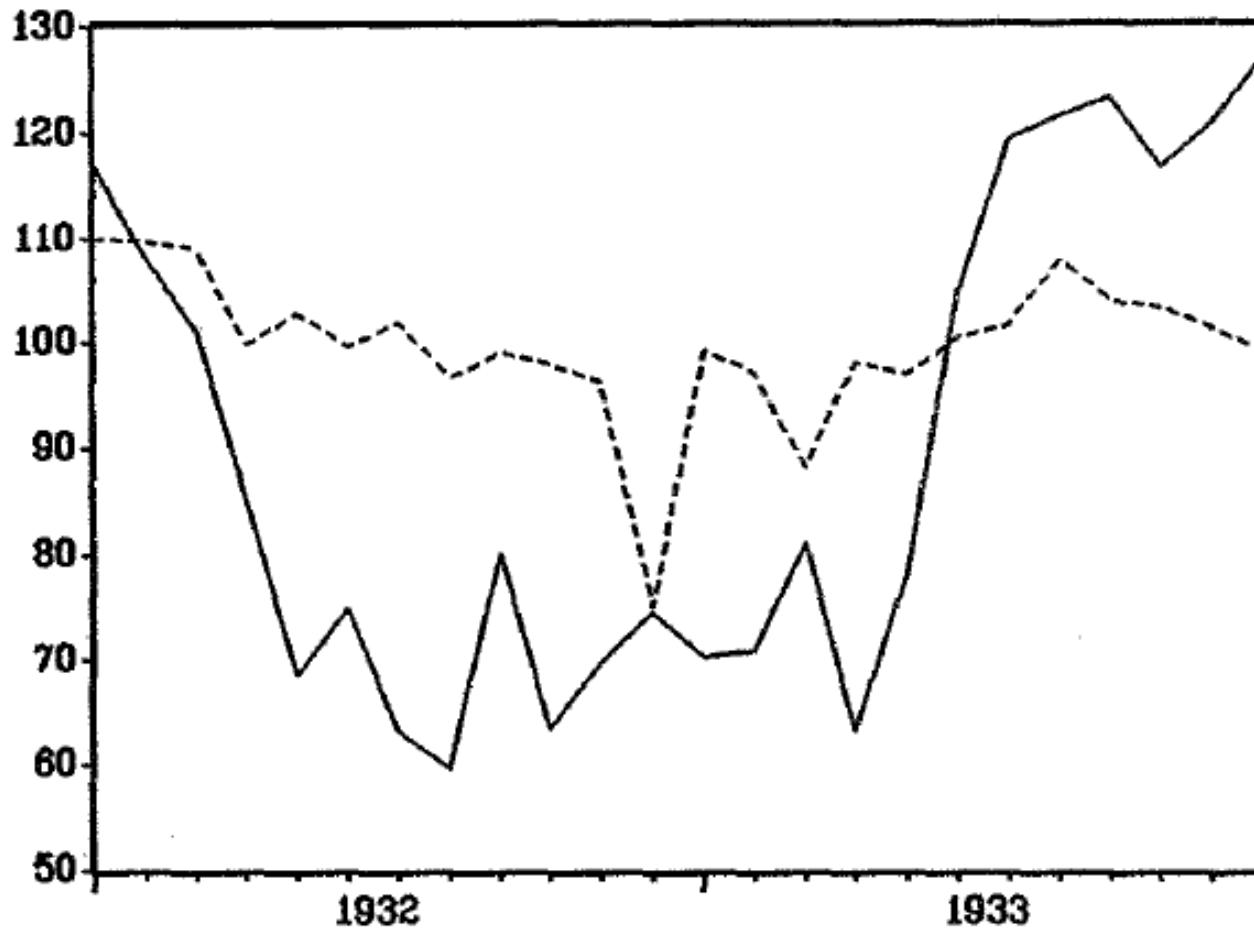
FIG. 2. Indexes of investment and consumption spendng, 1932–1933. Solid line: investment spending; dotted line: consumer spending.

Source. Moody's, 1937, pp. a14, a20–21.

From Temin and Wigmore, "The End of One Big Deflation"

TABLE 2
Monthly Growth Rates, 1933
(Percent per Month; Seasonally Adjusted)

Month	Autos	Steel	Industrial production	Purged industrial production
January	−02	07	00	−00
February	−29	00	−02	−01
March	−20	−26	−05	−04
April	42	46	07	04
May	18	35	16	14
June	19	35	14	11
July	14	29	10	07
August	06	−20	−05	−03
September	03	−21	−06	−05
October	−03	−09	−05	−05
November	−72	−28	−06	−01
December	03	24	01	−01

Source. Federal Reserve System (1940).

From: Temin and Wigmore, "The End of One Big Deflation"
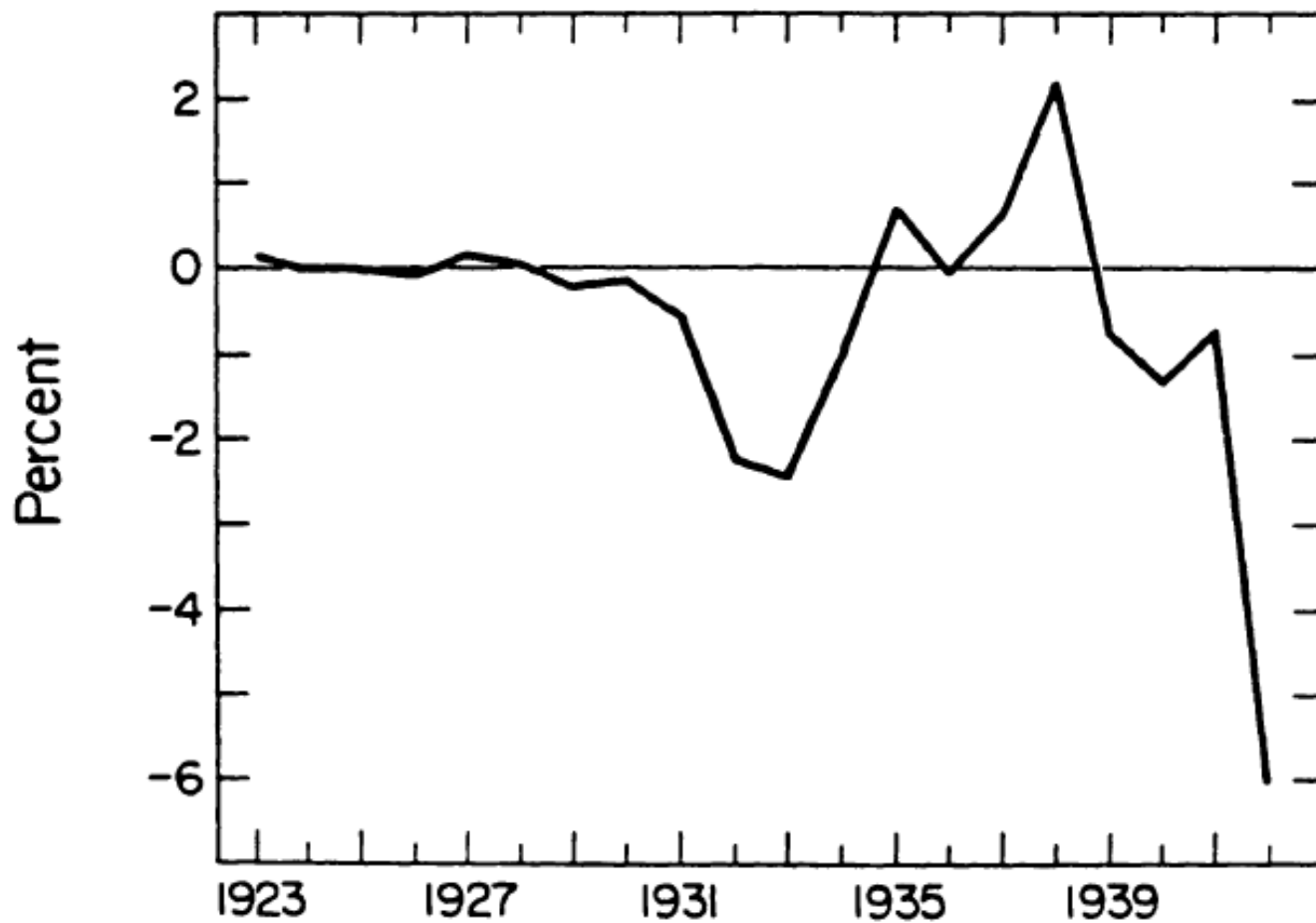
V. CHRISTINA ROMER, "WHAT ENDED THE GREAT DEPRESSION?"

FIGURE 4

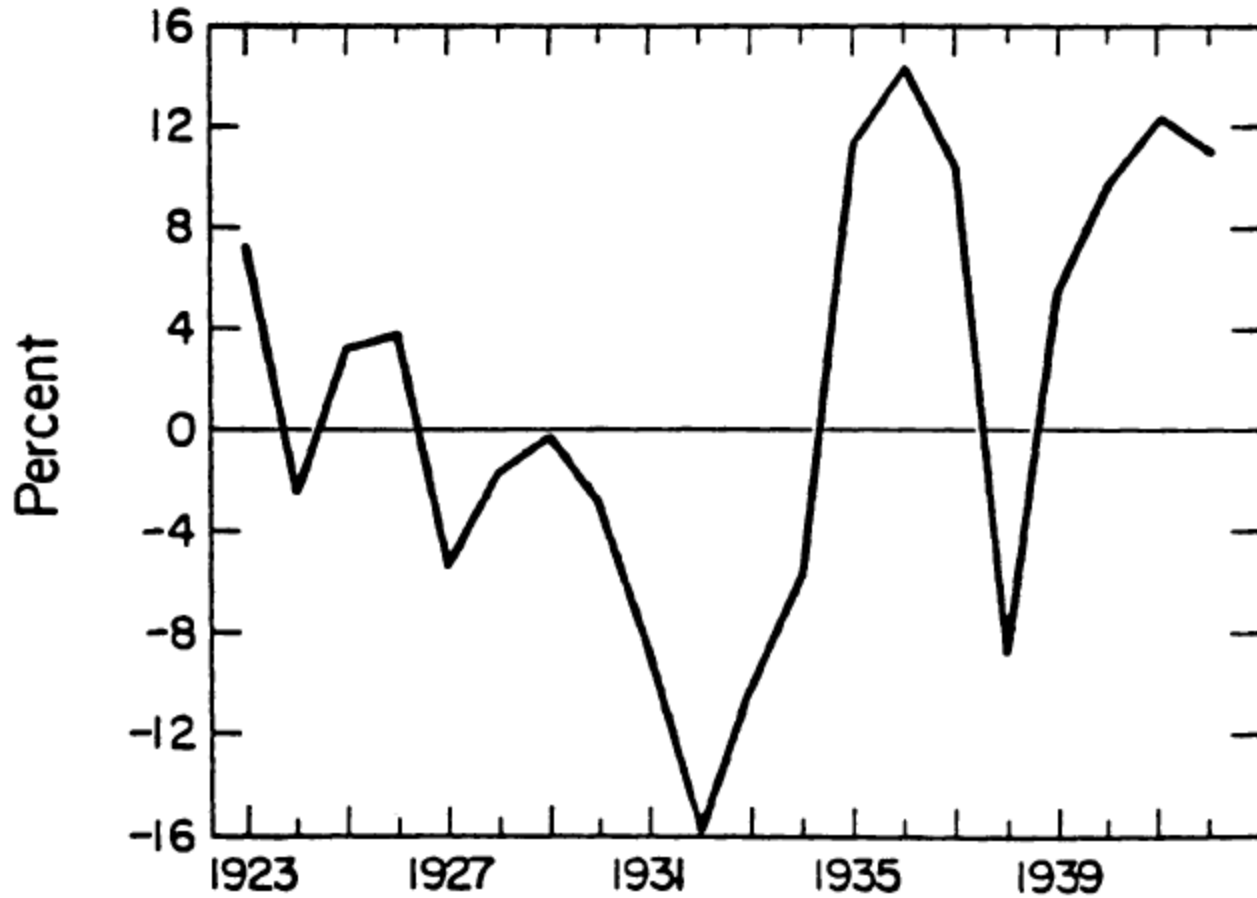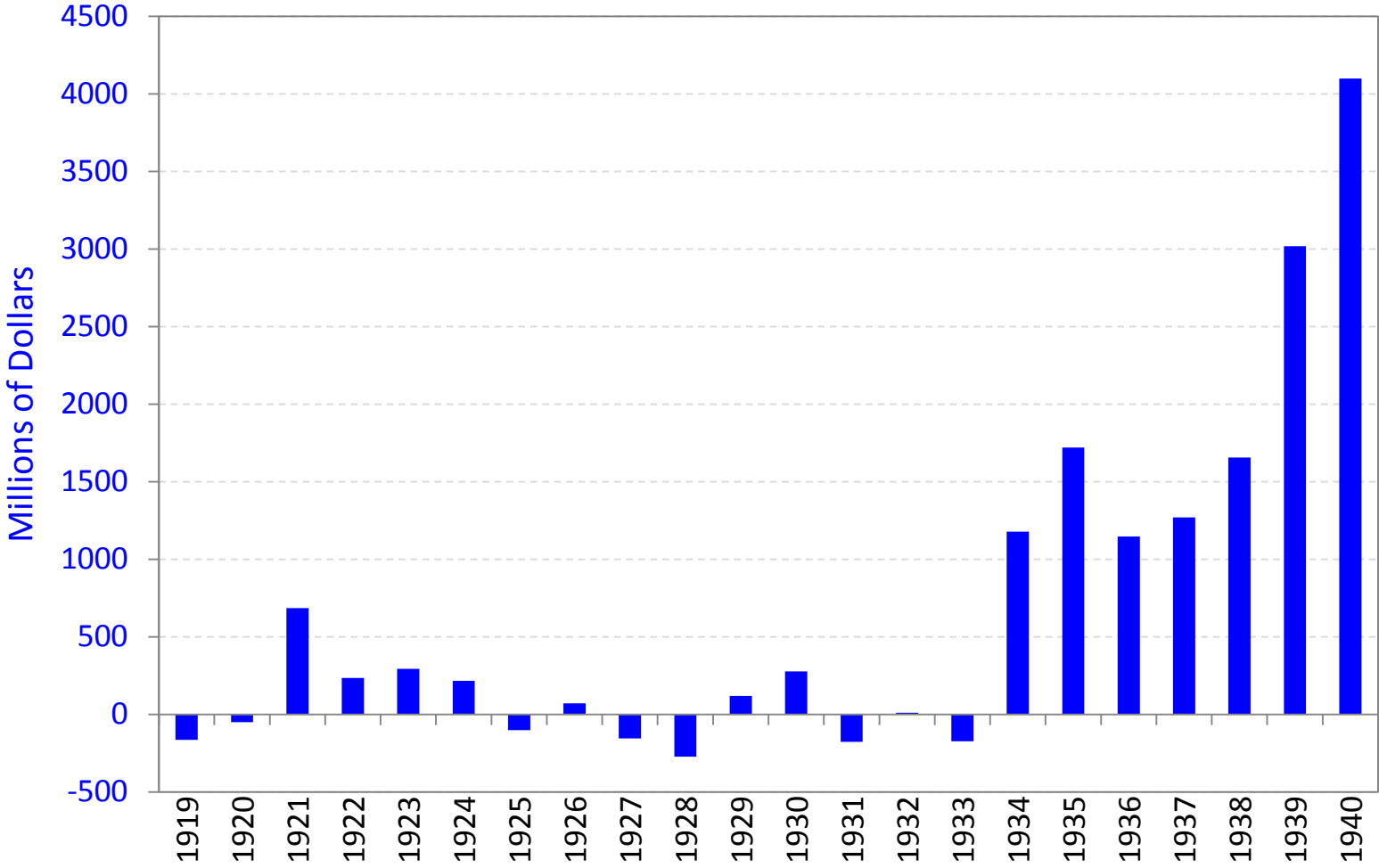CHANGES IN SURPLUS-TO-GROSS NATIONAL PRODUCT RATIO, 1923–1942

FIGURE 6

DEVIATIONS OF MONEY GROWTH RATE FROM NORMAL, 1923–1942

Gold Inflows to the U.S.

Mishkin Method of Estimating Ex Ante Real Rate

Ex Post Real Rate:

$$r^{ep}_t = i_t - \pi_t$$

where i is the nominal rate and π is actual inflation.

Ex Ante Real Rate:

$$r^{ea}_t = i_t - \pi^e_t$$

Where π^e is expected inflation.

The difference between r^{ep} and r^{ea} is unanticipated inflation (ε_t):

$$r^{ep}_t = (i_t - \pi_t) + (\pi^e_t - \pi^e_t)$$

$$r^{ep}_t = (i_t - \pi^e_t) - (\pi_t - \pi^e_t)$$

$$= r^{ea}_t - \varepsilon_t$$

- Under rational expectations, expectation of unanticipated inflation at a point in time is zero.

- You can't expect to be surprised.

Think of constructing estimate of π^e:

$$\pi^e_t = \alpha i_t + \beta' X_t$$

where X is a vector of information known at time t.

$$r^{ep}_t = i_t - (\alpha i_t + \beta' X_t) + \varepsilon_t$$

$$r^{ep}_t = (1 - \alpha) i_t - \beta' X_t + \varepsilon_t$$

Regress r^{ep} on i, and other explanatory variables known at time t.

Fitted values are estimates of r^{ea}.

TABLE 2
REGRESSION USED TO ESTIMATE EX ANTE REAL INTEREST RATES

Explanatory Variable	Coefficient	T-Statistic
Monetary Policy Variable		
Lag 0	0.044	0.29
Lag 1	−0.463	−3.02
Lag 2	0.182	1.09
Lag 3	−0.196	−1.20
Lag 4	0.352	2.30
Nominal Commercial Paper Rate		
Lag 0	0.834	0.25
Lag 1	0.191	0.04
Lag 2	1.181	0.22
Lag 3	0.954	0.18
Lag 4	−1.079	−0.32
Inflation Rate		
Lag 0	−0.396	−2.54
Lag 1	0.129	0.81
Lag 2	−0.014	−0.09
Lag 3	0.111	0.72
Lag 4	−0.031	−0.21
Change in Industrial Production		
Lag 0	−0.026	−0.47
Lag 1	0.045	0.78
Lag 2	−0.120	−2.00
Lag 3	0.012	0.22
Lag 4	−0.036	−0.67
Quarterly Dummy Variables		
Quarter 2	1.497	0.27
Quarter 3	−6.961	−1.76
Quarter 4	5.271	0.97
Constant	−1.804	−0.44

Notes: The dependent variable is the quarterly ex post real interest rate. The sample period used in the estimation is 1923:1 to 1942:2. The R^2 of the regression is .52.
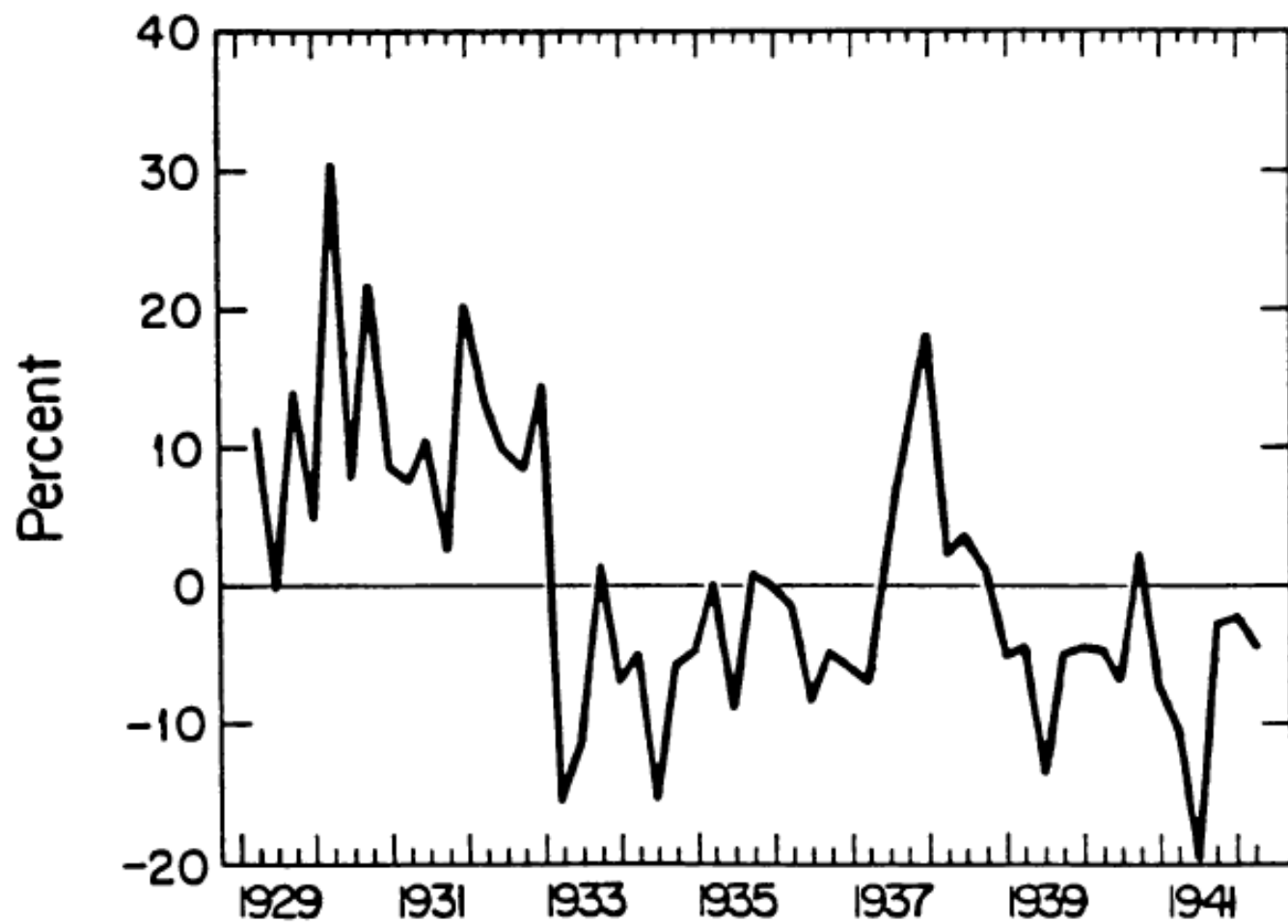*Source*: See the text.

FIGURE 8

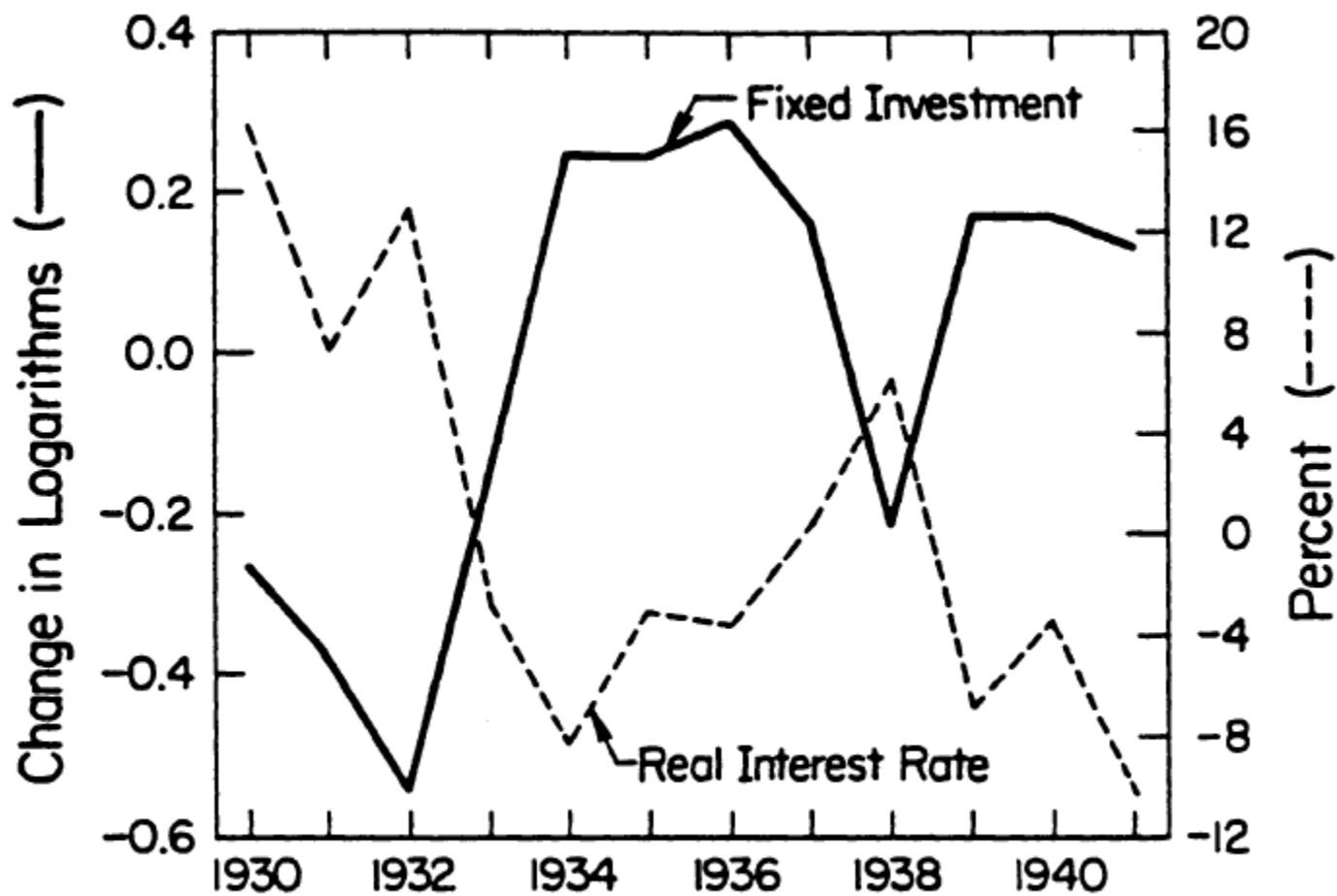EX ANTE REAL COMMERCIAL PAPER RATES, 1929–1942

FIGURE 9

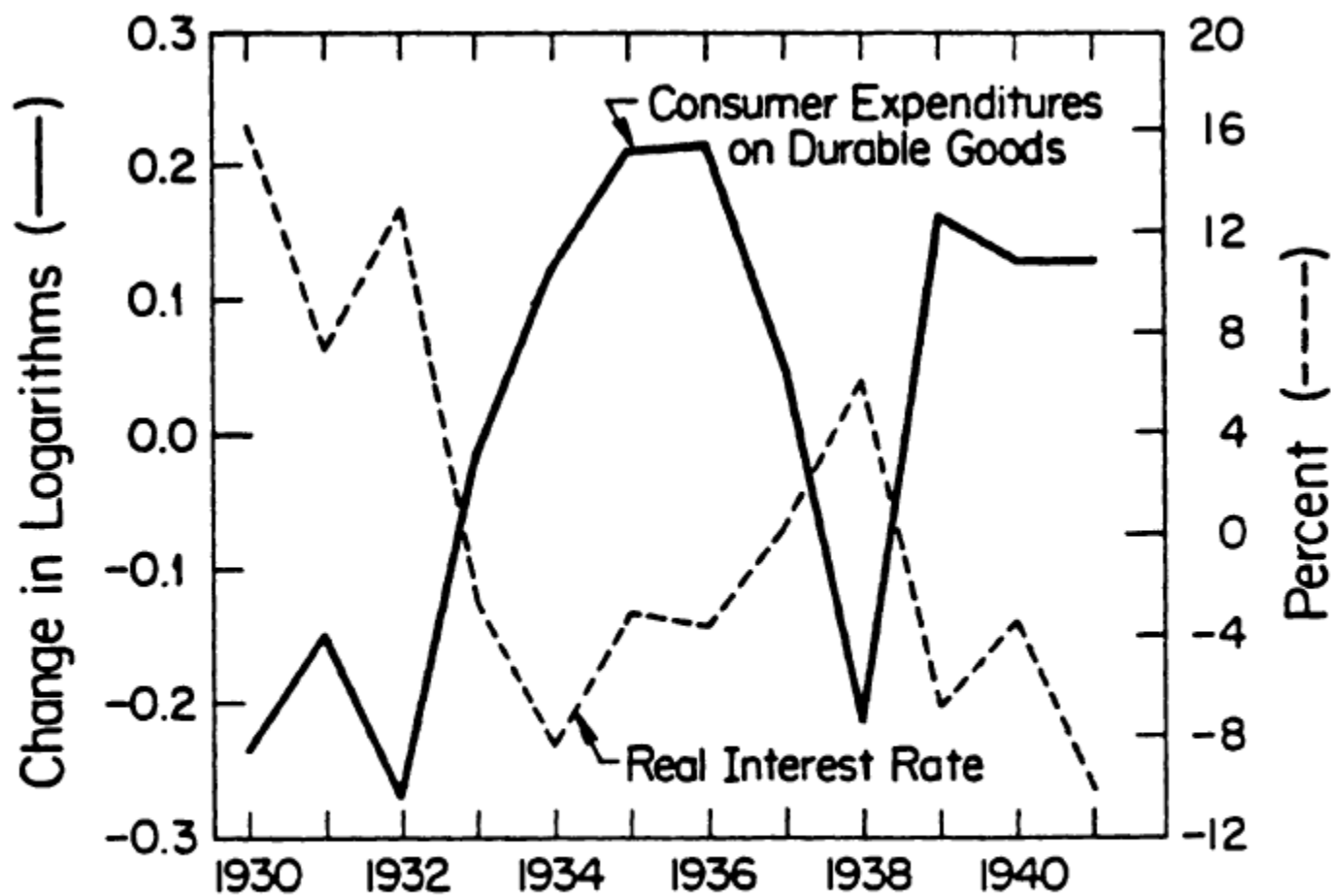REAL FIXED INVESTMENT AND EX ANTE REAL RATES, 1930–1941

FIGURE 10

REAL CONSUMER EXPENDITURES ON DURABLE GOODS AND EX ANTE REAL
RATES, 1930–1941

Behavior of Different Types of Consumer Spending