Recovery of 1933*

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Abstract

When Roosevelt abandoned the gold standard in April 1933, he converted what had been effectively real government debt into nominal government debt and opened the door to implementing an *unbacked fiscal expansion*. We argue that he followed a state-contingent fiscal rule that ran nominal debt-financed primary deficits until the price level rose and economic activity recovered. Theory suggests that government spending multipliers can be substantially larger when fiscal expansions are unbacked than when they are tax-backed. VAR estimates suggest that primary deficits made quantitatively important contributions to raising both the price level and real GNP from 1933 through 1937. The evidence does not support the conventional monetary explanation that gold revaluation and gold inflows, which were permitted to raise the monetary base, drove the recovery independently of fiscal actions.

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1 Introduction

Franklin D. Roosevelt's monetary and fiscal policies pulled the United States out of the Great Depression. His first step was monetary: America reduced the gold content of the dollar, abandoned the promise to convert dollars to gold, and abrogated the gold clause on all current, past, and future contracts. This paper emphasizes his second, fiscal, step: his administration expanded government spending, financed that spending with nominal bonds, and dissuaded people from believing that the bonds would be fully backed by future taxes. Because the monetary components—devaluing the dollar and revoking convertibility—were necessary for the fiscal step to work, this narrative is about *joint* monetary-fiscal actions.

When Roosevelt shucked off the gold standard's straightjacket, he was freed to exploit the nominal nature of government debt. If dollars are convertible to gold, even dollar-denominated government liabilities are *real* obligations. Credibility of the gold standard rested on government standing ready to raise the real taxes to acquire the requisite gold [Bordo and Kydland (1995)]. By revoking convertibility, Roosevelt enhanced his policy options. He could decide to continue the orthodox policy that new debt begets new taxes or to break from the past and allow prices to revalue outstanding bonds. Early in his presidency, Roosevelt chose the latter option.

Our thesis challenges the conventional wisdom that recovery had little to do with fiscal policy. Scholars from Brown (1956) to Romer (1992) to Fishback (2010) maintain that fiscal deficits during Roosevelt's first term were too small to close the gaping gap in output.[1] Those economists base their conclusion on a narrowly construed fiscal transmission mechanism. The government raises real spending, directly increasing real aggregate demand. Higher demand propagates through higher real expenditures and income, eventually to raise output by a multiple of the initial fiscal expansion. We call this mechanism "Keynesian hydraulics," to use Coddington's (1976) evocative label.

Nominal debt doubled before the end of Roosevelt's second term. Under Keynesian hydraulics, the resulting expansion in *nominal* demand provides no additional economic stimulus. Brown (1956) and the studies that followed explicitly exclude government borrowing from their analyses. Keynesian hydraulics implicitly assumes that higher taxes extinguish all wealth effects from higher nominal debt. That assumption effectively continues to treat government debt as a real obligation, denying that the suspension of gold convertibility fundamentally altered the nature of government debt and the fiscal options available to policy makers after 1933.

We broaden the perspective on fiscal transmission to include both Keynesian hydraulics and a vehicle by which government debt dynamics affect economic activity. When nominal government debt expands without raising expected taxes, private-sector wealth and aggregate demand increase via a conventional Pigou-Keyne-Patinkin effect. Roosevelt exercised this option—"unbacked fiscal expansion"—to implement a state-contingent policy: run debt-financed fiscal deficits until the American economy recovers.

Our perspective complements and elaborates Eichengreen's (2000) conclusion that "...the fundamental change in policy making in the 1930s was not the Keynesian revolution, but the 'nominal revolution'—the abandonment of the gold standard for managed money." To

[1] See also Chandler (1971), Peppers (1973), Beard and McMillin (1991), Raynold, McMillin, and Beard (1991), Eichengreen (2000), and Steindl (2004).

reach our perspective, define "money" as "nominal government liabilities." Nothing compels policy makers to back expansions in either component of nominal liabilities—base money or bonds— with higher taxes. When they don't, debt-financed fiscal expansion becomes a potent policy tool.

1.1 The Policy Problem

By the time Roosevelt was sworn in as the 32nd president of the United States in March 1933, the economy had been declining for over three years. Relative to the third quarter of 1929, real GNP was 36 percent lower while current-dollar GNP was 57 percent smaller; industrial production had fallen by half; unemployment had increased 22 percentage points; and government debt had grown from 16 percent to over 40 percent of output. Although his first acts salvaged a banking system left reeling by three consecutive crises, Roosevelt's focus never strayed far from those macroeconomic facts.

One fact figured prominently in his thinking: the precipitous decline in overall prices bankrupted the farmers and homeowners who had incurred nominal debts at elevated price levels. Those citizens were also among Roosevelt's strongest supporters. Figure 1 encapsulates the policy problem. FDR felt that the key to economic recovery lay in returning overall prices to their 1920s levels, to achieve "...the kind of a dollar which a generation hence will have the same purchasing power and debt-paying power as the dollar we hope to attain in the near future" [Roosevelt (1933c)]. The problem was that in the 1920s the price level was 60 percent above the long-run average to which it had to revert to maintain gold convertibility at the parity that prevailed over the previous century.

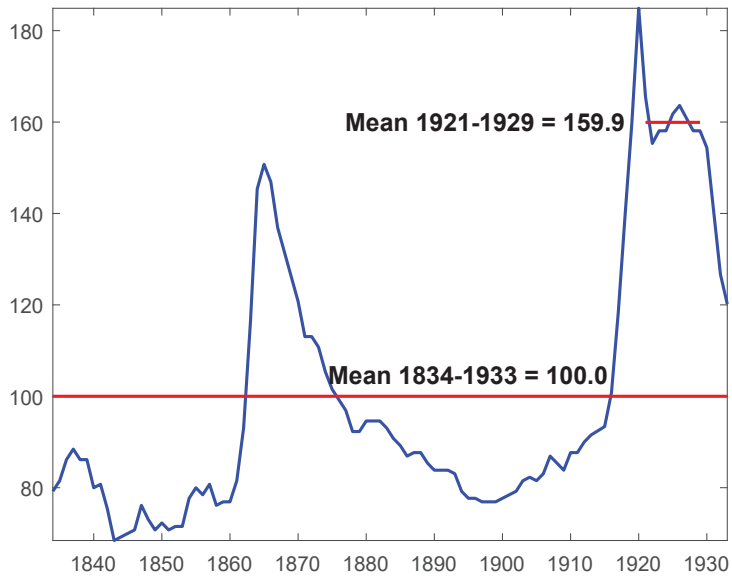

Figure 1: Consumer price index since the 1834 Coinage Act set the price of one ounce of gold at $20.67. Rescaled to make mean from 1834–1933=100. Source: Officer and Williamson (2018) and authors' calculations.

Roosevelt's objective to return the price level permanently to that high level was inconsistent with remaining on the gold standard at the historical conversion rate. FDR pur-

sued a triple-barreled approach to the problem. The executive branch—with Congressional approval—took control of monetary policy from a Federal Reserve that by all accounts had been "inept" since the depression started.[2] The monetary component sharply reduced the gold content of the dollar; it then evolved into complete abandonment of the gold standard and abrogation of gold clauses on all public and private contracts.

The second barrel ran "emergency" fiscal deficits financed by new issuances of nominal Treasury bonds. Emergency spending served two purposes. It provided much-needed relief through a vast array of works programs. But the modifier "emergency" also communicated the temporary and state-contingent features of the fiscal program.

Political strategy, which was crucial to establish the unprecedented fiscal program was credible, composed the third barrel. Roosevelt made recovery *the* policy priority; higher, for example, than the last century's fiscal orthodoxy. The president found innovative ways to persuade the people the stakes of recovery were unprecedentedly high. On the domestic front, he feared "agrarian revolution" and "amorphous resentment" of economic institutions.[3] Internationally, FDR conjured images of European fascism. In advisor George F. Warren's words, Roosevelt faced "a choice between a rise in price or a rise in dictators."[4] The president framed economic recovery as "a war for the survival of democracy" [Roosevelt (1936a)].[5] Jalil and Rua (2017) present evidence that in the second quarter of 1933 inflation expectations picked up rapidly. That evidence suggests the third barrel succeeded to convince people that Roosevelt would experiment with selling bonds that do not portend higher taxes, at least temporarily.

1.2 What We Do

The paper places FDR's policy actions in the political and intellectual context of the times. That context drives the narrative. Desperate times can engender creative measures. Despite running for office on his belief in sound finance, Roosevelt was at root a pragmatist, willing to experiment with the economic levers at his disposal—and even some levers that were not.

Several theoretical results underpin our narrative:

1. Under a classical gold standard with fixed parity, monetary and fiscal policies are not free to achieve any desired price level.

2. Unbacked fiscal expansion is infeasible under a classical gold standard.

[2]Friedman and Schwartz (1963, p. 407) characterize their adjective "inept" for monetary policy as a "plain description of fact." Also see Wicker (1965) and Meltzer (2003) for similar assessments.

[3]In October 1933, FDR told a group of financial advisors that the gold-buying policy the Administration pursued averted "an agrarian revolution in this country" Blum (1959, p. 72). Leuchtenburg's (1963) aptly-titled chapter, "Winter of Despair," documents that by the winter of 1932–33, economic despair transformed into "amorphous resentment" of the economic institutions that people blamed for the depression.

[4]This quotation is found in Rauchway (2014, p. 4) and Rauchway (2015, ch. 5), who lays out Warren's influence in context. See also Sumner (2001).

[5]As early as February 1933, Marriner Eccles, in his capacity as a private banker, testified to the Senate Finance Committee that in the absence of federal government intervention into the economy, "we can only expect to sink deeper in our dilemma and distress, with possible revolution, with social disintegration, with the world in ruins, the network of its financial obligations in shreds, with the very basis of law and order shattered" [Eccles (1933, p. 705)].

3. Unbacked fiscal expansion permanently raises the price level.

4. Government spending and transfer impacts from unbacked fiscal expansion generally exceed those from tax-backed fiscal expansion.

We bring both informal and formal empirical evidence to bear on the thesis. Surprise inflation significantly reduced the value of government debt. Over the seven years after America left the gold standard, nominal debt rose 30 percent more than real debt. Negative real returns on the government bond portfolio—both actual and surprise—became more prevalent in that period. Government debt, which was 16.4 percent of GNP in the last quarter of 1929, rose to 42.3 percent by the first quarter of 1933. Although nominal debt doubled over the next decade, it averaged only 41.6 percent of GNP to belie the critics' hysteria about fiscal sustainability.

Identified VAR evidence finds that temporary fiscal expansions produce persistent increases in output, the price level, the monetary base, the market value of nominal government debt, and the monetary gold stock. Fiscal disturbances are also important sources of fluctuations in those variables and account for significant fractions of the k-step-ahead forecasts errors in real GNP and the price level. Although the VAR recovers the patterns of correlation that underlie conventional monetary explanations of the recovery, the VAR points to fiscal, rather than monetary or gold, shocks as the genesis of those comovements.

2 Political and Intellectual Context

Roosevelt's decision to leave the gold standard and reflate arose against a backdrop of a growing political and intellectual consensus that higher retail and wholesale prices were critical to recovery of wages, employment, investment, and consumption. The banking crisis of February–March 1933 heightened expectations of a dollar devaluation as political pressure mounted against maintaining the gold standard at the existing parity.[6] To avoid capital losses from the banking panic, foreign depositors in U.S. banks liquidated their dollar balances and converted them to gold, pushing gold reserves close to their statutory minimums, particularly at the New York Fed. The bank would have had to raise its discount rate in the middle of a banking panic to attract gold from abroad to rectify dwindling gold reserves. To avoid further strain on the beleaguered financial sector, Senator Elmer Thomas advocated issuing unbacked currency to raise the price level to its 1920s level and Senator Tom Connally proposed reducing the gold content of the dollar by one-third. Financial and political forces were aligning against the gold standard.

Those realignments were echoed by a camp of economists who agitated for reflation. Irving Fisher's (1932; 1933b) debt-deflation theory argued that when the private sector is over-indebted, a falling price level triggers a sequence of events—lower asset prices, higher real interest rates, contraction of bank deposits, decrease in profits, reduction in output, rising unemployment, bank runs, and so on—that drivesdriving the economy into depression. Viewing nominal income through the equation of exchange, Fisher advocated government policies designed to raise the money supply and velocity.

Fisher carried on extensive correspondence with the president and met with him several times to discuss his economic proposals. In an April 30, 1933 letter to Roosevelt, Fisher

[6]This exposition draws on Eichengreen (1992), particularly chapter 11.

(1933a) wrote, "No one is happier than I over the prospect of the passage of the reflation legislation," referring to the Agricultural Adjustment Act, which included the Thomas Amendment giving the president unprecedented powers to reflate. George F. Warren, though, had the ear of the president. Pearson, Meyers, and Gans (1957, p. 5598), a detailed description of Warren's role in Roosevelt's inner circle, begins with the unequivocal, "George F. Warren was the first person who ever advised a President of the United States to raise the price of gold."

Keynes (1933) wrote an open letter to Roosevelt, published in the *New York Times*, calling for the U.S. government "...to create additional current incomes through the expenditures of borrowed or printed money." Although today Keynesian stimulus often is narrowly construed as the real mechanisms of Keynesian hydraulics, Keynes's emphasis in this letter is on "governmental loan expenditure" as "the only sure means of obtaining quickly a rising output at rising prices." Keynes prescribed unbacked fiscal expansion: nominal debt-financed deficits with no promise to raise future taxes to pay off the debt.

We do not claim that Roosevelt consciously engineered an unbacked fiscal expansion. Nor do we believe that he had in mind the precise economic mechanisms that we identify as the source of the recovery. There were false starts, such as the National Industrial Recovery Act of 1933, which in addition to being ruled to contain unconstitutional features, likely slowed recovery [Cole and Ohanian (2004)]. But his "try anything" macroeconomic approach contained the essential ingredients for an unbacked fiscal expansion: suspension of the gold standard, a commitment to run debt-financed emergency deficits until specified parts of the state of the economy improved, and a policy decision not to sterilize gold inflows, which permitted the monetary base to grow without further increases in government indebtedness for monetary reasons.

The paper does not try to use a formal model to reproduce recovery-period data, as Cole and Ohanian (2004) and Eggertsson (2008) do. In that tumultuous period, economic agents confronted an entirely new and still-evolving economic structure. Interpretations that rely on modeling conventions like well-understood policy rules and rational expectations are difficult to align with the historical facts. Instead, we use theory to frame the issues to to inform how we interpret the history and the data.

3 Contacts with Literature

Our argument that the *joint* monetary-fiscal mix that underlies an unbacked fiscal expansion was the source of the recovery in the 1930s contrasts with existing explanations which frequently attribute diminished roles to both monetary and fiscal policy. Existing studies argue that the combination of dollar devaluation, the departure from the gold standard, regime change, expansion of the monetary base, and rising inflation expectations account for the recovery. Our unbacked fiscal expansion interpretation broadly agrees with many of these arguments, but links them to the monetary and fiscal policies of the 1930s.

Another distinction concerns the view that monetary policy made no substantive contribution to the recovery. Friedman and Schwartz (1963), for example, conclude the immediate recovery "owed nothing to monetary expansion" [p. 433]. Wicker (1965) attributes Fed inaction to a leadership vacuum and the Fed's incomplete understanding of how monetary policy affects the economy and the price level. Meltzer (2003, p. 273) flatly declares that "...in

the middle and late thirties, just as in the early thirties, the Federal Reserve did next to nothing to foster recovery."

We argue that by pegging short-term interest rates throughout the 1930s, the Fed permitted unbacked fiscal expansion to reflate the economy. Expansions in nominal debt that do not portend higher future taxes raise household wealth at prevailing prices and interest rates. Bond holders convert higher wealth into higher aggregate demand. Some of the increased demand shows up in aggregate price levels, but if prices do not adjust instantaneously, some demand raises real economic activity. By pegging interest rates, monetary policy prevents the nominal debt expansion from raising debt service enough to put debt on an explosive path. Federal Reserve policy performed the critical role of stabilizing government debt. Pegged rates also do not fight against the higher price levels needed to bring the real market value of debt in line with the expected present value of the primary surpluses that back debt.[7] Monetary and fiscal policy are equal partners in successful unbacked fiscal expansion.

The economic consequences of the unbacked fiscal expansion that began in 1933 rationalize why concerns that expanding federal debt would threaten the U.S. government's creditworthiness were not realized. Studenski and Krooss (1952, p.428) summarize a key feature of unbacked fiscal expansion:

> "In its early years, the New Deal administration itself believed that the public credit could not sustain continuous budgetary deficits and increases in the public debt. But in practice this also proved incorrect. The public credit did not collapse under the burden of increased public debt. On the contrary, government credit grew stronger, interest rates on new government borrowing declined steadily, and the Treasury found it increasingly easy to finance its operations."

Unbacked expansions raise prices and real GNP to ensure that higher nominal debt does not transform into a higher debt-output ratio.

The initial impetus for recovery came from dollar devaluation and departure from the gold standard, which signaled a change in policy regime that raised inflation expectations, according to the consensus view. We agree that these elements all contributed to the recovery, but argue they cannot account for the rapid pick up in the price level and output in isolation. Temin and Wigmore (1990) offer evidence that dollar devaluation in 1933 signaled that Roosevelt had abandoned the deflation associated with adherence to the gold standard and that the lower dollar directly increased aggregate demand and indirectly raised prices and production throughout the economy. Hausman (2013) provides evidence of Temin and Wigmore's hypothesis by showing that increased agricultural incomes bolstered auto sales in rural areas. Romer (1992), however, makes a forceful case that the dollar depreciation following the departure from the gold standard in late April 1933 cannot account for the sustained increase in inflation in subsequent years. We agree with Romer and point out—as do Jalil and Rua (2017)—that both Britain and France experienced similar depreciations in their currencies upon exit from gold, yet prices and output did not rise as in the United States.

[7] This mechanism is described in detail in a growing literature that began with Leeper (1991), Woodford (2001), Sims (1994), and Cochrane (1999).

Our work complements Jalil and Rua's narrative evidence on the role of rising inflation expectations in the recovery of 1933. We ground those expectations in the monetary-fiscal policy mix.

The argument differs from Eggertsson (2008), who emphasizes a regime change in policy dogmas from Hoover to Roosevelt and relies on new Keynesian mechanisms for escaping from the lower bound on the nominal interest rate, with expectations anchored on an eventual return to the conventional active monetary/passive fiscal policy mix.[8] Eggertsson's story rests on the coordinated action of monetary and fiscal policy to maximize household utility. In the presence of distortionary taxation, higher deficits provide an incentive for the Fed to keep interest rates low for an extended period of time, to manage the value of outstanding debt. Monetary policy mitigates the distortions of tax policy by committing to generate inflation when the Fed has the freedom to do so—that is, once the zero lower bound ceases to bind. In this way, the time-consistent policy generates the same stimulatory mechanisms that Eggertsson and Woodford's (2003) optimal commitment policy delivers.

This interpretation faces several difficulties. Does evidence support the degree of policy coordination that Eggertsson's model requires? Eccles (1951) describes a highly decentralized Federal Reserve, both in its operations and in its objectives, an account that Wicker (1966), Meltzer (2003), and Wheelock (1991) confirm. Federal Reserve officials frequently voiced concerns about the prospect of inflation, even during the deflationary years in the early 1930s [Meltzer (2003, p. 280)]. The volume of those voices rose in FDR's first term in response to "imprudent" fiscal policies [citation]. Eggertsson's mechanism leans heavily on rational expectations at a time when the entire monetary system had no precedent. It is difficult to square that history with Eggertsson's sophisticated and single-mindedly inflationary Fed behavior.

History was not nearly as linear as our unbacked fiscal expansion interpretation makes it seem. Disparate viewpoints about the depression battled for "the soul of FDR," in Stein's (1996, ch. 6) memorable phrase. A 1932 "Memorandum" written by three young Harvard economists nicely distills those disparate views. The document denounces "the failure on the part of the government to adopt other than palliative measures" to combat the depression [Currie, White, and Ellsworth (2002, p. 534)]. Viewpoints Roosevelt contended with included: (1) economists who believe the depression cannot be stopped and any efforts to do so interfere with the "natural" functions of the economy; (2) those who believe the economy is so poorly understood that government efforts are likely to make matters worse; (3) some who adopt the view that depressions are cleansing and purge inefficiencies; (4) a group, like the Memorandum's authors, who "believe that recovery can and should be hastened thru [sic] adoption of proper measures."[9]

Roosevelt clearly sided with the fourth group, at least in the early years of the recovery.

[8] Leeper (1991) defines an active policy authority as free to pursue its objective, while a passive authority is constrained by the behavior of the active authority and optimizing private behavior. In conventional models, a determinate bounded rational expectations model requires either an active monetary policy with a passive fiscal policy or vice versa.

[9] Two authors went on to play critical roles in policy: Currie at the Federal Reserve Board, Treasury and the White House; White at the Treasury where, together with Keynes, he created the Bretton Woods system.

4 Why Unbacked Fiscal Expansion?

Contemporary supporters and critics understood that Roosevelt's price-level objective entailed a permanent increase in prices to 60 percent above their long-run average. But a permanent revaluation of the dollar price of gold required leaving the gold standard.

Result 1. *Under the gold standard with a fixed parity—the classical gold standard—monetary and fiscal policies cannot achieve any desired price level.*

Straightforward economic logic underlies this result.[10] Private holdings of gold, which standard asset-pricing reasoning determines, establish the goods value of gold—the aggregate price level. The Euler equation for private gold demand implies that

$$\frac{P_t^g}{P_t} = E_t \sum_{T=t}^{\infty} q_{t,T} \frac{u_{G,T}}{u_{c,T}} \tag{1}$$

where P_t^g is the dollar price of gold, P_t is the price level, $q_{t,T}$ is the stochastic discount factor, $u_{G,T}$ is the marginal utility of gold holdings, and $u_{c,T}$ is the marginal utility of consumption. When the dollar price of gold is fixed at $P_t^g = \bar{P}^g$, expression (1) implies that the marginal rate of substitution between gold and consumption uniquely determines the equilibrium price level.

Monetary policy must passively adjust to accommodate the price level consistent with the pegged price of gold. Fiscal policy must passively adjust primary surpluses to provide gold backing for outstanding government debt at that price level. This establishes that leaving the gold standard and abandoning convertibility were necessary to achieve FDR's price-level objective.

Definition 2. *Unbacked fiscal expansion increases government expenditures on purchases and transfers, issues nominal bonds to cover the deficit, and persuades people that surpluses will not rise to finance the bonds.*

Simple theory makes this definition precise and illustrates the price-level consequences of unbacked fiscal expansion. A representative household receives a constant endowment, derives utility from consumption and real money balances, and hold initial nominal wealth in the form of nominal money and bonds, $A_0 \equiv M_{-1} + B_{-1}$. Nominal bonds sold at t sell at price $1/(1+i_t)$ and money earns no interest. The household's intertemporal budget constraint at time 0 is

$$E_0 \sum_{t=0}^{\infty} q_{0,t} \left[c_t + \frac{i_t - 1}{i_t} m_t \right] = \frac{A_0}{P_0} + E_0 \sum_{t=0}^{\infty} q_{0,t} \left[y_t - \tau_t \right] \tag{2}$$

$q_{0,t}$ is the stochastic discount factor for the date-0 value of goods at t, m_t is real money balances, and τ_t is lump-sum taxes net of transfers. Money demand yields the liquidity preference schedule $m_t = L(i_t, c_t)$.

To close the model, we assume the central bank pegs the nominal interest rate, $i_t = \bar{i}$, as the Federal Reserve did after 1933. Fiscal policy sets $\tau_t = \bar{\tau} + \varepsilon_t$, where $E_t \varepsilon_{t+j} = 0$ for

[10] See Barro (1979) or Goodfriend (1988) for details.

$j > 0$, and government purchases are zero. Applying these policy rules, imposing goods- and bond-market clearing on (2), and evaluating expectations yields the equilibrium condition

$$\frac{M_{-1} + B_{-1}}{P_0} = L(\bar{i}, \bar{y}) + \tau_0 + \frac{\beta}{1-\beta}\bar{\tau} \tag{3}$$

The real value of government liabilities equals the expected present value of seigniorage revenues plus primary surpluses.

Lower τ_0 is an unbacked fiscal expansion. Higher transfers with no offsetting future taxes shift resources from the government to households. This positive wealth effect induces households to attempt to raise their consumption paths. Higher demand for goods raises their price, P_0, which reduces the real value of the household's nominal assets, A_0/P_0. This negative wealth effect must be large enough to eliminate the excess demand for goods at time 0, and make households happy to consume their endowments.

Corollary 3. *Unbacked fiscal expansion is infeasible under a classical gold standard.*

Unbacked fiscal expansion requires active fiscal behavior; the government does not use future surpluses to stabilize debt. Condition (3) uniquely determines the price level as a function of the expected present value of primary surpluses including seigniorage revenues—the right side—and outstanding nominal government liabilities. Asset-pricing condition (1) determines the price level as a function of the gold price, $\bar{P}^g$, and prevailing conditions in the gold market. These two price levels will generally be different.

When the price level consistent with $\bar{P}^g$ is too low to satisfy (3), the real value of debt exceeds its real backing. Households will over-accumulate government bonds to violate their optimality conditions. When the price level under the gold standard is too high, households will refuse to buy bonds, and the government will violate its budget constraint. By either outcome, no equilibrium exists.

Result 4. *Unbacked fiscal expansion permanently raises the price level.*

A one-time unbacked fiscal expansion raises P_0 in equilibrium condition (3). To see that this increase is permanent, examine how nominal government liabilities at time 0 change. Both real money balances, $M_0/P_0 = L(\bar{i}, \bar{y})$, and real debt, $B_0/P_0 = \bar{\tau}/(1-\beta)$, remain unchanged because they do not depend on τ_0. With the change in price level, ΔP_0, given by the equilibrium condition, both M_0 and B_0 expand in proportion to ΔP_0. In the absence of any further disturbances, nominal liabilities remain at those permanently higher levels, as does the price level.[11]

These theoretical points establish that an appropriately scaled unbacked fiscal expansion could, in principle, achieve FDR's price-level objective and that ending convertibility of dollars for gold was a necessary first step. But why did Roosevelt opt for a fiscal, rather than a monetary, solution?

[11] Because the expansion in M_0 depends on $L(\bar{i}, \bar{y})$, this is not conventional money financing of deficits, as in Sargent and Wallace (1981). Instead, the money supply expands passively to ensure the money market continues to clear at the pegged nominal interest rate $\bar{i}$.

4.1 Monetary Policy

In the wake of the Federal Reserve's "inactivity" in the worst years of the depression, Congress feared that any recovery would be stymied by continued Fed inaction.[12] The Thomas Amendment of May 1933 granted the Executive unprecedented monetary powers, which included fixing the gold value of the dollar, issuing greenbacks, and ordering the Fed to buy Treasury securities. This was a first step to ensure the Fed would not act to thwart the stimulative impacts of fiscal expansion.

Enter Klüh and Stella's (2018) argument that the Gold Reserve Act of 1934 undermined the Fed's ability to reverse the stimulus through open-market operations. The Act gave to the Treasury legal title to all monetary gold. Treasury bought gold by issuing gold certificates, which could be held only by the Fed and were redeemable *in dollars* only at the Treasury's discretion. Treasury gold purchases raised the Fed's monetary liabilities—new Treasury deposits at the Fed—without commensurate increases in liquid assets. By the end of 1936, the Fed's total monetary liabilities were $10.89 billion, of which only $2.43 billion were liquid. Over 80 percent of the Fed's monetary liabilities were irredeemable gold certificates.[13]

Klüh and Stella (2018, p. 4) observe that Fed officials "understood they could not win a war of attrition with the Treasury." The Treasury could undertake gold purchases to expand reserves without limit, secure in the knowledge that it was infeasible for the Fed to sterilize them.

Operational factors combined with institutional features of the Federal Reserve in the early 1930s to reduce the Fed to "impotence," according to Eccles (1951). At the time, there was no single Federal Reserve policy; there was a policy for each regional Reserve Bank and the Board of Governors. Eccles emphasizes that Reserve Banks were beholden to their directors, who acted in the private interests of bankers. Before accepting the nomination to chair the Federal Reserve Board, Eccles insisted on institutional reforms that consolidated decision-making power in Washington, D.C. The Banking Act of 1935, among other things, changed the decision-making process at the Fed, which Eccles describes:

> "...before a uniform decision could be reached...there had to be a complete meeting of the minds between the governors of the 12 Reserve banks and the 108 directors of those banks, plus the FRB in Washington. A more effective way of diffusing responsibility and encouraging inertia and indecision could not very well have been devised." Eccles (1951, p. 170)

While the Fed could not sterilize the Treasury's gold purchases, monetary policy also did little to advance Roosevelt's economic agenda. After only minor actions in 1933, the Fed conducted no open-market operations after November 1933. This inactivity occurred against a backdrop of current and former Fed officials publicly expressing concerns about run-away inflation. After leaving his position as Fed Chairman on May 10, 1933, Eugene Meyer wrote that "...the mere fact that the Administration has assumed responsibility for defining our monetary policies and fixing our price goal, indicates a subordinate role for the

[12] Meltzer (2003, p. 459), but see also Friedman and Schwartz (1963) and Wicker (1966).

[13] Board of Governors of the Federal Reserve System (1937). Total monetary liabilities are Federal Reserve and Federal Reserve Bank notes outstanding plus bank reserves; total liquid assets are gold reserves plus U.S. Treasuries.

Federal Reserve System" [Meyer (1934)]. Adolph Miller, one of the original governors of the Federal Reserve System, who served until 1936, was vociferous in calling for a return to gold, fearing the discretion that underlies a "managed currency," which he called "human nature money" [Miller (1936, p. 4)].

At a practical level, it was not clear that monetary stimulus would be effective. There was no assurance, particularly on the heels of sequential banking crises, that higher reserves would lead to higher bank deposits. Nor was it certain that higher deposits, if they were forthcoming, would result in increased bank loans to finance new investment.

As it happened, banks, worried about the Federal Reserve's failure to fulfill its lender-of-last-resort function, behaved conservatively and expanded holdings of government bonds, rather than loans to the private sector. From March 1933 to June 1940, annual growth rates of narrow money far outstripped those of broad money: reserves (23.1 percent), base (12.8 percent), M1 (7.7 percent), and M2 (5.2 percent). This was a very different pattern from the 1920s when M2 averaged 3.2 percent annual growth and reserves averaged 2.8 percent.

4.2 Fiscal Policy

Unbacked fiscal expansion served several of FDR's objectives. Given his strong support in Congress, particularly from "inflationists" like Senators Thomas and Connally, fiscal policy was largely under the president's direct control. Federal Reserve policy, to FDR's frustration, was beyond his control.

Fiscal policy also served political objectives. By providing immediate relief to the unemployed, farmers, and the "forgotten man," federal expenditures tamped down domestic unrest. Direct relief was a highly visible indicator that the federal government had the common man's interests at heart, helping to re-establish confidence in policy institutions. Finally, economists and politicians alike understood that deflation had redistributed wealth from debtors to creditors. Reflation, and the fiscal actions underlying it, were deliberate efforts to reverse that redistribution.[14] Roosevelt's attitudes toward redistribution shone through in a letter to Secretary of the Treasury Woodin: "I wish our banking and economist friends would realize the seriousness of the situation from the point of view of the debtor classes—i.e., 90 percent of the human beings in this country—and think less from the point of view of the 10 percent who constitute creditor classes" [Roosevelt (1933a)].

Roosevelt walked a fine line on fiscal policy, seeming to maintain contradictory positions simultaneously. During the 1932 campaign for president, he harshly criticized Hoover's deficits and took a "Pittsburgh pledge" to balance the budget by reducing expenditures [Roosevelt (1932a)]. Just six months earlier he delivered his famous speech about "the forgotten man at the bottom of the economic pyramid" [Roosevelt (1932b)]. That speech characterized the depression as a "more grave emergency" than World War I and called for a restoration of the purchasing power of farmers and rural communities and assistance to homeowners and farmers facing foreclosure.

[14] Fisher (1934, ch. VI) thoughtfully discusses how to arrive at a "just" price level that balances the losses of borrowers and creditors. Eccles (1933) pointed to the redistribution of wealth as a source of the prolonged depression: "During the period of the depression the creditor sections have acted on our system like a great suction pump, drawing a large portion of the available income and deposits in payment of interest, debts, insurance and dividends. . . ."

Six days after taking office, Roosevelt sent to Congress a proposal to cut federal spending by an amount equal to nearly 14 percent of total expenditures. Cuts eliminated government agencies, reduced federal worker pay, and, most critically in light of the politics of the time, shrank veterans' benefits by half. When the Economy Act of 1933 was finally signed into law, the spending cuts amounted to a little under seven percent of expenditures, but Roosevelt could point to the legislation to help establish his bona fides as a "sound finance" man.

Just 20 days into his administration, Roosevelt drew fine lines on fiscal matters in a press conference. Asked when it might be possible to balance the budget, the president replied, "...it depends entirely on how you define the term, 'balance the budget"' [Roosevelt (1933b, p. 13)]. His reply spawned the distinction between "ordinary" and "emergency" expenditures, which became institutionalized in Treasury Reports.[15]

FDR was more comfortable with deficits by 1936. In the face of precipitous declines in tax receipts, he argued that "To balance our budget in 1933 or 1934 or 1935 would have been a crime against the American people" [Roosevelt (1936b)]. And in response to budget director Lewis W. Douglas's argument that the only way to project a balanced budget in 1936 was to cut spending, Roosevelt replied, "No, I do not want to taper off [spending programs] until the emergency is passed" [Rosen (2005, p. 85)]. On the other hand, he supported tax hikes in 1935 and 1937.

Why did FDR waffle so on fiscal policy? Although it is possible, as Stein (1996) suggests, that Roosevelt was tentative and uncertain about fiscal stimulus, the waffling may have been deliberate. His distinction between "ordinary" and "emergency" government expenditures was central to communicating that unbacked fiscal expansion was state-contingent. Linking the state-contingent emergency expenditures tightly to the economic emergency—through both their timing and their labels—Roosevelt drove home their temporary nature. At the same time, by demonstrating fiscally responsible ordinary spending, he could reassure his critics, particularly bankers, that once the crisis passes, he would balance the budget. Roosevelt's January 1936 budgetary address made this point explicit when he said, "...it is the deficit of today which is making possible the surplus of tomorrow" [Roosevelt (1936c)].

5 Empirical Facts

This section presents a variety of facts about the state of the U.S. economy throughout the 1920s and 1930s focusing on corroborative evidence that points towards interpreting the recovery as an unbacked fiscal expansion. In the figures that follow, we contrast the performance of economic variables during the "gold standard" (January 1920 to March 1933) to their behavior during the "unbacked fiscal expansion" (April 1933 to June 1940). Data are quarterly. Vertical bars in the figures at April 1933 mark America's departure from the gold standard.

[15] The reply continued: "What we are trying to do is to have the expenditures of the Government reduced, or, in other words, to have the normal regular Government operations balanced and not only balanced, but to have some left over to start paying the debt. On the other hand, is it fair to put into that part of the budget expenditures that relate to keeping human beings from starving in this emergency? I should say probably not... You cannot let people starve, but this starvation crisis is not an annually recurring charge. I think that is the easiest way of illustrating what we are trying to do in regard to balancing the budget. I think we will balance the budget as far as the ordinary running expenses of the Government go" Roosevelt (1933b, pp. 13–14)

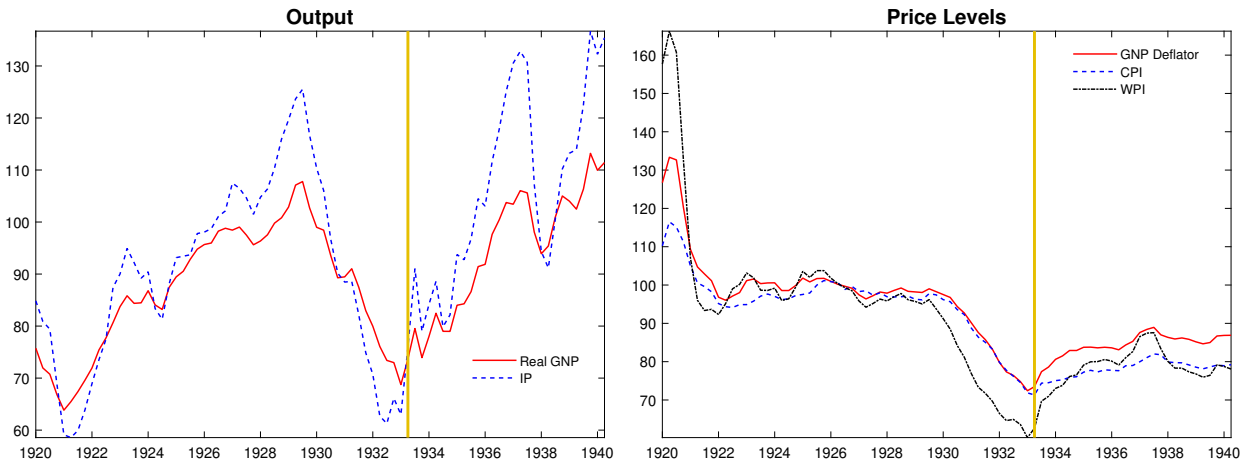

Figure 2: Measures of real economic activity and price levels. All series use 1926 base year. Vertical line marks when the United States abandoned the gold standard. Sources: Balke and Gordon (1986), Federal Reserve Board, BEA and BLS from NBER Macrohistory Database.

5.1 Macroeconomic Indicators

The price level, however measured, decreased by roughly 30 percent from the stock market crash in October 1929 to its trough in April 1933 when the United States abandoned the gold standard (right panel figure 2). Although consumer and wholesale prices and the GNP deflator rose through most of the 1930s, they never regained the 1920s target levels proposed by various policymakers.

Like prices, output also plunged after the stock market crash and rebounded with the abandonment of the gold standard. The left panel of figure 2 shows that real GNP fell by roughly 25 percent from peak to trough, as measured on an annual basis. GNP hits its trough in the first quarter of 1933. Industrial production dropped 45 percent from peak to trough and, like consumer and wholesale prices, began a sustained recovery in April 1933. Unlike those prices, GDP and industrial production eventually surpassed their pre-recession peaks later in the decade.

The left panel of figure 3 shows the dollar-sterling and dollar-franc exchange rates. The first vertical line marks when the United Kingdom left gold in September 1931, which triggered a very large dollar appreciation that was reversed in April 1933. Note that sterling's depreciation against the dollar is roughly comparable to its subsequent appreciation.

The figure's right panel plots the level of the GNP deflator along with two interest rates—the commercial paper rate for New York and the New York Fed's discount rate. Although during the gold standard period interest rates generally followed the decline in the price level, there are also several distinct deviations when rates rose sharply despite a flat or declining price level. For example, in October 1931, concerns about gold outflows induced most Federal Reserve Banks to raise their discount rates after Britain left the gold standard, even though prices were in free fall. The Federal Reserve banks aimed to mitigate gold outflows resulting

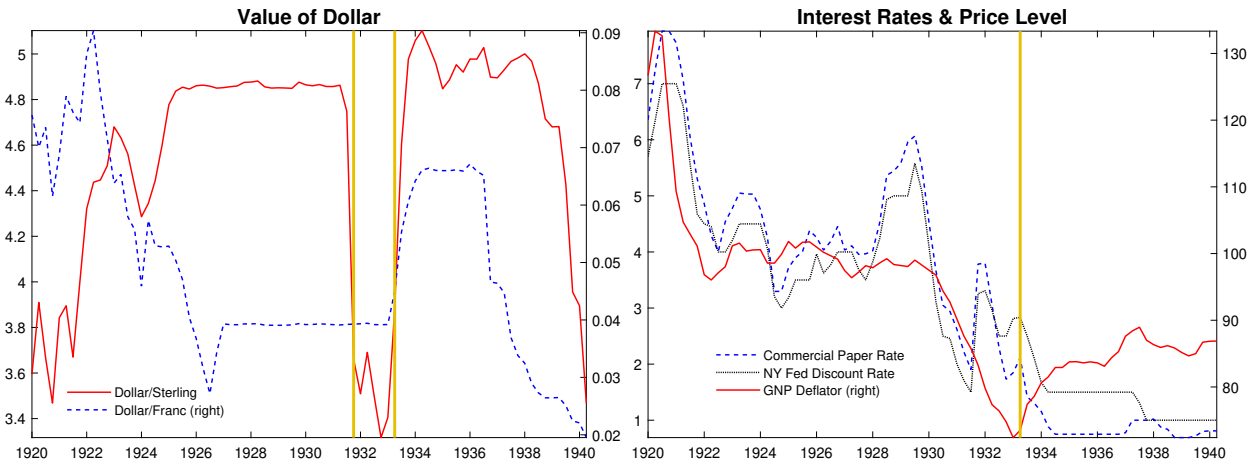

Figure 3: Exchange rates, inflation, and interest rates. Exchange rates in dollars per foreign currency; inflation is annual (quarter over four quarters prior). First vertical line marks when the United Kingdom abandoned the gold standard; second line marks when the United States abandoned the gold standard. Sources: Federal Reserve Board (1943).

from the appreciation of the dollar vis-à-vis the pound. Meltzer (2003, p. 280) claims that Federal Reserve policy decisions were mostly consistent with the Riefler-Burgess and real bills doctrines.[16] But these interest-rate hikes were clear attempts by the Federal Reserve to follow the gold standard's "rules of the game" [p. 273].

After the abandonment of the gold standard in April 1933, the Federal Reserve pegged interest rates near zero. Meltzer (2003, p. 413) notes that the Federal Reserve made few changes to the market portfolio and discount rate from 1933 to 1941. If anything, rates moved against the price level, so the Fed was certainly not following what today we might call a price-level target. This raises the theoretical question of how the price level was determined after America left the gold standard. Eggertsson (2008) claims that Fed policy anchored expectations on the belief that once monetary policy exited the zero lower bound, it would follow a now-standard active monetary/passive fiscal policy mix. These beliefs can, in principle, uniquely determine the price level.

The top panel of figure 4 plots the monetary base and the monetary gold stock and the bottom panel plots the gold cover ratio. Monetary aggregates fell in the early 1930s as financial unrest lead to contractions in deposits and cash hoarding by the public. Table 1 reports that total deposits in all banks fell 30 percent between 1929 and the low point in 1932–33. Deposits bounced back to their pre-depression levels by 1937. Loans, which declined over 50 percent never regained their previous level. Bank holdings of U.S. government obligations largely filled the asset void left by loans, tripling between 1929 and 1937.

The large jump in gold stock and the ratio in 1934 stem from the revaluation of gold to $35 an ounce. Steady increase in the two monetary measures during the unbacked fiscal

[16]Meltzer (2003, p. 282) elaborates that under the Riefler-Burgess framework, policymakers focused on borrowed reserves and short-term market interest rates as key signals of bank demand.

expansion period reflects the Roosevelt Administration's decision not to sterilize gold inflows. That decision was reversed in 1937, reducing the growth rate of the base [Irwin (2012)] (see appendix D for more details on sterilization).

For a couple of years before the gold revaluation, the cover ratio was precariously low, imposing a severe constraint on the level of the monetary base. Eichengreen (1992) recounts events during February and March 1933 when the New York Fed was at its statutory 40 percent minimum gold cover ratio, which prevented it from rediscounting bills. Initially, other reserve banks discounted bills on New York's behalf. By March 3 the Chicago Fed, which held the bulk of the System's excess gold, refused to provide further assistance to New York for fear that it would be unable to help banks in the Chicago district. These tensions, which stemmed from the absence of a coherent *national* monetary policy, exacerbated the already tenuous state of commercial banks and raised doubts about the credibility of the System's commitment to gold parity.

Official revaluation of gold in January 1934 increased the cover ratio sharply and it remained close to 0.90 for the remainder of the decade. Gold no longer constrained policy behavior as it had before April 1933, a point that is central to the theory of unbacked fiscal expansion that section 4 presents.

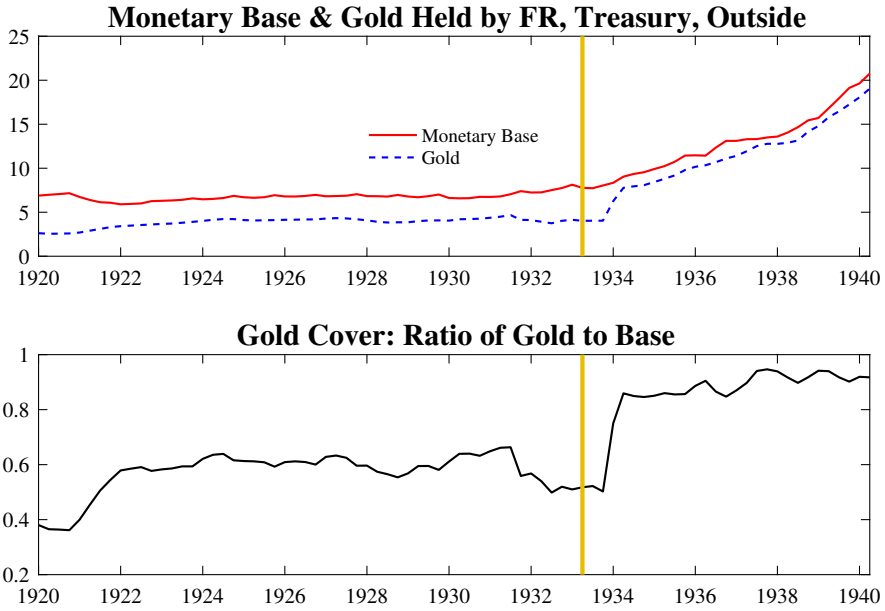

Figure 4: Monetary base and gold held by Federal Reserve Banks. Vertical line marks when the United States abandoned the gold standard. Source: Federal Reserve Board (1943) from NBER Macrohistory Database.

5.2 Policy Behavior

Many authors have noted that adherence to the gold standard imposed severe constraints on monetary and fiscal policies by focusing policy authorities on international considerations

	1929 High	1932-33 Low	1937 High
Annual data			
In 1939 prices, billions of dollars			
GNP	85.9	61.5	87.9
Gross domestic investment	14.9	1.1	11.4
In current prices, billions of dollars			
GNP	103.8	55.8	90.2
Gross domestic investment	15.8	0.9	11.4
Consumption	78.8	46.3	67.1
Biannual data			
All banks, billions of dollars			
Total deposits	59.8	41.5	59.2
Loans	41.9	22.1	22.1
U.S. government obligations	5.5	8.2	17.0

Table 1: Sources: Gordon (1952, p. 390) and Federal Reserve Board (1943).

at the expense of domestic conditions [see Wicker (1966) for discussions of monetary policy constraints]. Eichengreen (2000) argues that the gold standard prevented governments from reflating: "So long as the gold standard remained in place, the commitment to defend the central bank's gold reserves and stabilise the gold parity was an insurmountable obstacle to the adoption of expansionary policies." Apropos of fiscal policy under the gold standard, when taxes must back government debt, is Eichengreen's statement: "Deficit spending could not be used. . . if deficit spending could not be financed."

Figure 5 illustrates precisely the constraint on monetary policy that Eichengreen has in mind. Dashed lines are interest rates and the solid line is the growth rate of the gold stock. A shrinking gold stock usually induced Federal Reserve Banks to raise interest rates to attract gold from abroad, which arrived with a lag. And when Federal Reserve Banks lowered interest rates, gold would flow out of the United States. But in the 1920s, as figure 3 shows, these interest-rate movements occurred in the face of a steadily falling price level. The Fed's actions were designed to stabilize exchange rates at the expense of domestic prices.

Our interpretation of the 1930s recovery relies on a joint monetary-fiscal policy mix that was possible only after abandoning the gold standard. The top panel of figure 6 plots three measures of the federal budget surplus: gross, primary, and "ordinary," defined as total receipts less what are labeled "ordinary" expenditures. All three measures of deficits as a share of GNP deteriorated sharply as economic activity contracted in the early 1930s. Falling surpluses stemming from declining revenues due to lower corporate and income tax receipts and rising expenditures due to increased public works spending.[17] Although Roosevelt touted the evils of deficits and was more outspoken than President Herbert Hoover in his promise to cut expenditures, until the second half of the decade he did little to convert primary deficits to primary surpluses.[18]

Deficits remained sizeable until 1936, despite growing receipts from 1934 onward [table

[17]Stein (1996, p. 25), Studenski and Krooss (1952, p. 359), and Garbade (2012, p. 2).

[18]Stein (1996, p. 87) notes that, at least initially, Roosevelt was able to "rise above" his belief in reducing expenditures to do what he considered necessary which was increasing spending.

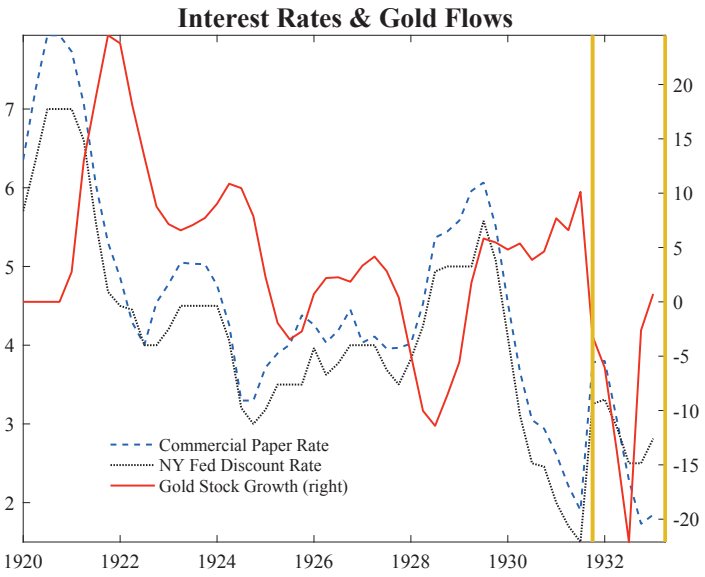

Figure 5: Interest rates and growth rate of monetary gold stock. Growth rate annual (quarter over four quarters prior). The vertical line marks when the United Kingdom abandoned the gold standard. Sources: Federal Reserve Board (1943).

2]. To reassure the public that fiscal finances were "sound," Roosevelt's Treasury drew a clear line between "ordinary" and "emergency" government expenditures. With the exception of 1936, when large veterans' bonuses were paid out, Roosevelt could claim that he balanced the "ordinary" budget [figure 6]. The bottom panel of the figure plots the primary surplus excluding and including seigniorage revenues: evidently, seigniorage did not make significant dents in the budget deficit.

	1929	**1930**	**1931**	**1932**	**1933**	**1934**	**1935**	**1936**	**1937**
Total receipts	4033	4178	3317	2121	2080	3116	3801	4116	5294
Total expenditures (excluding debt retirements)	3299	3440	3780	4594	4681	6745	6802	8477	8001
"Regular"	3299	3440	3780	4594	4681	2741	3148	5186	5155
"Emergency"	0	0	0	0	0	4004	3655	3301	2847
"Regular Deficit"	−734	−738	463	2473	2601	−375	−653	1070	−139
Deficit	−734	−738	463	2473	2601	3629	3001	4361	2707

Table 2: Millions of current dollars. "Emergency" expenditures are variously labeled as "emergency organization expenditures," "major expenditures due to or affected by the depression," "recovery and relief," or "public works." Designations of types of spending as "regular" or "emergency" changed over time. A negative deficit is a surplus. Source: Department of the Treasury (various).

Emergency expenditures drove budget deficits. Before 1934, non-ordinary expenditures consisted entirely of debt retirements. From 1934 to 1939, monthly expenditures were classified as general or emergency, where emergency spending was associated with relief measures under the New Deal. Annual Treasury reports retroactively categorize emergency expen-

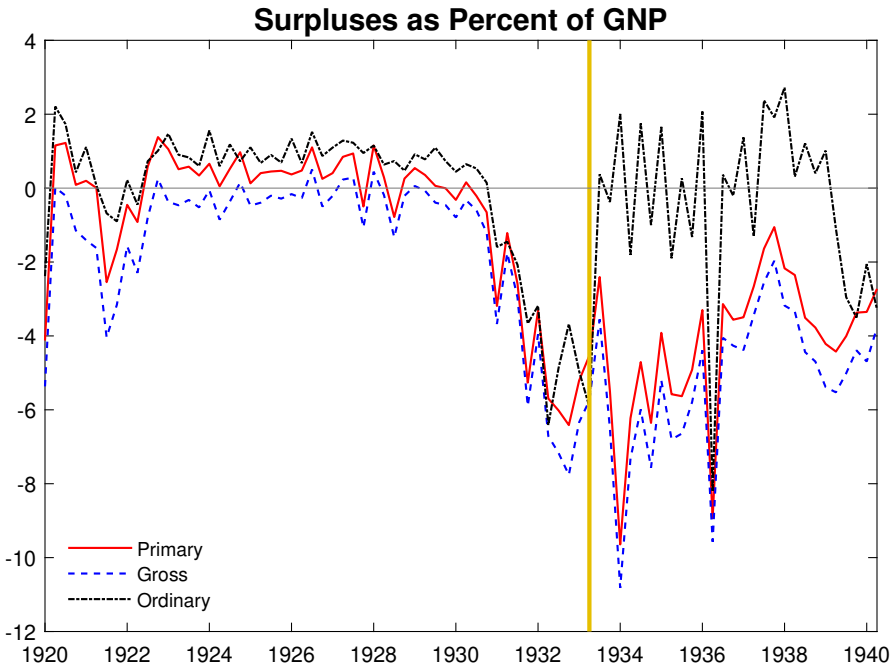

Figure 6: Surpluses defined as total receipts less expenditures, ordinary or total. Primary surplus is gross surplus less net interest payments. Seigniorage is defined as $(M_t - M_{t-1})/P_t$ where M is monetary base and P is the GNP deflator. Vertical line marks when the United States abandoned the gold standard. Sources: Federal Reserve Board (1943) from NBER Macrohistory Database, and Balke and Gordon (1986). See Appendix A for more details on the data series.

ditures only back to 1933 [see appendix A.2 for details]. Figure 7 (top panel) shows that emergency expenditures rose dramatically during Roosevelt's first year in office before falling back to an annual average of $3.4 billion per year until the end of 1939.

Emergency expenditures are strongly correlated with real GNP growth and inflation during the unbacked fiscal expansion period. Figure 7 (bottom panel) reports rolling correlations between emergency expenditures as a share of GNP and those two macroeconomic aggregates. Contemporaneous correlations are computed with a fixed rolling window of 28 quarters, beginning with the sample 1920Q1–1926Q4 and ending with the sub-period 1933Q3–1940Q2. Correlations early in the sample, therefore, reflect the fact that debt retirement is uncorrelated with inflation and economic growth. But as the window moves forward in time, emergency expenditures increasingly reflect New Deal spending on relief and those expenditures are very strongly linked to inflation and real GNP growth.

5.3 Keynesian Hydraulics vs. Unbacked Fiscal Expansion

Result 5. *Government spending and transfer impacts from unbacked fiscal expansions typically exceed those from Keynesian hydraulics alone.*

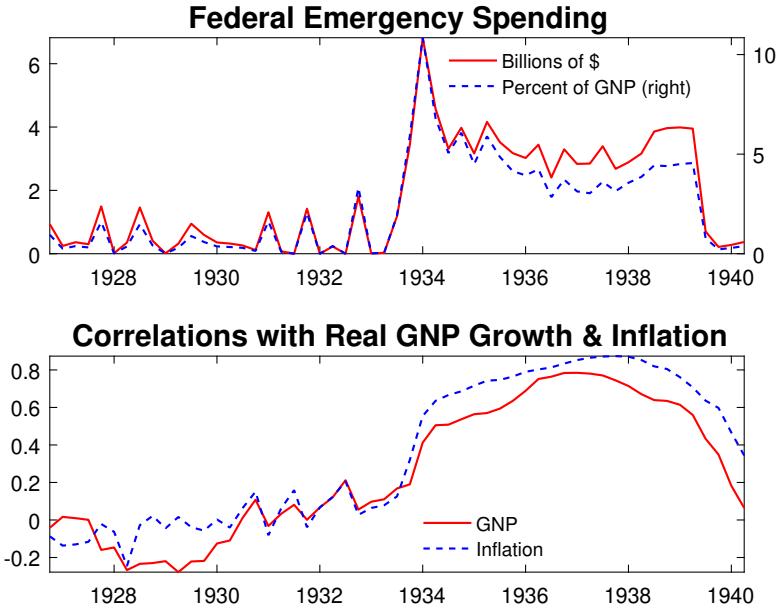

Figure 7: Emergency expenditures are total expenditures in excess of ordinary expenditures. Rolling correlations between inflation and real GNP growth and emergency federal expenditures as a share of GNP computed over a seven-year window. Source: Authors' calculations.

5.4 Developments in Government Debt

If FDR had intended to engineer an unbacked fiscal expansion, growth in government liabilities suggests he was successful. Nominal gross debt doubled during his first seven in office. By comparison, seven fiscal years after the financial crisis in 2008, U.S. gross federal debt increased by a factor of 1.8.

The left panel of figure 8 plots index numbers for nominal and real federal debt. Taken together, the two panels highlight central features of unbacked fiscal expansions: despite increases in nominal debt, real debt rises less dramatically and there may be no increase at all in debt as a share of income. The index equals 100 in 1932Q2 to 1933Q1, the year leading up to America's departure from the gold standard. After declining for a decade, nominal debt began to rise in 1931, while real debt started to increase a year earlier, due to deflation. From 1933Q2 until 1940Q2, the par value of nominal debt rose 112 percent, while real debt rose 82 percent. The ratio of these indexes reached its nadir when the country left gold and then rose 19 percent by 1940Q2, but 22 percent just before the 1937–1938 recession. Those changes in the ratio measure how much debt was devalued by a higher price level.[19]

More striking is the right panel of the figure. The debt-GNP ratio, whether measured at par or market value of debt, rose sharply from 15 percent in 1930 to 42 percent at the time gold was abandoned. Then it hovered around 40 percent for the next six years, until the recession raised the ratio. In the last few years of the decade, when Roosevelt abandoned the unbacked fiscal expansion policy, the debt-GNP ratio rose.

[19] These numbers are nearly identical when measured in terms of the market value of debt.

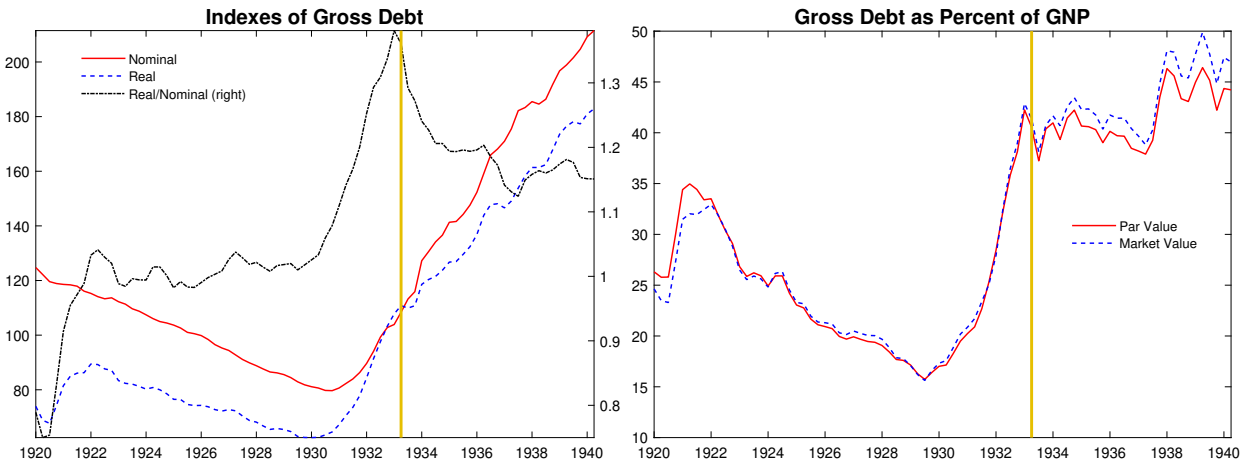

Figure 8: Par value of U.S. gross debt, real debt is par value deflated by GNP deflator. Converted to index numbers 100=1932Q2–1933Q1 (year before departure from gold standard). Nominal/Real is ratio of the two index numbers converted to percent. Par and market values of debt as percentage of nominal GNP. Vertical line marks when the United States abandoned the gold standard. Sources: Authors' calculations, Balke and Gordon (1986).

Figure 9 performs the accounting exercise that breaks the growth rate of the debt-GNP ratio in figure 8, B_t/P_tY_t, into growth rates of the three components. All three drove debt-output in the three years before Roosevelt took office. From the first quarter of 1993 on, nominal debt contributed to driving the ratio higher. That influence, though, was offset by higher prices and real GNP, with the exception of the recession of 1937–38.

5.5 Returns on Treasury Bond Portfolio

To interpret data related to the government's bond portfolio, we require some notation.[20] With a complete and general maturity structure, the government's budget identity is

$$\sum_{j=0}^{\infty} \left(Q_t^D(t+j) + IP_t(t+j)\right) B_{t-1}(t+j) = P_t s_t + \sum_{j=1}^{\infty} Q_t^D(t+j) B_t(t+j) \tag{4}$$

where $Q_t^D(t) \equiv 1$ and $IP_t(t+j)$ is the interest payable on bonds outstanding at t that mature in $t+j$. $Q_t^D(t+j)$ is the dirty price of bonds, defined as the clean price plus accrued interest.

The market value of debt outstanding in period t is

$$P_t^M B_t^M \equiv \sum_{j=1}^{\infty} Q_t^D(t+j) B_t(t+j) \tag{5}$$

so the budget identity may be rewritten as

$$R_t^M P_{t-1}^M B_{t-1}^M = P_t s_t + P_t^M B_t^M \tag{6}$$

[20] Appendix A.3 details the definitions and calculations that follow.

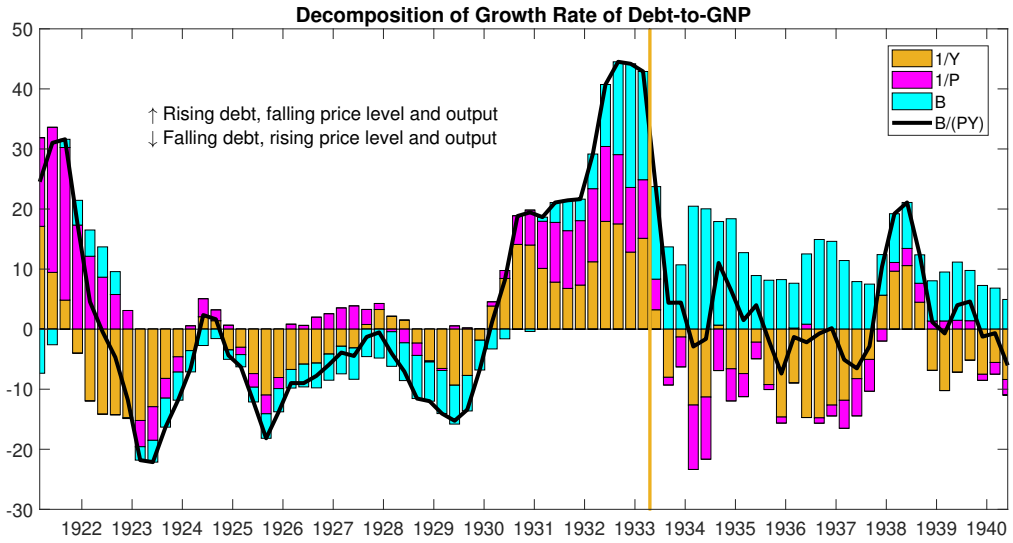

Figure 9: The four-quarter percentage change in debt-GNP ratio (solid line) decomposed into percentage changes of its components: nominal debt, the inverse of the price level, and the inverse of real GNP. Sources: Balke and Gordon (1986), Hall and Sargent (2015), and authors' calculations.

or, in real terms

$$r_t^M P_{t-1}^M b_{t-1}^M = s_t + P_t^M b_t^M \tag{7}$$

where $b_t^M \equiv B_t^M / P_t$ is the real par value of debt outstanding at t. The nominal and real rates of return on the portfolio—R_t^M and r_t^M—reflect *ex-post* returns.

With B_t^M the par value of debt and $P_t^M B_t^M$ the market value, $P_t^C B_{t-1}^M$ is the carry-over market value of debt. The growth rate in the market value of debt may be written as

$$\frac{P_t^M B_t^M}{P_{t-1}^M B_{t-1}^M} \equiv \underbrace{\frac{P_t^C B_{t-1}^M}{P_{t-1}^M B_{t-1}^M}}_{\substack{\text{nominal} \\ \text{rate of return}}} \cdot \underbrace{\frac{P_t^M B_t^M}{P_t^C B_{t-1}^M}}_{\text{size ratio}} \tag{8}$$

where P_t^C, defined in the appendix, reflects intermediate coupon payments and is the carry-over price of the portfolio. The first ratio on the right side of (8) is the nominal return, R_t^M, in (6). An *ex-post* real return simply deflates the nominal return by the inflation rate between $t-1$ and t to give r_t^M in (7).

The surprise component in the real return on the bonds portfolio is

$$\eta_t \equiv r_t^M - E_{t-1} r_t^M \tag{9}$$

This innovation can be decomposed into surprise capital gains and losses on the bond portfolio due to inflation and bond prices as

$$\eta_t = R_t^M \underbrace{(1/\pi_t - 1)}_{\text{due to price level}} + R_t^M \underbrace{\left(\frac{\sum_{j=1}^{\infty} \big(Q_t(t+j) - Q_{t-1}(t+j) \big) B_{t-1}(t+j)}{P_t^C B_{t-1}^M} \right)}_{\text{due to bond prices}} \tag{10}$$

	Gold Standard		Unbacked Fiscal Expansion	
	Monthly	*Annual*	*Monthly*	*Annual*
Nominal	0.24	2.91	0.23	2.72
Real	0.66	7.86	0.10	1.20
Surprise Real	0.40	4.81	−0.06	−0.76

Table 3: Summary of returns on government bond portfolio at monthly and annual rates.

Because η_t is the surprise revaluation on bonds carried into period t, its dollar magnitude is given by $\eta_t P^M_{t-1} B^M_{t-1}$. We gage the quantitative importance of these revaluations by computing them as a percentage of the market value of debt at the end of period t, $P^M_t B^M_t$.

Revaluation effects on nominal debt are a distinct feature of an unbacked fiscal expansion. An unanticipated increase in the primary deficit, financed by new bond issuance, does not trigger the expectation of higher surpluses in the future. The new bonds raise household nominal wealth and spending. Higher spending raises both the price level and production; the degree of nominal stickiness in the economy determines the precise split between the two. The maturity structure of government debt, together with how monetary policy reacts to the higher inflation, play a central role in the resulting inflation dynamics [Cochrane (2001), Leeper and Walker (2013), Sims (2013), Leeper and Leith (2017)].

Several patterns emerge from returns data in table 3. First, nominal returns are comparable across the gold standard and unbacked fiscal expansion period.[21] Second, real returns are substantially higher in the gold standard period than in the later period (average annual real returns of 7.86 percent versus 1.20 percent). Finally, on average, surprises in real returns are strongly positive in the early period (4.81 percent), but negative during the unbacked fiscal expansions (−0.76 percent).[22] These patterns are fully consistent with surprise inflation devaluing government debt during Roosevelt's administration.

A key feature of an unbacked fiscal expansion is that exogenous declines in surpluses, financed by nominal debt issuance, lead to revaluation of government debt through surprise increases in inflation and declines in bond prices. Sims (2013) computes surprise capital gains and losses on U.S. government bonds since World War II to argue that these revaluation effects are important—the same order of magnitude as annual fluctuations in primary surpluses. And Sims (2013), Leeper and Zhou (2013), and Leeper and Leith (2017) show that surprise revaluations of debt are a generic feature of any equilibrium produced by jointly optimal monetary and fiscal policies in the presence of distorting taxes and long-term debt.[23]

Figure 10 plots the nominal and real rates of return on the government's bond portfolio (top panel) and the one-month-ahead surprise change in the real return. Not surprisingly, *ex-post* real returns were high during the deflation in the years before leaving gold and far

[21] Return data start in 1926, so "gold standard" refers to 1926Q1 to 1933Q1.

[22] Romer (1992, p. 778) estimates the *ex-ante* real commercial paper rate to find that it is negative nearly the entire unbacked fiscal expansion period except the 1937–1938 recession.

[23] Of course, *any* stochastic model with monetary and fiscal policy in which inflation and interest rates fluctuate will generate revaluation effects. This holds regardless of the monetary-fiscal policy regime, so merely finding revaluation effects during the recovery of the 1930s does not imply that the United States experienced an unbacked fiscal expansion. Such an inference requires identifying assumptions, which we turn to in section 6.

lower once inflation picked up. But the bottom panel shows that surprise devaluations of the bond portfolio—η_t defined in (9)—were a distinct feature of the unbacked fiscal expansion period.[24]

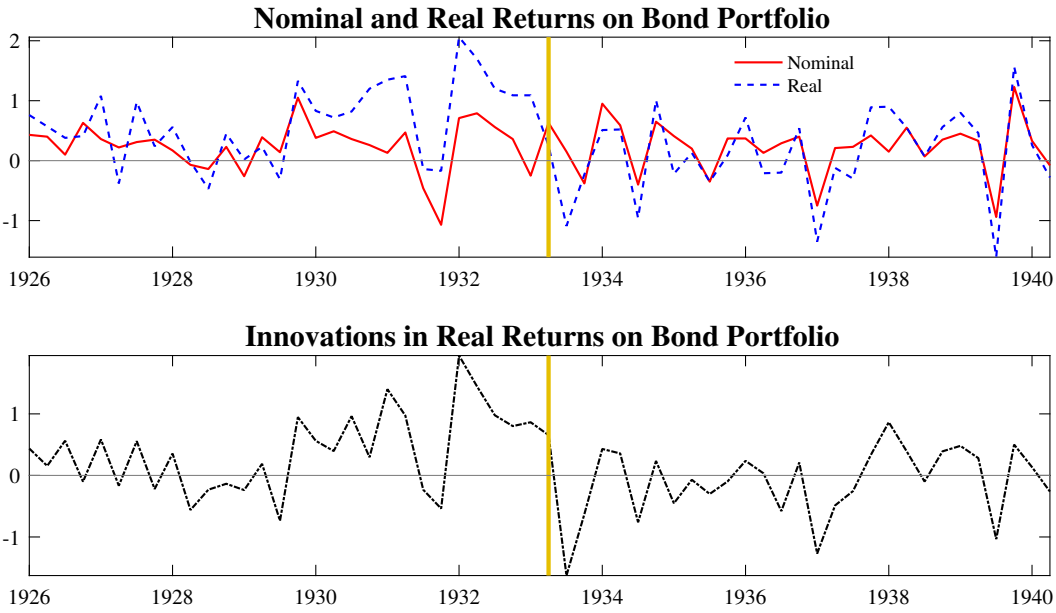

Figure 10: Quarterly averages of nominal and real net monthly returns on federal government bond portfolio and one-step-ahead unanticipated real monthly returns. See appendix A.3 for details. Vertical line marks when the United States abandoned the gold standard. Source: Hall and Sargent (2015), CRSP, and authors' calculations.

Surprise real returns on government debt are quantitatively important. Figure 11 shows that as a percentage of the market value of outstanding debt, these revaluations are a central feature of fiscal financing. The figure also makes clear that after leaving the gold standard, these revaluations are both large and frequently negative.

The decomposition of surprise real returns, graphed in figure 12, confirms that before leaving the gold standard, high realized real returns were driven by low inflation. The negative spike due to bond prices in 1931Q4 was created by the Fed's efforts to defend the gold parity by sharply raising discount rates. In the period of unbacked fiscal expansions, again with the exception of the jump in early 1938, surprise devaluations of debt due to inflation dominate the surprise real returns.

The last informal piece of empirical evidence about the unbacked fiscal expansion appears in figure 13, which plots the relative price of the bond portfolio. This relative price is computed as the real market value of debt over the par value of debt, which yields P_t^M/P_t, the goods-price of government bonds. Bonds became increasingly costly in terms of goods throughout the gold standard period, reaching a peak in 1933Q1. With the departure from

[24]Inspection of figure 10 may suggest that $\eta_t = r_t^M - 1$ indicating that innovations in real returns on the bond portfolio are a linear transformation of real returns. Appendix A.3 shows that when taking into consideration coupon payments and accrued interest, $\eta \neq r_t^M - 1$.

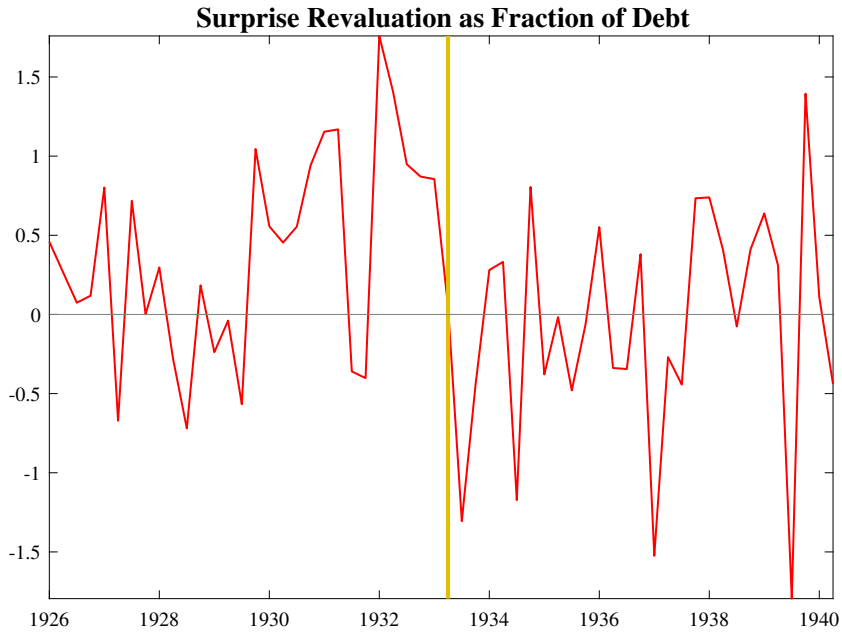

Figure 11: Surprises in real returns on bond portfolio as percentage of market value of outstanding debt, computed as $\eta_t P^M_{t-1} B^M_{t-1} / P^M_t B^M_t$. See appendix A.3 for details. Vertical line marks when the United States abandoned the gold standard. Source: Hall and Sargent (2015), CRSP, and authors' calculations.

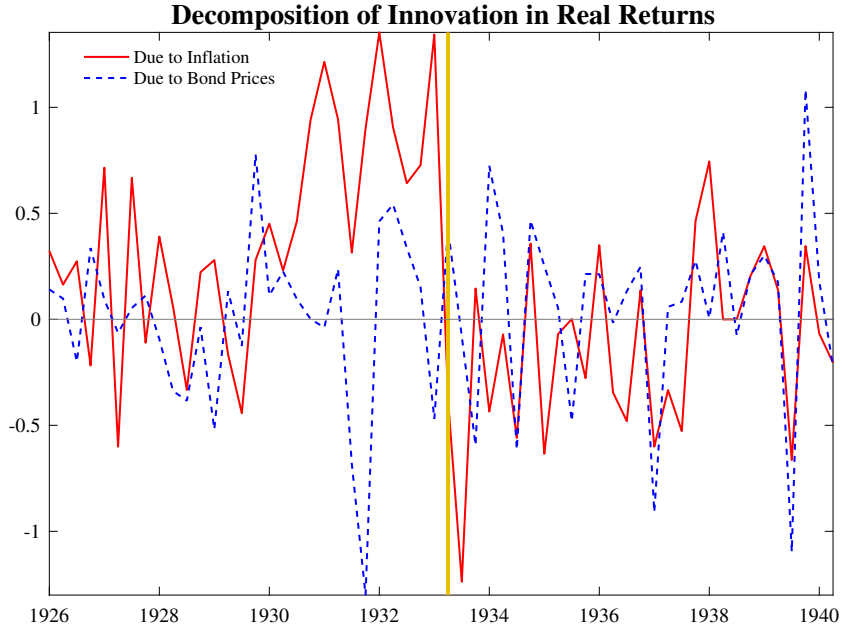

Figure 12: Decomposition of surprises in real returns on bond portfolio into components due to unanticipated inflation and unanticipated bond prices. See appendix A.3 for details. Vertical line marks when the United States abandoned the gold standard. Source: Hall and Sargent (2015), CRSP, and authors' calculations.

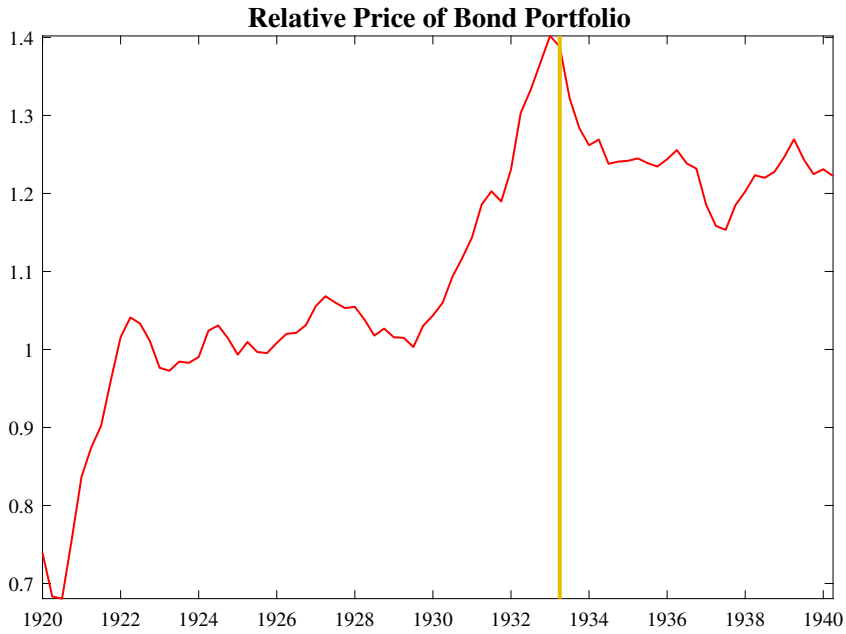

Figure 13: Relative price of the bond portfolio is the ratio of the real market value of debt to the par value of debt, roughly equivalent to the real "price" of the bond portfolio. Vertical line marks when the United States abandoned the gold standard. Source: authors' calculations.

gold came a steady devaluation of the bond portfolio, bottoming out in the middle of 1937 when the 1937–1938 recession began. This cheapening of bonds is consistent with bondholders substituting out of debt and into buying goods and services—an increase in aggregate demand triggered by unbacked fiscal expansion.

6 Structural VAR Analysis

We turn now to more formal analysis of fiscal and monetary impacts over the period of unbacked fiscal expansions. Because the identified VAR methodology is well understood, we review it only briefly here.[25]

6.1 VAR Methods

If y_t is a $k \times 1$ vector of time series, the economic structure is

$$A_0 y_t = A_+(L) y_{t-1} + \varepsilon_t \tag{11}$$

where $E\varepsilon_t\varepsilon_t' = I$ and ε_t is uncorrelated with y_s for $s < t$. The ε_t's are economically interpretable exogenous disturbances. The reduced-form is

$$y_t = B(L) y_{t-1} + u_t \tag{12}$$

where, assuming that A_0 is invertible, $B(L) = A_0^{-1}A_+(L)$, $u_t = A_0^{-1}\varepsilon_t$, and $Eu_tu_t' = A_0^{-1}(A_0^{-1})' = \Sigma$.

[25] See Leeper, Sims, and Zha (1996) or Christiano, Eichenbaum, and Evans (1999) for detailed surveys.

6.2 Data and Identification

We estimate a seven-variable monthly VAR from April 1933 to June 1940. The seven variables are: the commercial paper rate, R, (NSA), the monetary base, M, (NSA), federal primary surplus, S, (SA), the market value of nominal gross federal government debt, B, (NSA), the monetary gold stock, G, (NSA), monthly interpolated GNP deflator, P, (100 = 1926), and monthly interpolated real GNP, Y.[26]

VAR estimates employ the Sims and Zha (1998) prior, which allows for unit roots and cointegration, and probability bands are computed as in Sims and Zha (1999). When restrictions are imposed on lagged variables, estimation follows Cushman and Zha (1997) and Zha (1999). All variables except the primary surplus and the interest rate are logged; the interest rate is divided by 100 to put it in percentage units. We include six lags and a constant.[27]

This identification aims to be consistent with actual policy behavior in the post-gold standard period of the 1930s. In what follows, restrictions are imposed only on A_0, the contemporaneous interactions among innovations in variables, leaving lags unrestricted. With monthly time series, this means every variable responds to past values of every other variable.

Money Supply: The supply of monetary base, M^s, depends on the short-term nominal interest rate, R, and the monetary gold stock, G. The decision about whether or not to sterilize gold inflows lay with the Treasury during this period, but in the case when inflows were not sterilized, there was a direct impact of G on M^s. In addition, the Federal Reserve might decide to adjust supply in order to influence interest rates, so we have the relation

$$a_1 M_t^s = a_2 R_t + a_3 G_t + \varepsilon_t^{MP} \tag{13}$$

Money Demand: The demand for base money in a derived demand. Demand for for real balances, $M^d - P$, depends on the short-term nominal interest rate and income, Y

$$a_4 M_t^d = a_4 P_t + a_5 R_t + a_6 Y_t + \varepsilon_t^{MD} \tag{14}$$

The identification restricts the coefficients on nominal money and the price level to be equal.

Fiscal Policy: Fiscal policy chooses the primary surplus, S. An unindexed tax code makes revenues depend on the price level. Because surplus movements in the period were dominated by FDR's "emergency spending" programs, which were a reaction to prevailing economic conditions, there was little contemporaneous reaction of fiscal choices to variables other than measures of the price level and real economic activity. This leads to the fiscal rule

$$a_7 S_t = a_8 P_t + a_9 Y_t + \varepsilon_t^{PS} \tag{15}$$

[26] Primary surpluses were seasonally adjusted using the X-11 procedure in RATS. The deflator and real GNP were interpolated from Balke and Gordon's (1986) quarterly series using the Chow and Lin (1971) algorithm. Monthly series used to interpolate the deflator included M2, the consumer price index, the wholesale price index, the long-term yield on Treasury bonds (NBER Macrohistory Database, m13033a), and index composite wages (NBER Macrohistory Database, m08061c); series used to interpolate real GNP included industrial production, composite index of six roughly coincident series (NBER Macrohistory Database, m16003a); index of factory employment, total durable goods (NBER Macrohistory Database, m08146a), and production worker employment, manufacturing (NBER Macrohistory Database, m08010b).

[27] In notation analogous to that in Sims and Zha (1998), these results set the hyperparameters for the prior as $\mu_1 = 0.6, \mu_2 = 0.3, \mu_3 = 1.0, \mu_4 = 1.75, \mu_5 = 2.0, \mu_6 = 2.0$. The prior was chosen based on the model's marginal data density.

Government Debt: The VAR includes the nominal market value of gross federal debt, B. In principle, bond prices react immediately to all shocks in the economy, so B is an "information variable," in Leeper, Sims, and Zha's (1996) terminology. The debt equation is

$$a_{10}B_t = a_{11}R_t + a_{12}M_t + a_{13}S_t + a_{14}G_t + a_{15}P_t + a_{16}Y_t + \varepsilon_t^B \tag{16}$$

Gold: With the passage of the Gold Reserve Act in January 1934, the Treasury bought all gold at the price chosen by the Treasury and the President, which was $34.00 an ounce, a devaluation of the gold-value of the dollar of almost 60 percent from its value over the previous century. This made the demand for gold perfectly elastic at that price. Supply of gold to America, on the other hand, was driven by both exogenous political conditions in Europe and endogenous factors within the United States. Among those endogenous factors were the relative strength of the U.S. recovery, U.S. willingness to buy unlimited quantities of gold at a high price, increased sale of U.S. merchandise abroad as the dollar depreciated, the inflow of capital to the United States, and foreign-owned capital sent to U.S. to build up dollar balances or to purchase American securities [Paris (1938)]. We model the supply of monetary gold as a function of the nominal interest rate and goods-market conditions. Rather than separating demand and supply of gold, we posit an expression for the equilibrium monetary gold stock[28]

$$a_{17}G_t = a_{18}R_t + a_{19}P_t + a_{20}Y_t + \varepsilon_t^G \tag{17}$$

Goods Market: The remaining variables in the VAR are the price level and real GNP, which we refer to as "goods market variables." We follow much of the VAR literature by treating these as inertial variables that are predetermined and obey a recursive ordering. The limitation in this assumption is that we do not distinguish between the two "goods market shocks," treating them simply as disturbances unrelated to the behavior identified in other equations

$$a_{21}P_t = a_{22}Y_t + \varepsilon_t^P \tag{18}$$

$$a_{23}Y_t = \varepsilon_t^Y \tag{19}$$

Predeterminedness of goods market variables is not a stringent restriction for data at a monthly frequency.

Table 4 summarizes the identification. With 28 distinct moments in the covariance matrix of innovations and 23 freely estimated parameters, the system is overidentified.

The identification determines the money stock, nominal interest rate, and the gold stock simultaneously. With P and Y predetermined, given (18) and (19), (15) implies S. Equilibrium in the money and gold markets jointly determines M, R, and G. Finally, the market value of debt emerges from (16).

Table 5 reports posterior modes and 68-percent probability intervals for the estimated parameters in table 4's pattern matrix. The money supply rule is consistent with the central bank expanding high-powered money in response to surprise increases in the nominal interest rate. Contemporaneous interactions between gold and the base are weak. Money demand has a significantly negative interest elasticity and essentially no short-run income elasticity, which

[28]Equilibrium emerges from equating gold demand, $G^d = f(P^G)$, and gold supply, $G^s = g(P^G, R, P, Y)$, where P^G is the pegged gold price, and solving out for P^G.

	MP	MD	FP	B	G	P	Y
R	×	×		×	×		
M	×	$\times_1$		×			
S			×	×			
B				×			
G	×			×	×		
P		$\times_1$	×	×	×	×	
Y		×	×	×	×	×	×

Table 4: Pattern matrix for Baseline identification. × denotes a freely estimated parameter, $\times_1$ are restricted to be of equal but opposite sign, and a blank is a zero restriction.

is not surprising in monthly data. Primary surpluses are weakly connected to goods market innovations, although over longer horizons real economic activity does affect surpluses. Real income innovations raise the monetary gold stock, which is consistent with the U.S. economic recovery inducing gold inflows from abroad, which are met by an elastic demand for gold by the Treasury. Finally, the nominal market value of government bonds is significantly associated with contemporaneous innovations in variables, reflecting the responsiveness of asset prices to news. Those contemporaneous relationships make good economics sense: a surprisingly high market value of bonds is associated with negative innovations in the interest rate, money stock, primary surpluses, and the price level, but positive innovations in gold. Strongest effects are associated with the interest rate and inflation, as theory would suggest.

$$
\begin{aligned}
\underset{(.021,.070)}{.062} M^s &= \underset{(.597,1.836)}{1.134} R + \underset{(-.005,.002)}{.001} G + \varepsilon^{MP} \\
\underset{(.0349,.0986)}{.0586} (M^d - P) &= \underset{(-2.042,-.746)}{-1.844} R + \underset{(-.004,.011)}{.004} Y + \varepsilon^{MD} \\
\underset{(.0042,.0049)}{.0046} S &= \underset{(-.030,.009)}{-.009} P + \underset{(-.011,.004)}{.003} Y + \varepsilon^{PS} \\
\underset{(.016,.020)}{.019} G &= \underset{(-.270,.516)}{.135} R + \underset{(-.010,.029)}{.010} P + \underset{(.002,.018)}{.010} Y + \varepsilon^{G} \\
\underset{(.083,.097)}{.090} B &= \underset{(-1.020,-.525)}{-.782} R - \underset{(-.033,-.016)}{.024} M - \underset{(-.0026,-.0015)}{.0021} S + \underset{(.004,.008)}{.006} G \\
&\quad - \underset{(-.054,-.015)}{.034} P + \underset{(-.002,.013)}{.006} Y + \varepsilon^{B} \\
\underset{(.155,.180)}{.167} P &= \underset{(.019,.055)}{.038} Y + \varepsilon^{P} \\
\underset{(.061,.072)}{.066} Y &= \varepsilon^{Y}
\end{aligned}
$$

Table 5: Posterior mode estimates of parameters in table 4's pattern matrix. 68-percent probability intervals appear in parentheses. Coefficients and probability intervals in the table are divided by 1000.

6.3 Primary Surplus Impacts

Figure 14 reports the dynamic impacts of a surprise decrease in the real primary surplus during the unbacked fiscal expansion period. The one standard deviation initial shock raises the primary deficit by \$0.22 billion, which is about half of the average annualized monthly deficit in the sample. Because the deficit decays rapidly, the total increase over the three-year forecast horizon is only \$0.52 billion. This is a relatively small and transitory fiscal impulse. Higher deficits do not bring forth higher future surpluses, lending support to the interpretation that fiscal expansion is unbacked.

Higher deficits produce Keynesian impacts. Prices and output, which the identification prevents from rising contemporaneously, steadily increase and significantly so. The monthly impacts peak at 0.0046 percent for the price level and 0.0098 for real GNP, but the persistence of the responses implies that the total increases over the three-year horizon are substantial: 0.12 percent for the price level and 0.26 percent for output.

Monetary policy makes effort to offset the inflationary consequences of the fiscal expansion, suggesting the Fed behaves passively. Nominal interest rates fall slightly in the short run. The lower nominal rates, together with higher expected inflation, drive *ex-ante* real rates lower. Lower real rates induce households and firms to shift demand for goods into the present.

New nominal bonds finance the higher deficits. Debt jumps on impact and remains elevated. Economic recovery encourages gold to flow into the United States. By choosing not to sterilize gold inflows, the Treasury allows the monetary base to expand to accommodate rising demand for money.

Looking down the column in figure 14 it is easy to see the conventional monetary narrative of the recovery that Friedman and Schwartz (1963), Romer (1992), and Steindl (2004) recount.[29] The initial revaluation of gold, together with the steady inflows of gold largely due to political uncertainty in Europe, were permitted by the Treasury to steadily increase the monetary base. Expansion in high-powered money stimulated real activity and raised prices. At the same time, enhanced confidence in banks after the early 1930s crises reduced cash hoarding and raised the income velocity of money to reinforce the expansionary effects of the growth in the base.

But the impulse responses create a problem for this conventional narrative. How does one reconcile monetary-induced economic recovery with the sharp short-run declines in primary surpluses and the persistent increase in nominal government debt? Existing literature does not address this question, primarily because the fiscal dimensions have not been fully integrated with the monetary interpretations of the recovery.

[29] Friedman and Schwartz give this narrative a different twist than Romer. Friedman and Schwartz (1963, p. 499) write that "... the rise in the money stock [from 1933 to 1937] was produced not by the monetary authorities but by gold inflow. Though accidental gold inflows served the same economic function as compliant monetary authorities would have, it occurred despite rather than because of the actions of unions, business organizations, and government in pushing up prices." Romer, in contrast, attributes much of the growth in base money to the Treasury's decision not to sterilize the inflows, which was a policy choice.

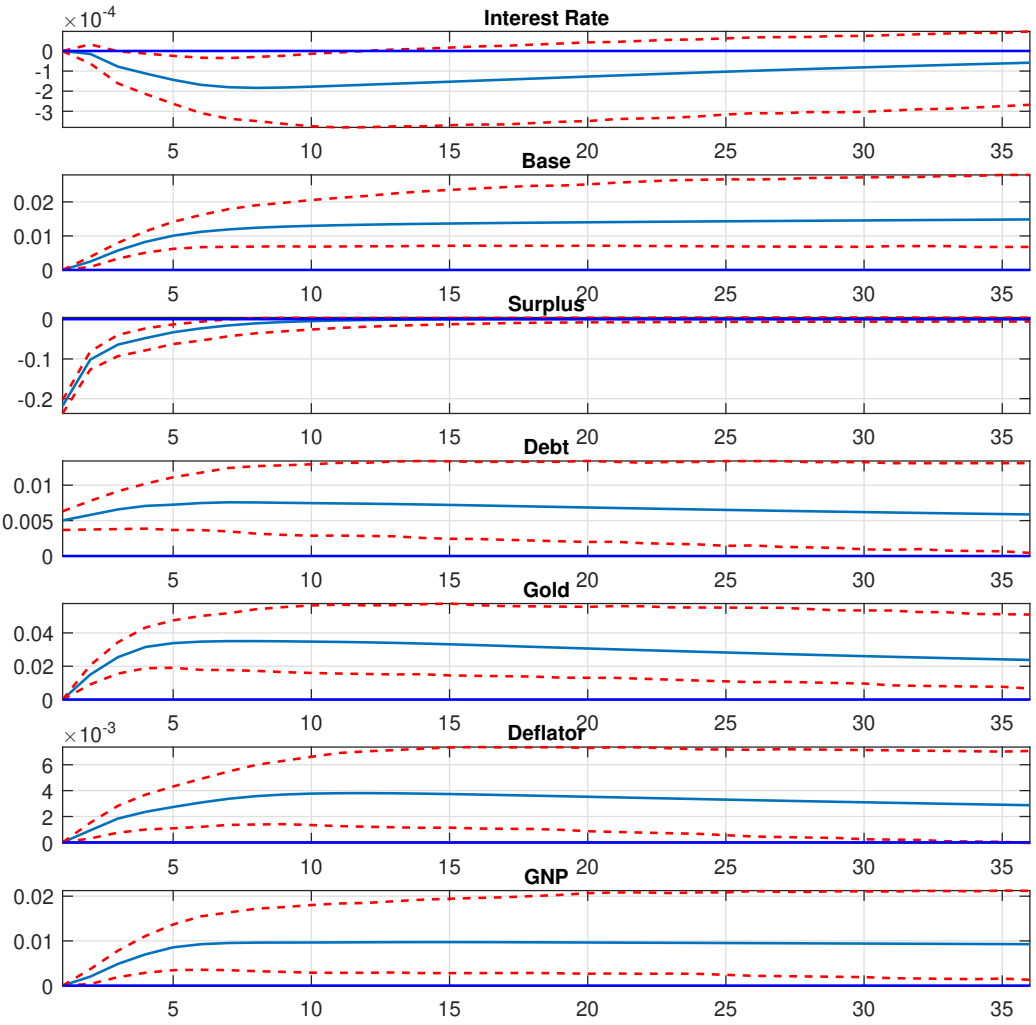

Figure 14: Responses to an unanticipated decrease in the primary surplus in the unbacked fiscal expansion period (April 1933 to June 1940). Solid lines are maximum likelihood estimates; dashed lines are 68 percentile probability bands based on 1000 draws from the posterior distribution of all the VAR parameters.

6.4 Monetary Impacts

Higher deficits generate positive comovements among output, the price level, the monetary base, and the gold stock. But that interpretation ascribes to fiscal policy a causal role. Perhaps those fiscally-induced correlations are but a small part of the story about the recovery. Perhaps other disturbances, unrelated to fiscal policy, generate the same comovements, but account for the bulk of fluctuations in output and prices, as the conventional monetary narrative maintains.

We address these concerns by examining the remaining impulse response functions. Figure 15 reports the dynamic impacts of four shocks related to the monetary sector—monetary policy, money demand, "government debt," and "the gold stock." Our identification does not attach any distinct behavioral interpretation to the shocks in the equations for debt and gold, other than that the disturbances emanate from bond and gold markets.

From early 1933 until December 1936, the Treasury opted not to sterilize gold inflows, which permitted the monetary base to expand along with the gold stock. We view figure 15 with an eye toward shocks that move base money strongly and persistently. The first two columns—monetary policy and money demand disturbances—generate such movements, but only money demand raises the gold stock, and then does so only very briefly. In any case, neither shock has significant impacts on the price level.

Turning to the fifth row of the figure—responses of the gold stock—we see that both bond-market and gold-market shocks persistently raise the gold stock, with gold-market shocks quantitatively more important. Positive innovations in gold are followed by a higher monetary base, although not significantly higher; if anything, though, higher monetary gold leads to lower prices and real GNP. These disturbances tend to be followed by a lower commercial paper rate and a higher market value of government debt.

Only disturbances to the primary surplus generate the full set of movements in assets, the price level, and real GNP that would seem to align with existing explanations of the recovery. But in the VAR, those movements are initiated by an exogenous shift in fiscal behavior. These impacts of a shock that raise the primary deficit are fully consistent with what the theory predicts for the consequences of an unbacked fiscal expansion. We turn now to how important these fiscal disturbances are in generating fluctuations in the variables of interest.

6.5 Quantitative Importance

We examine variance and historical decompositions to assess the quantitative importance of fiscal policy for the economic recovery. Those decompositions measure how important each exogenous shock is for future movements in the variables in the VAR.

6.5.1 Variance Decompositions Table 6 reports variance decompositions of the seven variables in the VAR at 6- and 36-month horizons. These statistics record how important disturbances in each exogenous shock are for explaining fluctuations in the variables, on average over the estimated sample.

Looking first at the goods market variables, P and Y, in the first two panels, aside from own shocks, the only disturbance that accounts for an important fraction of error variance in

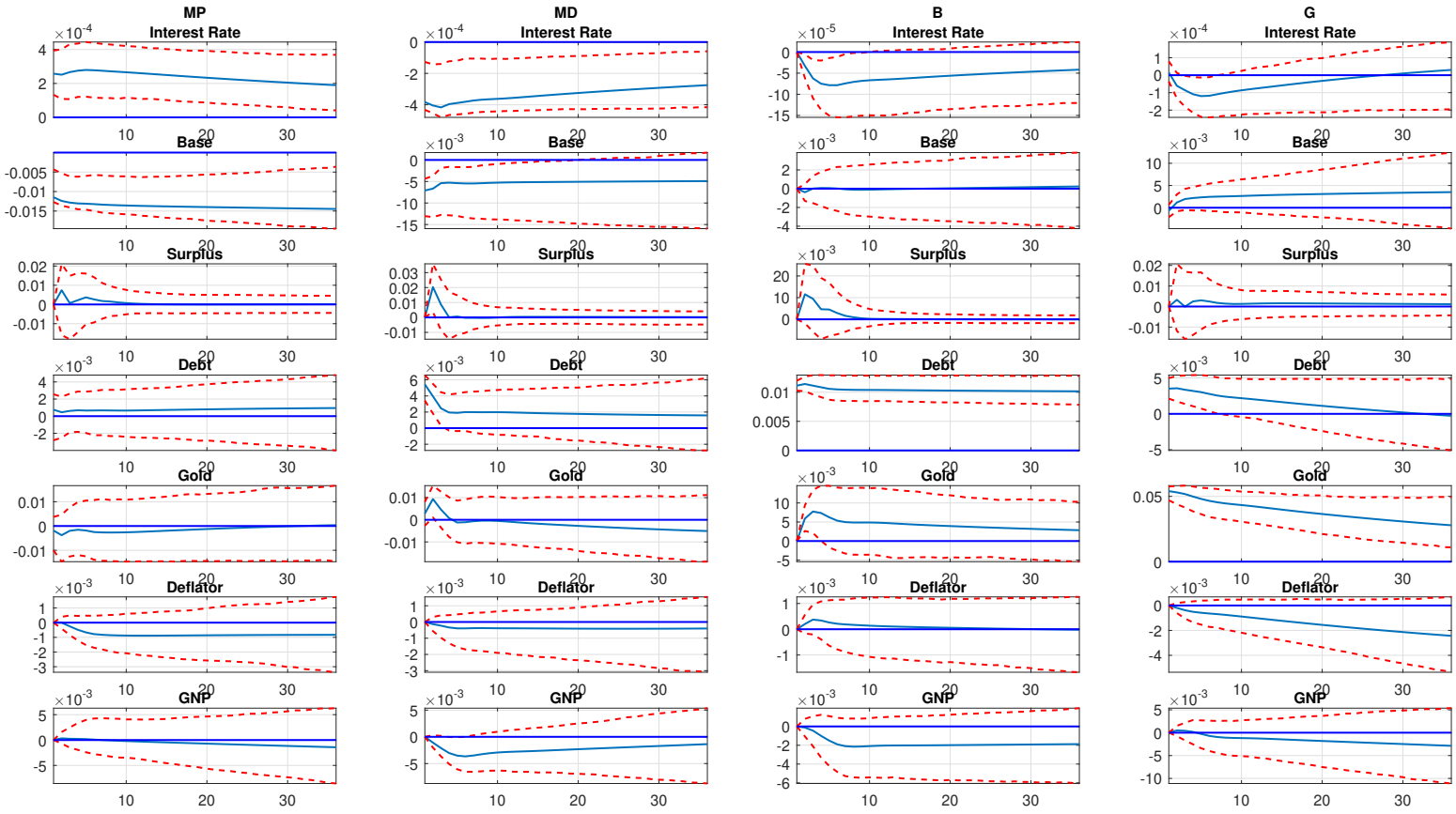

Figure 15: Responses to a unanticipated shocks in the "monetary sector," which includes monetary policy (MP), money demand (MD), government debt (B), and the gold stock (G). Unbacked fiscal expansion period (April 1933 to June 1940). Solid lines are maximum likelihood estimates; dashed lines are 68 percentile probability bands based on 1000 draws from the posterior distribution of all the VAR parameters.

those variables comes from fiscal policy. A bit under 20 percent of goods market variables' fluctuations arise from shocks to the primary surplus. Monetary disturbances—monetary policy, money demand, and gold flows—jointly explain only 5.6 percent.

Money market shocks together account for substantial fractions of error variances in the monetary base (53 percent) and the commercial paper rate (81 percent). But primary surpluses explain almost all the remaining variance in base money (42 percent), suggesting a strong endogenous response of money to fiscal disturbances.

Primary surpluses—the fifth panel—are largely exogenous, with own shocks accounting for 98 percent of surplus movements at all horizons. This finding is consistent with Roosevelt's "emergency spending" driving fiscal policy in the period. Of course, this spending was most decidedly *not exogenous* in the usual meaning of the term because the spending was an explicit response to economic conditions in the preceding years.

Primary surplus disturbances explain one-third of the forecast error variance in gold. This finding belies the argument by Friedman and Schwartz (1963) and others that gold inflows were almost entirely due to European political turmoil and gold discoveries. Of course, a substantial fraction (60 percent) of fluctuations in gold are due to exogenous shocks in demand and supply for gold, which may reflect the factors that Friedman and Schwartz emphasize.

6.5.2 Historical Decompositions The vector of variables in the VAR, y_t, may be decomposed into the forecast conditional only on initial conditions using estimated VAR parameters, $E_0 y_t$, and the sum of the realized exogenous shocks, ε_t, as

$$y_t = \sum_{s=0}^{t-1} C_s \varepsilon_{t-s} + E_0 y_t \tag{20}$$

Group the shocks into three bins: fiscal policy, $\varepsilon_t^F = \varepsilon_t^{PS}$, goods markets, $\varepsilon_t^M = (\varepsilon_t^P, \varepsilon_t^Y)$, and other, $\varepsilon_t^O = (\varepsilon_t^{MP}, \varepsilon_t^{MD}, \varepsilon_t^G, \varepsilon_t^B)$, with associated moving-average coefficients C^F, C^M, and C^O. Then (20) for variable j in period t may be written as

$$y_{jt} = E_0 y_{jt} + \sum_{i=1}^{t} C_j^F(i)\varepsilon_i^F + \sum_{i=1}^{t} C_j(i)\varepsilon_t^M + \sum_{i=1}^{t} C_j(i)\varepsilon_t^O \tag{21}$$

where each summation is the cumulative impact of exogenous shocks on variable j from period 1 to period t.

Figures 16 and 17 plot all the components in decomposition (21) for the price level and real GNP. After accounting for lags in the VAR estimation, forecasts run from October 1933 through June 1940. Solid lines are actual values, y_{jt}, and solid dotted lines are forecasts, $E_0 y_{jt}$. The remaining three lines are actual values less the contributions of each of the three shock groups.

Forecasts of both variables rise monotonically over the period, suggesting that in the absence of shocks, deterministic dynamics would raise prices and output. The marginal contribution of each shock group appears as the vertical distance between the actual value and the value less that group's addition. A consistent pattern across both figures is that the four shocks that constitute the "other" group—monetary policy, money demand, gold,

	Percent of P Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	0.5	0.2	9.2	0.1	0.4	89.1	0.6
36	1.1	0.3	18.1	0.0	4.2	75.6	0.7
	Percent of Y Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	0.0	1.5	8.9	0.3	0.0	6.8	82.5
36	0.1	1.2	17.4	0.7	0.7	4.6	75.3
	Percent of M Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	60.2	13.1	20.8	0.0	1.4	1.4	3.0
36	46.2	6.7	41.7	0.0	2.1	0.7	2.6
	Percent of R Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	26.5	57.6	4.2	1.4	3.2	4.5	2.7
36	27.1	53.9	7.4	1.6	1.7	6.2	2.3
	Percent of PS Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	0.1	0.7	98.0	0.4	0.1	0.3	0.4
36	0.1	0.7	97.9	0.4	0.1	0.3	0.4
	Percent of G Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	0.2	0.6	19.8	1.0	72.2	3.2	3.1
36	0.1	0.5	33.6	0.7	58.8	4.6	1.7
	Percent of B Due to Shocks in						
Months	**MP**	**MD**	**FP**	**B**	**G**	**P**	**Y**
6	0.2	5.4	22.3	61.5	5.4	1.5	3.7
36	0.4	2.6	26.9	63.8	1.9	0.9	3.6

Table 6: Percentage of forecast error variance in GNP deflator (P), real GNP (Y), monetary base (M), commercial paper rate (R), monetary gold stock (G), and nominal market value of debt (B) attributable to shocks to each equation. Columns may not sum to 100 due to rounding.

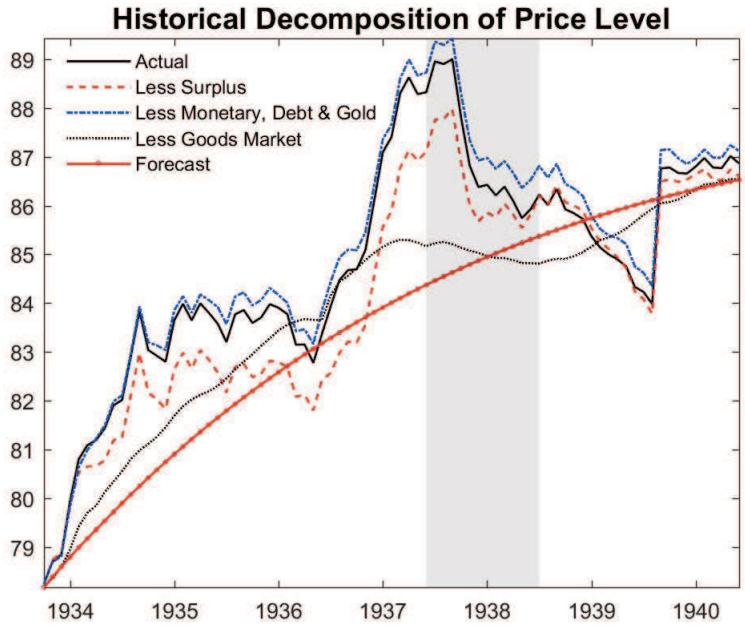

Figure 16: Historical decomposition of the price level into the right-hand-side components of equation (21).

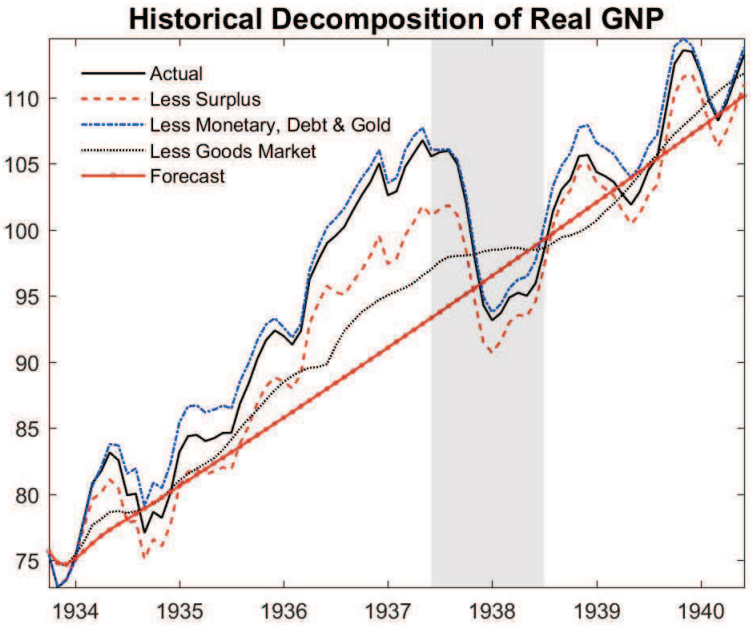

Figure 17: Historical decomposition of real GNP into the right-hand-side components of equation (21).

and debt—have small effects that run counter to Roosevelt's economic objectives: prices and output would be a bit higher in the absence of those disturbances.

Fiscal shocks always serve to raise real GNP and tend to raise the price level, except for a period in 1938–1939. Goods market disturbances are the biggest contributors to macroeconomic activity, but their impacts can be positive or negative, depending on the period.

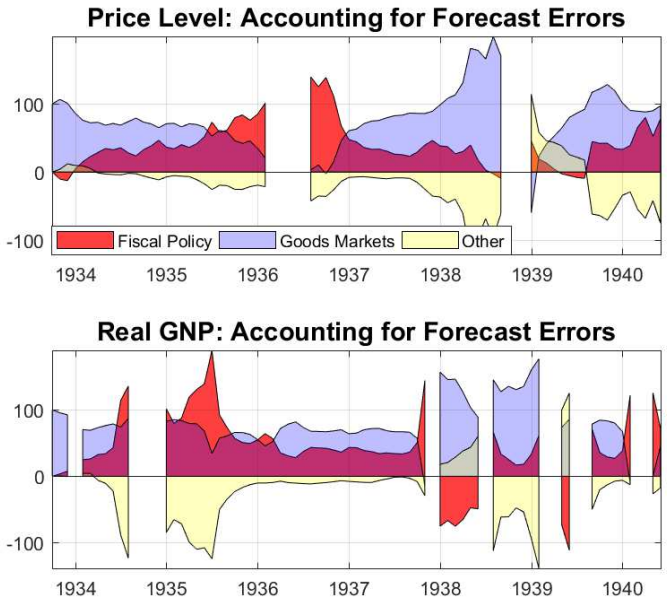

Figure 18: Percentages of forecast error of the price level and real GNP due to shock categories in equation (21), October 1933–June 1940, using April–September 1933 as initial conditions. Extreme values associated with near zero forecast errors have been excluded.

A clearer sense of each shock group's importance may be gleaned from the percentage of forecast errors accounted for by the group. Computing

$$1 = \frac{\sum_{i=1}^{t} C_j^F(i)\varepsilon_i^F}{y_{jt} - E_0 y_{jt}} + \frac{\sum_{i=1}^{t} C_j(i)\varepsilon_t^M}{y_{jt} - E_0 y_{jt}} + \frac{\sum_{i=1}^{t} C_j(i)\varepsilon_t^O}{y_{jt} - E_0 y_{jt}} \tag{22}$$

and converting to percentages, we obtain figure 18. The figure excludes periods when percentages are extreme because forecast errors are close to zero.[30]

Fiscal policy disturbances frequently account for a substantial fraction of forecast errors in the price level, rising steadily in the early part of the sample to explain about 100 percent in early 1936 (top panel of figure). That percentage rises still further later in 1936. On average, between January 1934 and July 1938, surplus disturbances account for over 45 percent of price-level forecast errors. In some periods, surpluses play a bigger role than do shocks from goods markets. In contrast, through the middle of 1938, "other" shocks always drive the price level down.

The story of fiscal shocks for output is more varied. Until late 1937, fiscal policy consistently drove output above forecast, accounting for an average of 66 percent of real GNP forecast errors between January 1934 to November 1937. By the second half of the recession that started in May 1937, though, fiscal shocks were driving down output substantially.

[30]Those periods arise when the actual values are close to the forecasts. Removing periods in which at least one percentage exceeds 200, for the price level removes March–July 1936 and October–December 1938, while for real GNP removes January 1934, October–December 1934, December 1937, July 1938, March–April 1939, July–August 1939, and March–April 1940.

7 Lessons for Today

We have argued that unbacked fiscal expansion was the source of the recovery from the Great Depression. Roosevelt's "try anything" policies produced debt-financed primary deficits that remained in place until recovery was underway. Monetary policy combined with that fiscal policy to stabilize debt by preventing nominal interest rates from rising with inflation. The paper offered a variety of evidence that debt-financed deficits generated gold inflows and expanded the monetary base at the same time that they raised prices and output. Gold inflows and higher base money that were not associated with higher deficits and nominal debt have little predictive power for the GNP deflator and real GNP. Despite rapid growth in nominal debt between 1933 and 1937, the debt-GNP ratio was stable at about 40 percent, the level it had reached before the United States abandoned gold. This leads to the conclusion that unbacked fiscal expansion lifted the U.S. economy out of the depression without endangering the creditworthiness of the country.

Roosevelt's successful, if incomplete, reflation carries two important lessons for policymakers today. Many countries now suffer from low—below-target—inflation rates and tepid economic growth. Rather than relying on a joint monetary-fiscal attack on the problem, as Roosevelt did, these countries are leaning entirely on monetary policy. Central banks in the Euro Area, Sweden, Switzerland, and Japan have set policy interest rates below zero and undertaken large-scale asset purchases in an effort to reduce real interest rates and stimulate aggregate demand and inflation. This policy relies on intertemporal substitution induced by low real rates, rather than the wealth effects of an unbacked fiscal expansion. Fiscal policies in those areas, meanwhile, have lacked Roosevelt's initial single-minded goal to stimulate the economy, fluctuating between fiscal stimulus and fiscal austerity. Despite the Herculean efforts of monetary authorities for several years, there is little evidence of reflation in those countries.

Ironically, those same countries and the United Kingdom, like the United States in the 1930s, are well positioned to undertake unbacked fiscal expansions. Monetary policies are already passive and central banks are on board to achieve higher inflation rates.[31]

A second lesson from the Roosevelt policies is that fiscal stimulus and fiscal sustainability need not be in conflict. When the aim is to raise inflation and economic growth, higher nominal government debt—if people are convinced it does not portend higher future taxes—can achieve both the macroeconomic objectives and the goal of stabilizing debt. The two goals go hand-in-hand: higher inflation reduces the real value of the debt and higher economic growth raises surpluses and reduces debt-output ratios. But to engineer an unbacked fiscal expansion, governments must understand that rapid growth in *nominal* debt need not threaten fiscal sustainability, just as it didn't in 1930s America.

In the current atmosphere of what Sims (2016) calls "hyper-Ricardian" beliefs about policy in which the public sees higher debt as bringing forth much higher surpluses in the future, it may be difficult for policymakers to credibly commit to an unbacked fiscal expansion. Here, too, FDR may have something to teach. Roosevelt never claimed to be aiming for what even he might have regarded as "irresponsible" fiscal policy. But his communications and

[31] Because individual Euro Area countries do not control their monetary policy, it would require a coordinated unbacked fiscal expansion across member nations together with the ECB's pegging of interest rates.

actions made clear that he was willing to do whatever it took to bring the country out of the depression. Roosevelt was also agnostic, willing to experiment, even with what at the time seemed to be radical policies. He kept the public's attention on the policy *objectives*, objectives over which there was nearly universal agreement, rather than on the policy tools.

Roosevelt's eventual backtracking on fiscal stimulus also carries a valuable message for policy makers today. Successful recovery from severe economic downturns mandates single-minded pursuit of economic recovery objectives. Allowing ancillary concerns to enter the calculus confuses economic decision makers and can undermine that success.

Appendices

A Data

A.1 Net Interest

A.1.1 Interest Receipts This section details our sources and calculation of monthly net interest. Interest receipts are only available on a yearly basis in the *Annual Report of the Secretary of the Treasury on the State of the Finances*. From 1928 to 1940, we use the total of series called "Interest, exchange, and dividends on capital stock" or "Total interest, exchange, dividends" computed from the unrevised daily Treasury statements.[32] Disaggregated components of this series are available in tables based on warrants issued or revised daily Treasury statements.[33]

[32]From 1928 to 1933, interest receipts are split into general and special funds categories. We use total interest receipts.

[33] On Page 389 of the 1928 Annual Report, daily Treasury statements (unrevised) are defined as figures compiled "from the latest daily reports received by the Treasurer of the United States, from Treasury officers, and public depositaries holding Government funds. The daily Treasury statement, therefore, is a current report compiled from latest available information, and, by reason of the promptness with which the information is obtained and made public, it has come into general use as reflecting the financial operations of the Government covering a given period, and gives an accurate idea of the actual condition of the Treasury as far as it is ascertainable from day to day. This is known as 'current cash basis,' according to daily Treasury statements (unrevised)." Revised Treasury statements reflect actual transactions during the period under review. Page 373 of the 1929 annual report explains that receipts and expenditures are revised "on account of the distance of some of the Treasury offices and depositaries from the Treasury, it is obvious that the report from all officers covering a particular day's transactions can not be received and assembled in the Treasury at one time without delaying for several days the publication of the Treasury statement." Warrants issued (receipts) are defined based on Section 305 of the Revised Statues as, "receipts for all moneys received by the Treasurer of the United States shall be indorsed upon warrants signed by the Secretary of the Treasury, without which warrants, so signed, no acknowledgment for money received into the Public Treasury shall be valid. The issuance of warrants by the Secretary of the Treasury, as provided by law, represents the formal covering of receipts into the Treasury." Warrants issued (expenditures) are defined by the fact that, "The Constitution of the United States provides that no money shall be drawn from the Treasury but in consequence of appropriations made by law. Section 305 of the Revised Statutes requires that the Treasurer of the United States shall disburse the moneys of the United States upon warrants drawn by the Secretary of the Treasury. As the warrants are issued by the Secretary they are charged against the appropriate appropriations provided by law. Some of these warrants do not represent actual payments to claimants, but are merely advances of funds to be placed to the credit of disbursing officers of the Government with the Treasurer of the United States for the payment of Government obligations. The disbursing officer then issues his check on the Treasurer in payment of such obligations. As far as the appropriation accounts are concerned, the warrants issued and charged thereto constitute expenditures, but it will be observed that such expenditures necessarily include unexpended balances to the credit of the disbursing officers. Under normal conditions these balances over a period of several years fluctuate very little in the aggregate, and the difference between the total expenditures on a warrant basis and a cash basis (revised) is immaterial.

TABLE 1.—*Receipts and expenditures for the fiscal year 1928, classified according to funds*

[On basis of daily Treasury statements (revised), see p. 389]

	General funds	Special funds (various acts) [1]	Trust funds (various acts) [1]	District of Columbia (act June 29, 1922) [2]	Total
Ordinary receipts:					
Revenue receipts—					
Customs	$568,154,301.86	$2,291.06			$568,156,592.92
Internal revenue	2,791,799,268.52	393,843.15			2,792,193,111.67
Interest, premium, and discount	[3] 43,706,736.12	136,388,871.69			[3] 180,095,607.81

[1] Exclusive of District of Columbia special and trust funds.
[2] Includes District of Columbia special and trust funds.
[3] Includes $11,212,165.68 receipts credited direct to appropriations.

Figure 19: 1928 Annual Report, page 391

TABLE 1.—*Receipts and expenditures for the fiscal year 1929, classified according to funds*

[On basis of daily Treasury statements (revised), see p. 373]

	General funds	Special funds (various acts)[1]	Trust funds (various acts)[1]	District of Columbia (act June 29, 1922)[2]	Total
ORDINARY RECEIPTS					
Revenue receipts:					
Customs	$602,813,939.84	$6,216.58			$602,820,156.42
Internal revenue	2,939,629,903.78	414,582.31			2,940,044,486.09
Miscellaneous taxes	6,217,857.20	2,842,745.01			9,060,602.21
Interest, exchange, and dividends on capital stock	32,783,750.49	137,786,535.06			170,570,285.55

Figure 20: 1929 Annual Report, page 374

In 1927, interest receipts are only available based on warrants issued.[34] Although the aggregate total of "Interest, premium, and discount" is no longer provided, the disaggregated elements of this total are included. We continue to included dividends, premiums, discounts, and exchanges to be consistent with the years when only the aggregate series is available.

[34] See footnote 33 for a description of warrants versus unrevised cash basis.

TABLE 4.—*Comparison of detailed receipts for the fiscal years 1927 and 1926*

[On basis of warrants issued, see p. 421]

	1927	1926	Increase, 1927	Decrease, 1927
Ordinary receipts:				
Customs—				
Duties	$603, 426, 552. 67	$577, 891, 561. 18	$25, 534, 991. 49	
Tonnage tax	2, 245, 912. 51	1, 825, 049. 44	420, 863. 07	
	605, 672, 465. 18	579, 716, 610. 62	25, 955, 854. 56	
Internal revenue—				
Income tax	2, 219, 952, 443. 72	1, 974, 104, 141. 33	245, 848, 302. 39	
Miscellaneous internal revenue taxes	648, 230, 548. 89	862, 252, 303. 79		$214, 021, 754. 90
Collections under enforcement of national prohibition act	[1] 501, 891. 11	[2] 415, 336. 63	86, 554. 48	
	2, 868, 684, 883. 72	2, 836, 771, 781. 75	245, 934, 856. 87	214, 021, 754. 90
Public lands (included in public domain receipts below).				
Miscellaneous—				
Interest, premium, and discount—				
Interest on bonds of foreign governments under funding agreements	139, 826, 159. 14	139, 804, 662. 99	21, 496. 15	
Interest on unfunded obligations of foreign governments	20, 563, 440. 76	19, 556, 925. 99	1, 006, 514. 77	
Interest on miscellaneous obligations	1, 092, 143. 04	989, 520. 80	102, 622. 24	
Interest on overpayments under section 209, transportation act, 1920, as amended	5, 244. 48	17, 811. 46		12, 566. 98
Interest on farm loan bonds	670, 060. 92	3, 648, 139. 22		2, 978, 078. 30
Interest on public deposits	4, 707, 706. 25	4, 530, 081. 48	177, 624. 77	
Interest on advance payments to contractors	44, 551. 39	194, 161. 69		149, 610. 30
Dividends on capital stock of the Panama Railroad owned by the United States	350, 000. 00	350, 000. 00		
Final dividend of the U. S. Sugar Equalization Board	[3]			
Gain by exchange	1, 707, 203. 70	24, 418. 98	1, 682, 784. 72	

[3] On July 15, 1926, the unexpended balance to the credit of the checking account of the United States Sugar Equalization Board on the books of the Treasurer of the United States amounting to $11,370,621.39 was transferred to the warrant account, $5,000,000 of which was covered into the Treasury to the credit of the appropriation as a repayment of capital stock originally advanced therefrom; the remainder, $6,370,621.39, was covered into the Treasury as "Miscellaneous Receipts—final dividends of United States Sugar Equalization Board." Since this transfer of funds from one account to another is merely an adjustment between accounts in this fiscal year of cash transactions occurring in prior fiscal years, the items have not been included in the receipts or expenditures as they did not affect the cash in the Treasury during the current fiscal year.

Figure 21: 1927 Annual Report, page 431

Starting in 1922, interest receipts, premium, discounts, and exchanges are no longer given as separate categories. The components of federal receipts are listed alphabetically.[35]

Comparison of receipts, fiscal years 1922 and 1921, on the basis of warrants issued (net).

	1922	1921	Increase, 1922.	Decrease, 1922.
Customs	$357,544,712.40	$308,025,102.17	$49,519,610.23	
Internal revenue:				
Income and profits taxes	2,086,918,464.85	3,228,137,673.75		$1,141,219,208.90
Miscellaneous	1,121,239,843.45	1,351,835,935.31		230,596,091.86
Sales of public lands	895,391.22	1,530,439.42		635,048.20
Alaska fund	136,053.10	174,329.90		38,276.80
Assessments on Federal reserve banks for salaries, etc.	3,067,169.36	4,819,339.72		1,752,170.36
Assessments on national banks for expenses of examiners	2,012,600.00	1,583,037.11	429,562.89	
Consular fees	6,707,058.72	5,676,850.61	1,030,208.11	
Customs fees, fines, penalties, services of officers, etc.	1,032,589.34	1,173,285.63		140,696.29
Commerce collections	239,432.57	305,904.84		66,472.27
Donation of royalty on machine guns		520,266.12		520,266.12
Depredations on public lands	60,149.90	68,646.25		8,496.35
Deposits for surveying public lands	68,461.03	62,324.51	6,136.52	
District of Columbia general receipts	14,777,218.19	14,439,985.93	337,232.26	
District of Columbia sources	457,798.25	561,106.29		103,308.04
Discount on bonds, notes, and certificates purchased	3,436,145.91	10,675,194.55		7,239,048.64
Earnings on radio service	369,735.67	666,371.84		296,636.17
Federal land banks, liquidation of capital stock	1,057,830.00	954,835.00	102,995.00	
Food Administration		37,078,988.55		37,078,988.55
Forest Service, cooperative fund	1,394,826.71	1,946,041.18		551,214.47
Fees on letters patent	2,875,013.15	2,696,502.46	178,510.69	
Forest reserve fund	5,125,668.20	2,591,297.93	2,534,370.27	
Franchise tax (surplus earnings of Federal reserve banks)	59,974,465.64	60,724,742.27		750,276.63
Funds contributed for river and harbor improvements	2,930,051.68	3,774,947.68		844,896.00
Gain by exchange	7,245,624.49	19,008.08	7,226,616.41	
Grain Corporation, decrease of capital stock	25,000,000.00	100,000,000.00		75,000,000.00
Housing Corporation, operations and disposal of properties	4,523,207.53	4,240,055.17	283,152.36	
Farm loan bonds:				
Principal	44,400,000.00		44,400,000.00	
Interest	8,611,170.08	8,306,075.00	305,095.08	
Foreign loans:				
Principal	49,114,107.46	83,678,223.38		34,564,115.92
Interest	6,607,723.54	18,327,306.91		11,719,583.37
Interest on foreign obligations, sale of surplus property, War Department	21,107,317.25	12,701,508.93	8,405,808.32	
Interest on public deposits	7,388,278.07	5,668,852.42	1,719,425.65	
Interest on loans to railroad companies	[1] 3,000.00	[2] $4,000.00		$1,000.00
Interest on advance payments to contractors	14,300.29	667,383.05		653,082.76
Immigrant fund	2,517,823.19	5,767,893.69		3,250,070.50
Judicial fees, fines, penalties, etc	5,132,937.71	4,382,676.51	750,261.20	
Land fees	1,139,880.25	1,753,759.83		613,879.58

[1] Exclusive of $12,906,960.89 interest received on account of loans to railroads under section 210 of the transportation act of 1920, and $27,324,181.14 interest collected under the provisions of the Federal control act of Mar. 21, 1918, which amounts were credited, respectively, to the revolving funds, "Loans to railroads" and "Federal control of transportation systems."

[2] Exclusive of $4,369,007.49 interest received on account of loans to railroads under sec. 210 of the transportation act of 1920, and $26,415,163.88 interest collected under the provisions of the Federal control act of Mar. 21, 1918, which amounts were credited, respectively, to the revolving funds, "Loans to railroads" and "Federal control of transportation systems."

Figure 22: 1922 Annual Report, page 107

Interest receipts on foreign obligations – a subset of total interest receipts – are available on an unrevised cash basis. This data is also available at a monthly frequency for fiscal years 1929 to 1931 and 1936 to 1940. The location of these data is included in Table 7.

[35]Net warrants issued includes unexpended balances to the credit of disbursing officers at the end of the year, but not expenditures under such unexpended balances at the beginning of the year.

Table name	Year	Basis	Page number
Comparison of receipts, fiscal years 1920 and 1919	1920	warrant	262/263
Comparison of receipts, fiscal years 1921 and 1920	1921	warrant	140
Receipts and expenditures for fiscal years 1920 and 1921 (int. on foreign obligations)		unrevised	152
Comparison of receipts, fiscal years 1922 and 1921	1922	warrant	107
Receipts and expenditures for fiscal years 1921 and 1922 (int. on foreign obligations)		unrevised	100
Comparison of receipts, fiscal years 1923 and 1922	1923	warrant	114
Receipts and expenditures for fiscal years 1922 and 1923 (int. on foreign obligations)		unrevised	107
Comparison of receipts, fiscal years 1924 and 1923	1924	warrant	131
Receipts and expenditures for fiscal years 1923 and 1924 (int. on foreign obligations)		unrevised	123
Comparison of receipts, fiscal years 1925 and 1924	1925	warrant	150
Receipts and expenditures for fiscal years 1924 and 1925 (int. on foreign obligations)		unrevised	141
Comparison of receipts, fiscal years 1926 and 1925	1926	warrant	429
Receipts and expenditures for fiscal years 1925 and 1926 (int. on foreign obligations)		unrevised	176
Comparison of receipts, fiscal years 1927 and 1926	1927	warrant	431
Receipts and expenditures for fiscal years 1926 and 1927 (int. on foreign obligations)		unrevised	30
Receipts and expenditures for the fiscal year 1928	1928	revised	391
Receipts and expenditures for the fiscal year 1928 (int. on foreign obligations)		unrevised	19
Receipts and expenditures for the fiscal year 1929	1929	revised	375
Receipts and expenditures for the fiscal year 1929 (int. on foreign obligations)		unrevised	20
Ordinary Receipts (monthly) (foreign obligations)		unrevised	535
Receipts and expenditures for the fiscal year 1930	1930	revised	469
Receipts and expenditures for the fiscal year 1930 (int. on foreign obligations)		unrevised	35
Ordinary Receipts (monthly) (foreign obligations)		unrevised	631
Receipts and expenditures for the fiscal year 1931	1931	warrant	426
Receipts and expenditures for the fiscal year 1931 (int. on foreign obligations)		unrevised	25
Receipts and Expenditures, by months (foreign obligations)		unrevised	575
Receipts and expenditures for the fiscal year 1932	1932	warrant	341
Receipts and expenditures for the fiscal year 1932 (int. on foreign obligations)		unrevised	27
Details of receipts by sources and funds, for the fiscal year 1933	1933	warrant	310
Receipts and expenditures for the fiscal year 1933 (int. on foreign obligations)		unrevised	19
Details of receipts by sources and funds, for the fiscal year 1934	1934	warrant	276
Receipts and expenditures for the fiscal year 1934 (int. on foreign obligations)		unrevised	20
Details of receipts by sources and funds, for the fiscal year 1935	1935	warrant	296
Receipts and expenditures for the fiscal year 1935 (int. on foreign obligations)		unrevised	32
Details of receipts by sources and funds, for the fiscal year 1936	1936	warrant	314
Receipts and expenditures for the fiscal year 1935 (int. on foreign obligations)		unrevised	35
Classified receipts and expenditures, monthly		unrevised	339/344
Actual receipts for the fiscal year 1937	1937	warrant	380
Classified receipts and expenditures for the fiscal years 1932 to 1937		unrevised	338
Classified receipts and expenditures, monthly (int. on foreign obligations)		unrevised	320/326
Actual receipts for the fiscal year 1937	1938	warrant	457
Classified receipts and expenditures for the fiscal years 1932 to 1938		unrevised	401
Classified receipts and expenditures, monthly (int. on foreign obligations)		unrevised	379/387
Details of receipts, by sources and accounts	1939	warrant	314
Classified receipts and expenditures, monthly (int. foreign obligations)		unrevised	337/345
Details of receipts, by sources and accounts.	1940	warrant	587
Classified receipts and expenditures, monthly (int. foreign obligations)		unrevised	612/619

Table 7: Table names and page numbers from the *Annual Reports of the Secretary of the Treasury* for interest receipts

A.1.2 Interest Expenditures Interest expenditures are available on a monthly basis starting in January 1922. For July 1919 to December 1921, interest expenditures are available on a quarterly frequency. We divide the quarterly data by three to interpolate monthly data for this time period.

Table name	Year	Basis	Page number
Preliminary Statement Showing Classified Expenditures (quarterly)...	1920	unrevised	see 1921 357
Receipts and expenditures of the Government for fiscal (yearly)...		unrevised	see 1926 448
Preliminary Statement Showing Classified Expenditures (quarterly)...	1921	unrevised	357
Receipts and expenditures of the Government for fiscal (yearly)...		unrevised	see 1926 448
Preliminary Statement Showing Classified Expenditures (monthly)...	1922	unrevised	103
Receipts and expenditures of the Government for fiscal (yearly)...		unrevised	see 1926 448
Preliminary Statement Showing Classified Expenditures (monthly)...	1923	unrevised	110
Receipts and expenditures for fiscal years 1922 and 1923 (yearly)		unrevised	107
Preliminary Statement Showing Classified Expenditures (monthly)...	1924	unrevised	127
Receipts and expenditures for fiscal years 1923 and 1924 (yearly)		unrevised	123
Preliminary Statement Showing Classified Expenditures (monthly)...	1925	unrevised	145
Receipts and expenditures for fiscal years 1924 and 1925 (yearly)		unrevised	142
Expenditures of the Government, by months for the fiscal year 1926	1926	unrevised	452
Receipts and expenditures of the Government for fiscal years (yearly)		unrevised	450
Expenditures by months, classified according to...	1927	unrevised	463
Ordinary receipts, expenditures chargeable against... (yearly)		unrevised	448
Expenditures by months, classified according to...	1928	unrevised	425
Receipts and expenditures for the fiscal year 1928		unrevised	19
Expenditures by months, classified according to...	1929	unrevised	414
Receipts and expenditures for the fiscal year 1929 (yearly)		unrevised	20
Expenditures by months, classified according to...	1930	unrevised	510
Receipts and expenditures for the fiscal year 1930 (yearly)		unrevised	35
Expenditures by months, classified according to...	1931	unrevised	464
Ordinary receipts, expenditures chargeable against... (yearly)		unrevised	446
Expenditures by months, classified according to...	1932	unrevised	371
Receipts and expenditures for the fiscal year 1932 (yearly)		unrevised	27
Expenditures by months, classified according to...	1933	unrevised	313
Receipts and expenditures for the fiscal year 1933 (yearly)		unrevised	280
Expenditures by months, classified according to...	1934	unrevised	308
Receipts and expenditures for the fiscal year... (yearly)		unrevised	305
Expenditures by months, classified according to...	1935	unrevised	330
Expenditures by months, classified according to (yearly)...		unrevised	334
Classified receipts and expenditures, monthly	1936	unrevised	337
Classified receipts and expenditures, monthly (yearly)		unrevised	339
Classified receipts and expenditures, monthly	1937	unrevised	322/328
Classified receipts and expenditures, monthly (yearly)		unrevised	328
Classified receipts and expenditures, monthly	1938	unrevised	381/389
Classified receipts and expenditures, monthly (yearly)		unrevised	389
Classified receipts and expenditures, monthly	1939	unrevised	339/347
Classified receipts and expenditures, monthly (yearly)		unrevised	347
Classified receipts and expenditures, monthly	1940	unrevised	614/621
Classified receipts and expenditures, monthly (yearly)		unrevised	621

Table 8: Table names and page numbers from the *Annual Reports of the Secretary of the Treasury* for interest expenditures

A.1.3 Calculating Monthly Net Interest Because interest receipts are only available on a yearly basis, we are only able to calculate net interest on a yearly basis. We then use the yearly net interest series to impute monthly net interest. We first calculate the ratio of yearly interest receipts to yearly interest expenditures and then multiply this ratio by monthly interest expenditures to impute monthly interest receipts. Let the expression for imputed interest receipts in month t be given as:

$$\text{Imputed Monthly Interest Receipts}_t = \frac{\text{Yearly Interest Receipts}}{\text{Yearly Interest Expenditures}} * \text{Monthly Interest Expenditures}_t$$

Monthly net interest is then calculated as:

$$\text{Imputed Monthly Net Interest}_t = \text{Monthly Interest Expenditures}_t - \text{Imputed Monthly Interest Receipts}_t$$

A.2 Federal Receipts and Expenditures

This section details how our series of monthly federal receipts and expenditures from July 1919 to June 1940 from the *Annual Reports of the Secretary of the Treasury on the State of Finances* differ from other sources. We use data for receipts and expenditures that was revised in 1933 to "cover all expenditures of the Reconstruction Finance Corporation, including payments against credits established for the corporation through the purchase of its notes under section 9 of the Reconstruction Finance Corporation Act."[36] We use data on an unrevised cash basis for receipts and expenditures.[37]

Our three main sources of comparison are data from the NBER Macro History Database (NBER)[38], Firestone's (1960) book, and Romer (1992) who uses receipts and outlays[39] from the 1979 *Statistical Appendix to the Annual Report*, table 2, pp. 4-11 [Romer (1992)].

A.2.1 Federal Receipts Receipts from Firestone correspond to our series except for fiscal years 1931, 1932, and 1940. On page 80, Firestone explains that trust fund receipts were eliminated from internal revenue after June 1932 and his series take into a account this revision back to July 1930. Firestone (page 82) also deducts net transfers from the Federal Old-Age and Survivors Insurance Trust Fund from receipts to obtain lower monthly receipts for fiscal year 1940. The NBER receipts data is split into three receipt series a, b, and c. NBERa matches our series up to fiscal year 1932. NBERb matches Firestone for fiscal years 1931 and 1932 – also taking into account the elimination of trust fund receipts – and then tracks our series through fiscal year 1940. NBERc (not shown) also deducts net transfers from the Federal Old-Age and Survivors Insurance Fund and thus tracks Firestone for fiscal year 1940.

[36] Footnote 1, Table 6, page 312 of *Annual Report of the Secretary of the Treasury on the State of the Finances for Fiscal year ended June 30, 1933*

[37] See footnote 33 for an explanation of accounting conventions.

[38] Accessed via the NBER's Macrohistory Database, Chapter 15

[39] Starting in 1968, the Department of the Treasury (various) introduced new unified budget concepts including outlays. On page 8, the report explains that federal outlays include loans and expenditures.

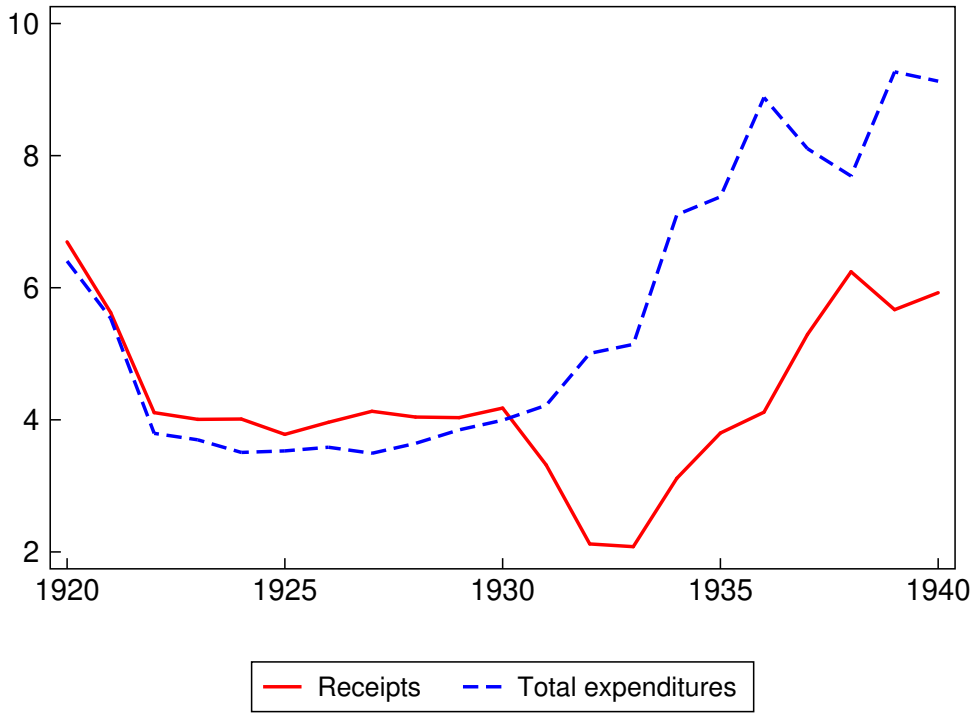

Figure 23: Fiscal Year Totals of Monthly Receipts and Total Expenditures, billions of dollars. Source: Department of the Treasury (various). See Table 9 for details.

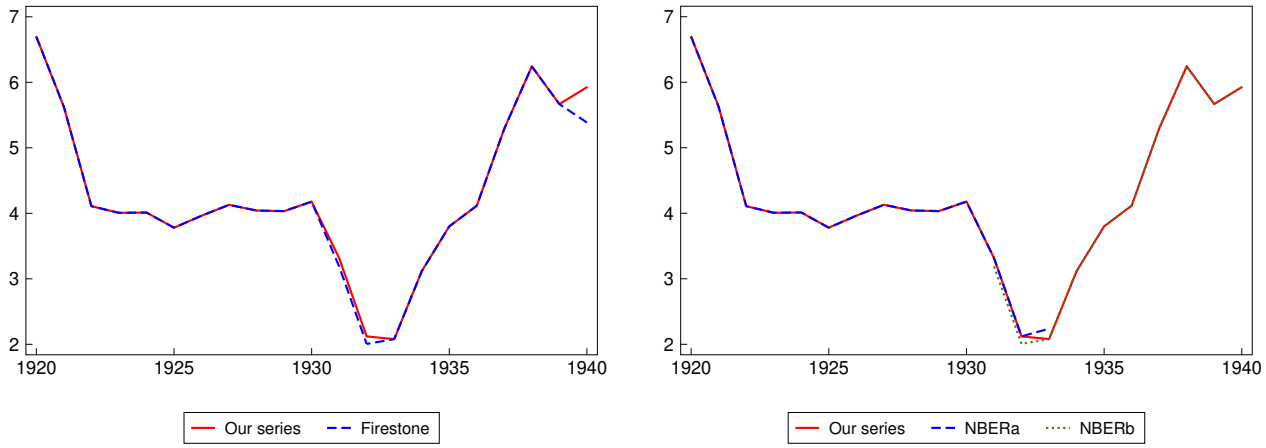

Figure 24: Fiscal year totals of monthly receipts and total expenditures, billions of dollars. Source: Department of the Treasury (various) (see Table 9 for details); Firestone (1960); NBER Macrohistory database (m15004b,m15004c).

Our yearly totals of monthly receipts data do not always match the yearly totals in other tables in the annual reports. Although the yearly data is revised throughout various annual reports, the monthly is not. The yearly receipts data is unrevised from fiscal years 1920 to

1935. In 1936, the data is revised starting in 1931. Our series of annual totals of monthly receipts data matches the yearly data until fiscal year 1933 when our series turns slightly lower.

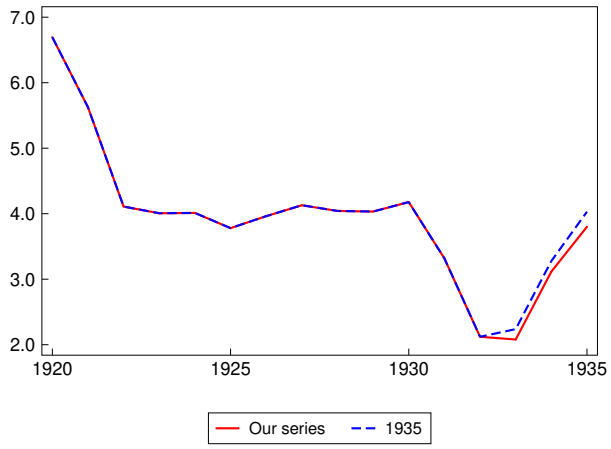

Figure 25: Fiscal year totals of monthly receipts and receipts by fiscal year, billions of dollars. Source: Department of the Treasury (various). See Table 9 for details.

Annual receipts data remains unrevised from fiscal years 1936 to 1939. In 1939, receipts were mostly revised downwards for fiscal years 1931 through 1935. This revised series matches our series from fiscal years 1933 through 1939. In 1940, receipts data was revised downwards for fiscal years 1937 through 1940.[40]

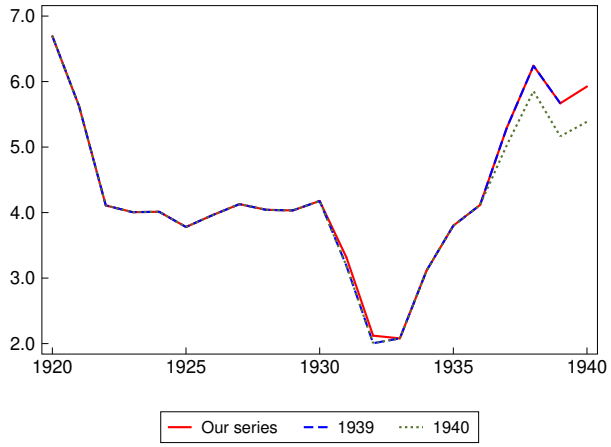

Figure 26: Fiscal year totals of monthly receipts and receipts by fiscal year, billions of dollars. Source: Department of the Treasury (various). See Table 9 for details.

[40]Footnote 14 on Page 649 of the 1940 Annual Report explains that: "In the fiscal year 1941 amounts representing appropriations equal to 'Social Security-Unemployment taxes' collected and deposited as provided under sec. 201 (a) of the Social Security Act Amendments of 1939, less reimbursements to the General Fund for administrative expenses, are deducted on the daily Treasury statement from total receipts. Such net amounts are reflected under trust account receipts as net appropriations to the Federal old-age and survivors insurance trust fund. The fiscal years 1937, 1938, and 1939, have been revised in this statement to reflect similar treatment. Fiscal year 1940 figures are also on this revised basis."

A.2.2 Federal Expenditures Firestone and the NBER use ordinary expenditures for their expenditure series starting in December 1920 through fiscal year 1933 (June 1933). Romer uses ordinary outlays through fiscal year 1933.[41] Ordinary expenditures are a subset of total expenditures and exclude public debt retirements. For fiscal years 1920 through 1926, ordinary expenditures exclude purchases of obligations of foreign governments in addition to public debt retirements. Starting in fiscal year 1934, the *Annual Report of the Secretary of the Treasury* divides total expenditures into general and emergency categories.[42] Starting in 1934, Firestone, the NBER, and Romer begin using total expenditures for their expenditures series. We use total expenditures throughout the entire sample. Prior to fiscal year 1934, total expenditures are on average roughly 13 percent higher than ordinary expenditures.

The expenditure series from Firestone matches our series of ordinary expenditures from 1922 through fiscal year 1930. Firestone explains on page 82 that starting in fiscal year 1931, trust fund transactions were eliminated from ordinary expenditures chargeable against ordinary receipts. Trust fund expenditures were, however, still included in ordinary receipts through 1933 for comparison purposes. Our yearly totals of monthly ordinary expenditures diverge from Firestone's from fiscal years 1931 to 1933. Firestone's data for January 1932 to June 1933 matches that of NBERc (not shown). Our series of ordinary expenditures matches NBERb up to fiscal year 1933. Romer's series of ordinary outlays is almost always lower than our series and those given by the NBER and Firestone.

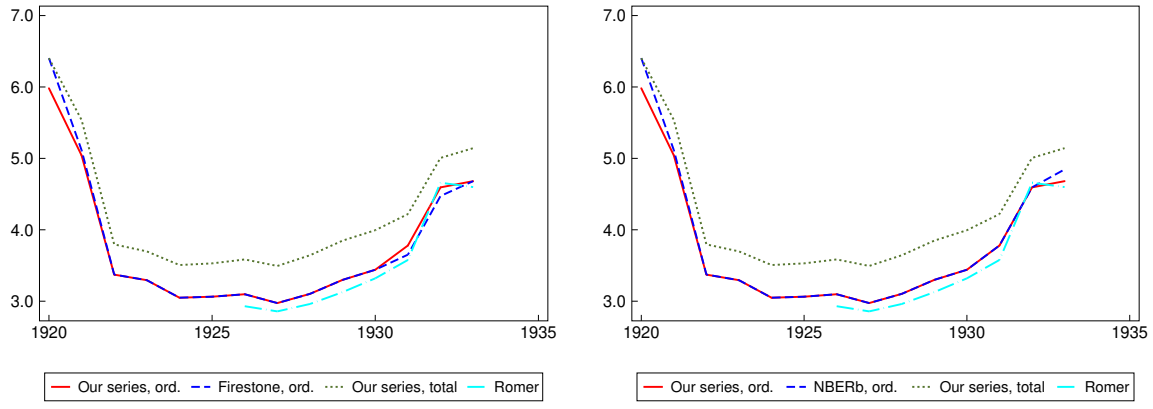

Figure 27: Fiscal year totals of monthly ordinary expenditures, billions of dollars. Source: Department of the Treasury (various) (see Table 9 for details); Firestone (1960); NBER Macrohistory database (m15004b,m15004c).

The total expenditure series from Firestone matches NBERc from fiscal year 1934 through fiscal year 1937. From fiscal year 1937 through 1939, Firestone's data matches NBERd. Firestone explains on page 84 that under an act of February 1938, the Secretary of the

[41] See footnote 39 for the difference between outlays and expenditures.

[42] Table 6 Footnote 6 on page 316 from the *Annual Report of the Secretary of the Treasury on the State of the Finances for Fiscal year ended June 30, 1934* explains that "Emergency expenditures prior to the fiscal year 1934 (except Reconstruction Finance Corporation) are included in general expenditures, the classification of which emergency expenditures is not available for comparison with emergency expenditures for the fiscal year 1934. Therefore, neither the totals of general expenditures nor the totals of emergency fiscal expenditures for the fiscal year 1934 are comparable with the total of prior fiscal years."

Treasury canceled $2.7 billion of obligations purchased from the RFC which the RFC could not repay to the Treasury. As a consequence, budget expenditures show only amounts spent from funds allocated by the RFC for purposes for which no provisions for repayment to the Treasury were made.The series from Firestone matches NBERe (not shown) for fiscal year 1940. Our series is larger than Firestone's and NBERc from 1934 through 1938. Although the gap shrinks from 1938 through 1940, our series is slightly higher than the other three series. Romer's series of total outlays is below our series and those given by the NBER and Firestone for most years.

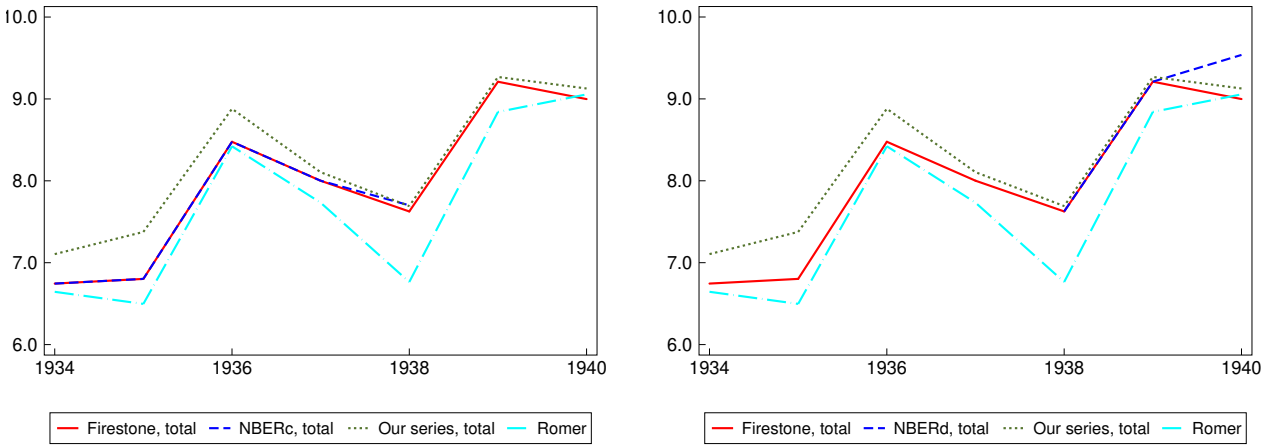

Figure 28: Fiscal Year Totals of Monthly Total Expenditures, billions of dollars. Source: Department of the Treasury (various) (see Table 9 for details); Firestone (1960); NBER Macrohistory database (m15004b,m15004c).

As with the receipts series, our series for total and ordinary expenditure do not always match yearly data given elsewhere in the annual reports. From fiscal year 1922 to fiscal year 1931 our series of yearly totals of monthly expenditures data match yearly totals given elsewhere in the annual reports on an unrevised cash basis. In the 1927 annual report, ordinary expenditures are revised upwards. In the 1933 annual report, total and ordinary expenditures are revised for fiscal years 1932 and 1933. These revisions differ from revisions covering the expenditures of the Reconstruction Finance Corporation in 1933.

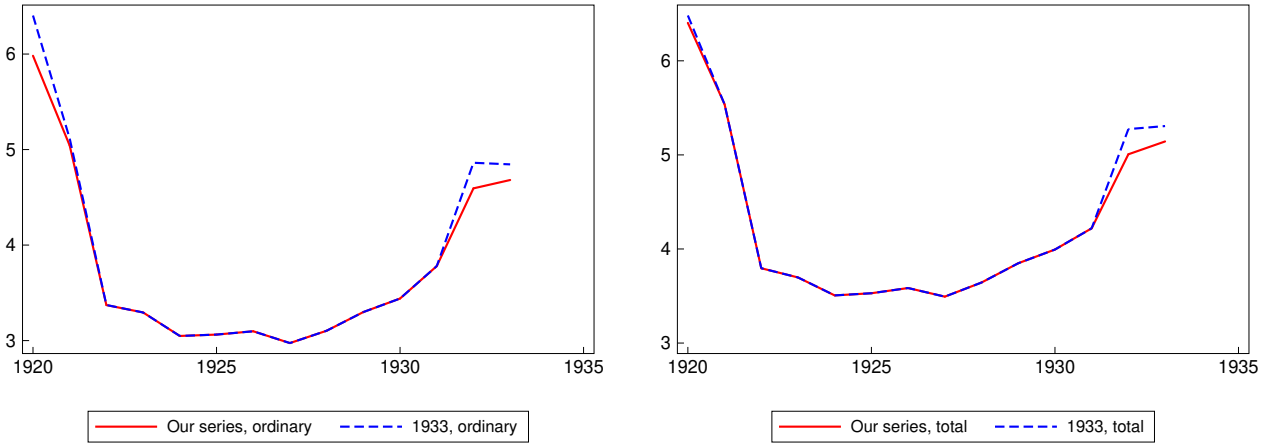

Figure 29: Fiscal year totals of monthly ordinary and total expenditures and ordinary and total expenditures by fiscal year, billions of dollars. Source: Department of the Treasury (various) (see Table 9 for details).

As mentioned previously, starting in 1934 until 1939, monthly expenditures are split into general and emergency expenditures categories rather than ordinary and total expenditures categories. Tables of yearly totals continue to categorize expenditures into ordinary and total even though the monthly series does not maintain this distinction. Our yearly totals of monthly ordinary expenditures stop in 1934 and we instead compute general expenditures for 1934-1939. Yearly ordinary and total expenditure series in the table are not revised from 1933 to 1935. Starting in 1936, the yearly ordinary and total expenditure series are revised back to 1930. Our series of total expenditures is lower than the 1935 and 1936 yearly series.

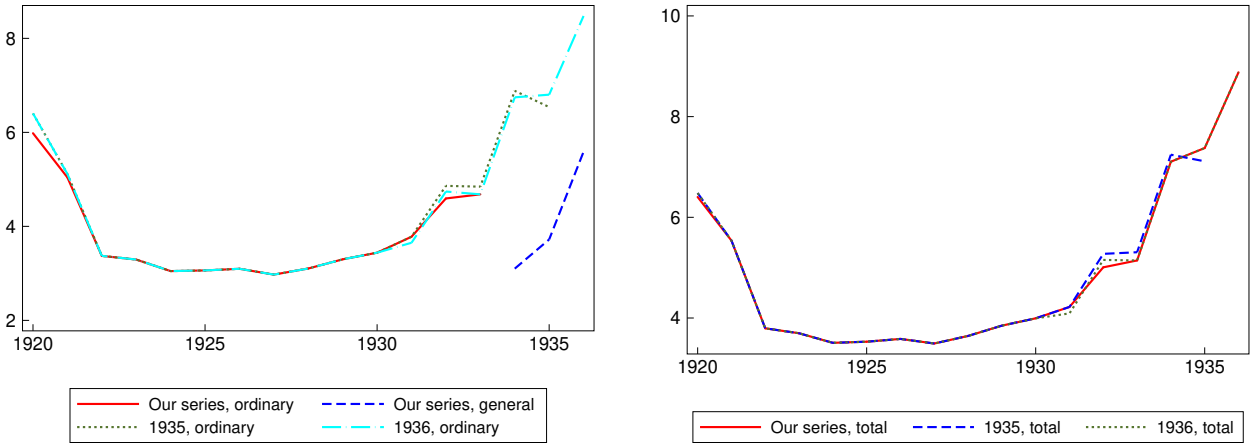

Figure 30: Fiscal year totals of monthly ordinary and total expenditures and ordinary and total expenditures by fiscal year, billions of dollars. Source: Department of the Treasury (various) (see Table 9 for details).

Yearly ordinary and total expenditures are revised in 1937, 1939, and 1940. The 1937 total expenditure series matches our series of yearly totals of monthly data the best.

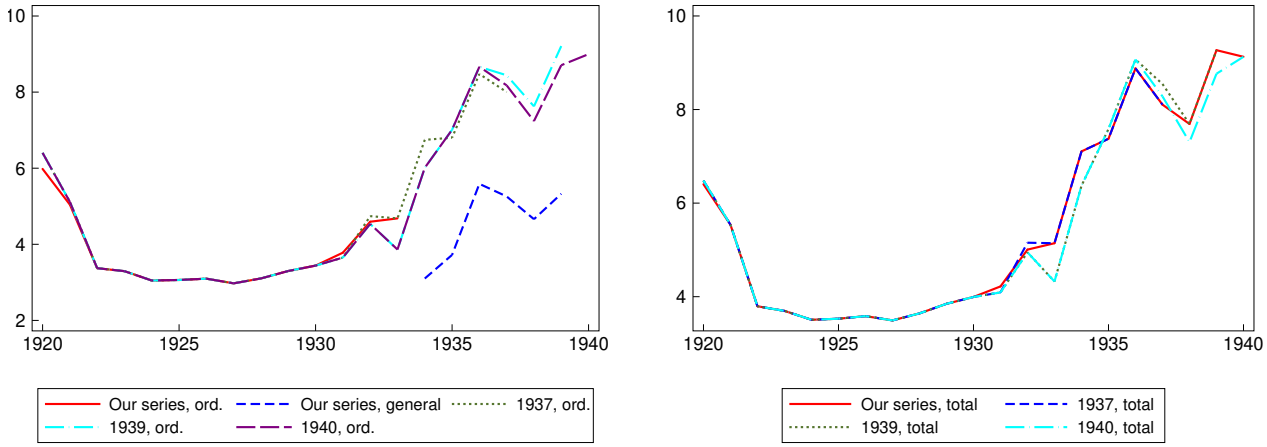

Figure 31: Fiscal year totals of monthly total expenditures, billions of dollars. Source: Department of the Treasury (various) (see Table 9 for details).

Table name	Year	Receipts page	Expenditures page
Ordinary receipts, and expenditures chargeable against (monthly)	1920	see 1921	
Ordinary receipts, and expenditures chargeable against (yearly)		see 1922	
STATEMENT SHOWING CLASSIFIED RECEIPTS...	1921	240	241
Ordinary receipts, and expenditures chargeable against (yearly)		see 1922	
Ordinary receipts, and expenditures chargeable against (monthly)	1922	270	271
Ordinary receipts, and expenditures chargeable against (yearly)		270	271
Ordinary receipts, and expenditures chargeable against (monthly)	1923	512	513
Receipts and expenditures of the United States Government...		512	513
Ordinary receipts, and expenditures chargeable against (monthly)	1924	378	379
Receipts and expenditures of the United States Government...		378	379
Ordinary receipts, and expenditures chargeable against (monthly)	1925	472	474
Receipts and expenditures of the United States Government...		472	474
Ordinary receipts, and expenditures chargeable against (monthly)	1926	445	447
Ordinary receipts, and expenditures chargeable against (yearly)		443	443
Ordinary receipts, and expenditures chargeable against (monthly)	1927	462	462
Ordinary receipts, and expenditures chargeable against (yearly)		445	445
Summary of ordinary receipts, expenditures chargeable (monthly)...	1928	424	424
Summary of ordinary receipts, expenditures chargeable (yearly)...		407	407
Summary of ordinary receipts, expenditures chargeable (monthly)...	1929	412	412
Summary of ordinary receipts, expenditures chargeable (yearly)...		394	394
Summary of ordinary receipts, expenditures chargeable (monthly)...	1930	506	506
Summary of ordinary receipts, expenditures chargeable (yearly)....		488	488
Summary of ordinary receipts, expenditures chargeable (monthly)...	1931	462	462
Ordinary receipts, expenditures chargeable against (yearly)...		448	448
Summary of ordinary receipts, expenditures chargeable (monthly)...	1932	370	370
Receipts and expenditures for the fiscal years 1789 to...		365	369
Summary of ordinary receipts, expenditures chargeable (monthly)...	1933	312	312
Receipts and expenditures for the fiscal years 1789 to...		306	310
Summary of ordinary receipts, expenditures chargeable (monthly)...	1934	306	306
Receipts and expenditures for the fiscal years 1789 to...		301	305
Summary of ordinary receipts, expenditures chargeable (monthly)...	1935	328	328
Receipts and expenditures for the fiscal years 1789 to...		323	327
Classified receipts and expenditures, monthly...	1936	337	339/342
Receipts and expenditures for the fiscal years 1789 to...		359	363
Classified receipts and expenditures, monthly...	1937	320	322/324
Receipts and expenditures for the fiscal years 1789 to...		349	353
Expenditures by major functions for the fiscal years 1930-1937			354
Classified receipts and expenditures, monthly...	1938	379	381/384
Receipts and expenditures for the fiscal years 1789 to...		413	417
Expenditures by major functions for the fiscal years 1931-1938			418
Classified receipts and expenditures, monthly...	1939	337	339/342
Receipts and expenditures for the fiscal years 1789 to...		361	365
Expenditures by major functions for the fiscal years 1931-1939			367
Classified receipts and expenditures, monthly...	1940	612	615/616
Receipts and expenditures for the fiscal years 1789 to...		645	649
Expenditures by major functions for the fiscal years 1933-1940			653
Receipts in general and special accounts, by major sources...		651	

Table 9: Table names and page numbers from the *Annual Reports of the Secretary of the Treasury* for federal receipts and expenditures

A.3 Market Value and Returns

The following section details our calculation of market value and return on the United States's bond portfolio. We use data from Hall and Sargent (2015), provided to us by the authors, as well as the CRSP to obtain the quantity, price, accrued interest, interest rate, and coupon frequency of each government security outstanding in a given month.

Let $B_{it}(t+j)$ denote the dollar value of type i bonds outstanding in period t that mature in period $t+j$ and $Q^D_{it}(t+j)$ be the dirty price (price+accrued interest) of such bonds. Because the number of types of bonds of a certain maturity each period can vary over time, we let $N_t(t+j)$ represent the number of such bonds in period t.

Let $B_t(t+j)$ denote the dollar value of all bonds outstanding in period t that mature in period $t+j$, defined as

$$B_t(t+j) = \sum_{i=1}^{N_t(t+j)} B_{it}(t+j) \tag{23}$$

Then the par value of all debt outstanding at the end of period t—the face value of the bond portfolio—is

$$B^M_t = \sum_{j=1}^{\infty} \sum_{i=1}^{N_t(t+j)} B_{it}(t+j) = \sum_{j=1}^{\infty} B_t(t+j) \tag{24}$$

Define $\nu_i(t+j)$ as the share of security of type i that is outstanding at t and matures at $t+j$

$$\nu_i(t+j) = \frac{B_{it}(t+j)}{\sum_{i=1}^{N_t(t+j)} B_{it}(t+j)} = \frac{B_{it}(t+j)}{B_t(t+j)} \tag{25}$$

where $\sum_{i=1}^{N_t(t+j)} \nu_i(t+j) = 1$. Then the weighted dirty price of bonds outstanding at t that mature in $t+j$ is

$$Q^D_t(t+j) = Q_t(t+j) + AI_t(t+j) = \sum_{i=1}^{N_t(t+j)} \Big(Q_{it}(t+j) + AI_{it}(t+j) \Big) \nu_i(t+j) \tag{26}$$

where $Q_t(t+j)$ is the clean price of bonds outstanding at t that mature in $t+j$, $AI_t(t+j)$ is the accrued interest on bonds outstanding at t that mature in $t+j$. For zero-coupon bonds, the dirty price is equal to the clean price.

We also define $\mu_t(t+j)$ as the share of the total par value of bonds outstanding at the end of t that matures in $t+j$

$$\mu_t(t+j) = \frac{B_t(t+j)}{B^M_t} \tag{27}$$

where $\sum_{j=1}^{\infty} \mu_t(t+j) = 1$. This permits us to define the nominal price of the bond portfolio, P^M_t, as

$$P^M_t = \sum_{j=1}^{\infty} Q^D_t(t+j) \mu_t(t+j) \tag{28}$$

With a complete and general maturity structure, the government's budget identity is

$$\sum_{j=0}^{\infty}\big(Q_t^D(t+j)+IP_t(t+j)\big)B_{t-1}(t+j)=P_ts_t+\sum_{j=1}^{\infty}Q_t^D(t+j)B_t(t+j) \tag{29}$$

Where $Q_t^D(t)\equiv 1$ and $IP_t(t+j)$ is the interest payable on bonds outstanding at t that mature in $t+j$. Interest payable is an government expense in period t and is thus included in the government budget identity.

The market value of debt outstanding in period t is

$$P_t^MB_t^M\equiv\sum_{j=1}^{\infty}Q_t^D(t+j)B_t(t+j) \tag{30}$$

so that the comparable expression at $t-1$ is

$$P_{t-1}^MB_{t-1}^M\equiv\sum_{j=1}^{\infty}Q_{t-1}^D\big((t-1)+(j+1)\big)B_{t-1}\big((t-1)+(j+1)\big)=\sum_{j=1}^{\infty}Q_{t-1}^D(t+j)B_{t-1}(t+j) \tag{31}$$

The carry-over market value uses the same bonds as the market value for period $t-1$ but using period t dirty prices and intermediate coupon payments. The carry-over price, P_t^C, reflects coupon payments that were paid between periods $t-1$ and t. The carry-over market value is defined as

$$P_t^CB_{t-1}^M\equiv\sum_{j=0}^{\infty}\Big(Q_t^D(t+j)+IP_t(t+j)\Big)B_{t-1}(t+j) \tag{32}$$

$IP_t(t+j)$ is the interest payable on bonds outstanding at t that mature in $t+j$. P_t^C differs from its dirty-price analog only when there is a coupon payment in month t. Figure 32 illustrates the timing of coupon payments.

Figure 32: Timing of actual and carry-over market value

Using the definitions of market value and carry over market value, (29) can be written as:

$$P_t^CB_{t-1}^M=P_ts_t+P_t^MB_t^M \tag{33}$$

Multiplying and dividing the left hand side by last period's market value allow the government budget identity to be expressed in terms of the rate of return on government debt:

$$\underbrace{\frac{P_t^CB_{t-1}^M}{P_{t-1}^MB_{t-1}^M}}_{\text{rate of return}}P_{t-1}^MB_{t-1}^M=P_ts_t+P_t^MB_t^M \tag{34}$$

The rate of return can also be derived by decomposing changes in market value into rates of return and changes in size. We start by expanding the ratio of period t to period $t-1$ market value

$$\frac{P_t^M B_t^M}{P_{t-1}^M B_{t-1}^M} \equiv \underbrace{\frac{P_t^C B_{t-1}^M}{P_{t-1}^M B_{t-1}^M}}_{\text{rate of return}} \cdot \underbrace{\frac{P_t^M B_t^M}{P_t^C B_{t-1}^M}}_{\text{size ratio}} \tag{35}$$

The expression for the rate of return is the same as (34) and can be expressed as

$$\frac{P_t^C B_{t-1}^M}{P_{t-1}^M B_{t-1}^M} = \frac{\sum_{j=1}^{\infty} \Big(Q_t(t+j) + AI_t(t+j) + IP_t(t+j) \Big) B_{t-1}(t+j)}{\sum_{j=1}^{\infty} \Big(Q_{t-1}(t+j) + AI_{t-1}(t+j) \Big) B_{t-1}(t+j)} \tag{36}$$

This rate of return reflects the percentage change in the value of the bond portfolio between period $t-1$ and t, holding the bond portfolio fixed.

The size ratio can be expressed as

$$\frac{P_t^M B_t^M}{P_t^C B_{t-1}^M} = \frac{\sum_{j=1}^{\infty} \Big(Q_t(t+j) + AI_t(t+j) \Big) B_t(t+j)}{\sum_{j=1}^{\infty} \Big(Q_t(t+j) + AI_t(t+j) + IP_t(t+j) \Big) B_{t-1}(t+j)} \tag{37}$$

Changes in size incorporates new issues, redemptions, and coupon payments that occur between periods $t-1$ and t. The size ratio reflects the percentage change in the value of the bond portfolio that arises from changes in the bond portfolio itself, including any changes in maturity structure.

$$r_t^M = \frac{P_t^C B_{t-1}^M / P_t}{P_{t-1}^M B_{t-1}^M / P_{t-1}} = \frac{\sum_{j=1}^{\infty} Q_t(t+j) B_{t-1}(t+j) / P_t}{\sum_{j=1}^{\infty} Q_{t-1}(t+j) B_{t-1}(t+j) / P_{t-1}} \tag{38}$$

Of course, the identity (34) can be expressed in real terms as:

$$r_t^M P_{t-1}^M b_{t-1}^M = s_t + P_t^M b_t^M \tag{39}$$

where $b_t^M \equiv B_t^M / P_t$ is the real par value of debt outstanding at t.

The surprise component in the real return on the bonds portfolio is:

$$\eta_t^D \equiv r_t^M - E_{t-1} r_t^M \tag{40}$$

Using $E_{t-1}[Q_t^D(t+j)/P_t] = \big(Q_{t-1}(t+j) + AI_t(t+j) + IP_t(t+j)\big)/P_{t-1}$, then the expectation is of no real capital gain or loss on the portfolio. Accrued interest, $AI_t(t+j)$, and interest payable, $IP_t(t+j)$, of bonds outstanding in period t that mature in period $t+j$ is known in period $t-1$. Hence, $E_{t-1}[AI_t(t+j) + IP_t(t+j)] = AI_t(t+j) + IP_t(t+j)$. The surprise in the real return becomes

$$\eta_t^D = \sum_{j=0}^{\infty} \left(\frac{\big(Q_t(t+j) + AI_t(t+j) + IP_t(t+j)\big)/P_t}{\big(Q_{t-1}(t+j) + AI_t(t+j) + IP_t(t+j)\big)/P_{t-1}} - 1 \right) \frac{\big(Q_{t-1}(t+j) + AI_t(t+j) + IP_t(t+j)\big) B_{t-1}(t+j)}{P_{t-1}^M B_{t-1}^M} \tag{41}$$

Real returns can be scaled by components isolating changes in the price level and changes in bond prices. Re-writing (41) as:

$$\eta_t^D = \underbrace{\frac{P_t^c B_{t-1}^M / P_t}{P_{t-1}^M B_{t-1}^M / P_{t-1}}}_{r_t^D} - \underbrace{\frac{P_t^c B_{t-1}}{P_{t-1}^M B_{t-1}}}_{R_t^D} + \frac{\sum_{j=1}^{\infty} \big(Q_t(t+j) - Q_{t-1}(t+j)\big) B_{t-1}(t+j)}{P_{t-1}^M B_{t-1}^M} \tag{42}$$

Which can be further re-arranged to:

$$\eta_t^D = R_t^D \underbrace{(1/\pi_t - 1)}_{\text{due to price level}} + R_t^D \underbrace{\left(\frac{\sum_{j=1}^{\infty} \big(Q_t(t+j) - Q_{t-1}(t+j)\big) B_{t-1}(t+j)}{P_t^C B_{t-1}^M} \right)}_{\text{due to bond prices}} \tag{43}$$

If there are no changes in the price level between periods $t-1$ and t, i.e. $\pi = 1$ and weighted changes in bond prices sum to zero $\sum_{j=1}^{\infty} Q_t(t+j) - Q_{t-1}(t+j) = 0$, then $\eta_t^D = 0$ indicating no capital gains or losses. If there is no change in the price level ($\pi_t = 1$) then $R_t^D(1/\pi_t - 1) = 0$ then capital gains or losses can be interpreted as the weighted change in bond prices as a share of market value scaled by nominal returns. If the weighted changes in bond prices sum to zero, $\big(\sum_{j=1}^{\infty} \big(Q_t(t+j) - Q_{t-1}(t+j)\big) = 0$, then capital gains or losses are changes in the price level scaled by nominal returns.

Real and nominal returns are denominated in percentage points of market value outstanding at B_{t-1}

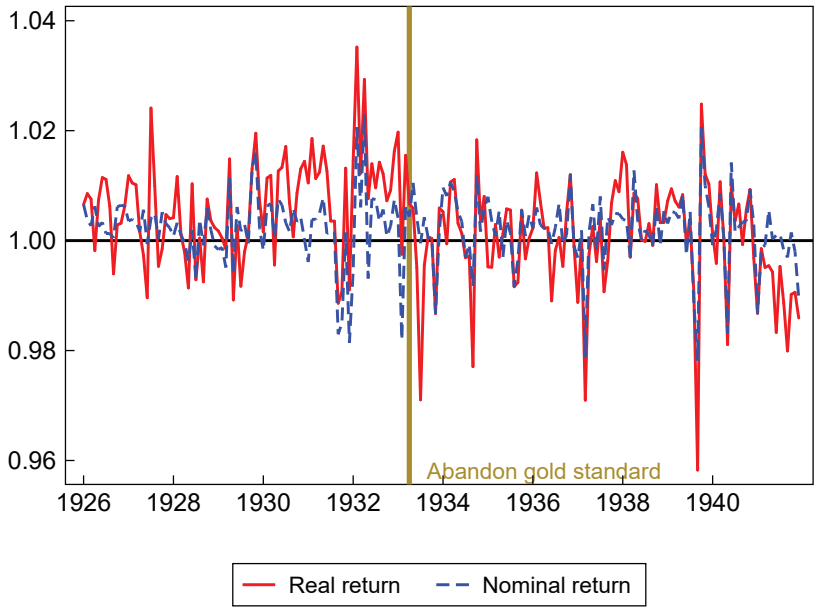

Figure 33: Real and nominal price returns

Real returns to U.S. debt show a much larger drop than nominal returns to U.S. debt after the departure form the gold standard.

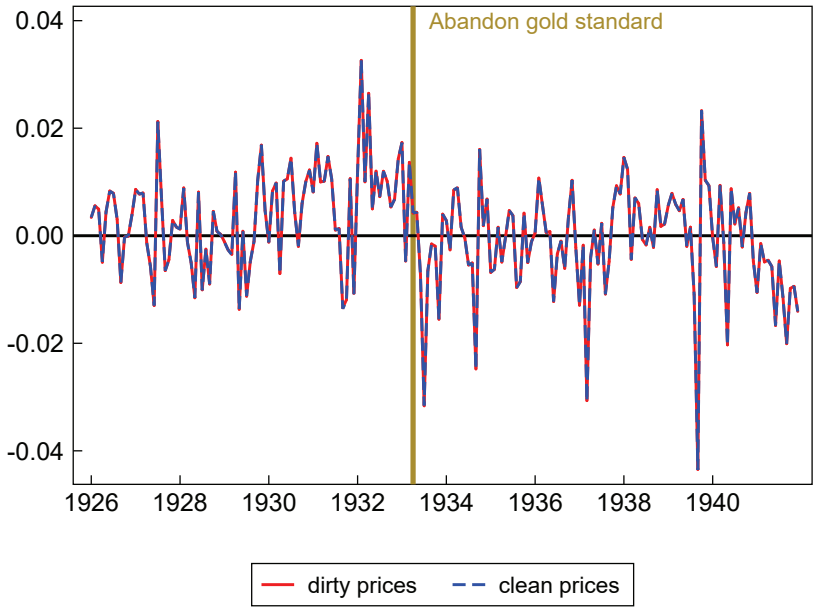

Figure 34: Real innovations to price returns with clean and dirty prices

Innovations show large losses after the abandonment of the gold standard.

Innovations capture the unexpected losses or gains on U.S. debt due to bond prices or the price level. We multiplying innovations by the beginning of period market value ($P^M_{t-1}B^M_{t-1}$) to capture the dollar amount of the difference between real and expected real returns to holding U.S. debt. We then take this dollar amount as ratio of the current period market value ($P^M_t B^M_t$) to capture surprise capital gains or losses as a percent of market value. Figure 35 is thus:

$$\eta^D_t \frac{P^M_{t-1}B^M_{t-1}}{P^M_t B^M_t} * 100 \tag{44}$$

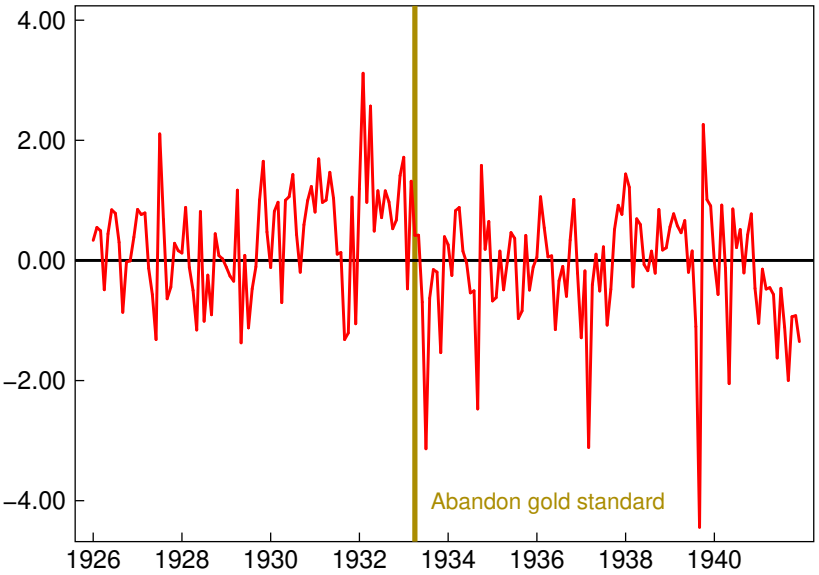

Figure 35: Capital gains and loss as a percent of market value (44)

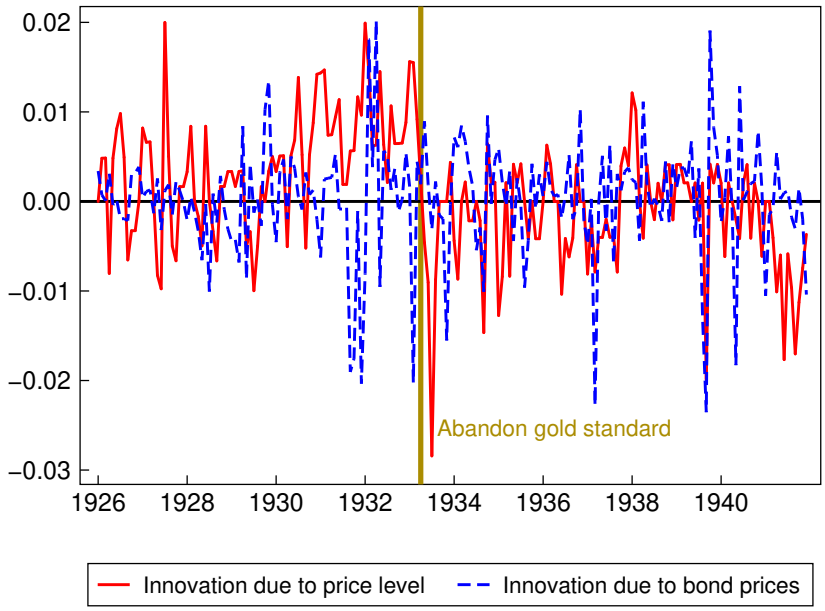

Figure 36: Innovations to price returns decomposed into changes from bond prices and changes from the price level (43)

After the abandonment of the gold standard, the price level is largely responsible for the capital loss on holding government debt.

B The Appendix

The following parametric assumptions are made section **??**. Begin with the government's budget constraint in steady state

$$\frac{P^l B^l}{P}\left(1-\beta^{-1}\right) = F - T.$$

Then

$$\frac{P^l B^l}{PY}\left(\beta^{-1}-1\right) = \frac{T-F}{Y}$$

implies an assumption on the steady state debt to GDP ratio pins down the structural surplus. Assume an annual debt-to-GDP ratio of 30 percent. This implies

$$\frac{P^l B^l}{PY} = 1.2$$

in a quarterly model. Assuming

$$\frac{C}{Y} = 0.8 \text{ and } \frac{F}{T} = 0.2$$

determines the tax to GDP ratio residually. In turn an assumption on the fraction of government spending in output determines steady state taxation. Furthermore

$$\begin{aligned}\frac{PT}{B^l} &= \frac{T}{Y}\frac{YP}{B^l}\\ \frac{PF}{B^l} &= \frac{F}{Y}\frac{YP}{B^l}\end{aligned}$$

where the right hand sides of each expression are already determined ratios. To determine the other ratios in the government budget constraint calibrate

$$\frac{M}{P^l B^l} = 1$$

which corresponds to the ratio of $M1$ to the market value of debt in 1933. This permits

$$\frac{P^g G^m}{P^l B^l} = \frac{P^g G^m}{M}\frac{M}{P^l B^l} = \alpha \frac{M}{P^l B^l}$$

which completes the solution for required ratios.

Other parameter values which are picked fairly arbitrarily: $\beta = 0.99$, $\sigma = 1$, $\varphi = 20$, $\kappa = 100$, $\alpha = 0.4$, $\rho = 0.95$. The shocks all have auto regressive coefficient 0.5. From the liquidity preference schedule, (**??**),the elasticity of money demand with respect to the interest rate is

$$\frac{\beta}{(1-\beta)\,\varphi}.$$

For values of this elasticity around unity, the parameter φ must be of the order of 100. The basic patterns observed in the impulse responses don't depend much on the assumed calibration. Policy parameters are given by: $\gamma_b = 0.1$ under the gold standard. In the unbacked fiscal expansion $\gamma_b = 0$ and $\phi_\pi = 0.9$.

C Additional VAR Results

This appendix reports a more complete set of VAR results than those in the text. Figure 37 reports actual data and unconditional forecasts for the seven series in the VAR. Figure 38 shows the full moving average representations for the seven-variable VAR estimated over the unbacked fiscal expansion period (April 1933 to June 1940).

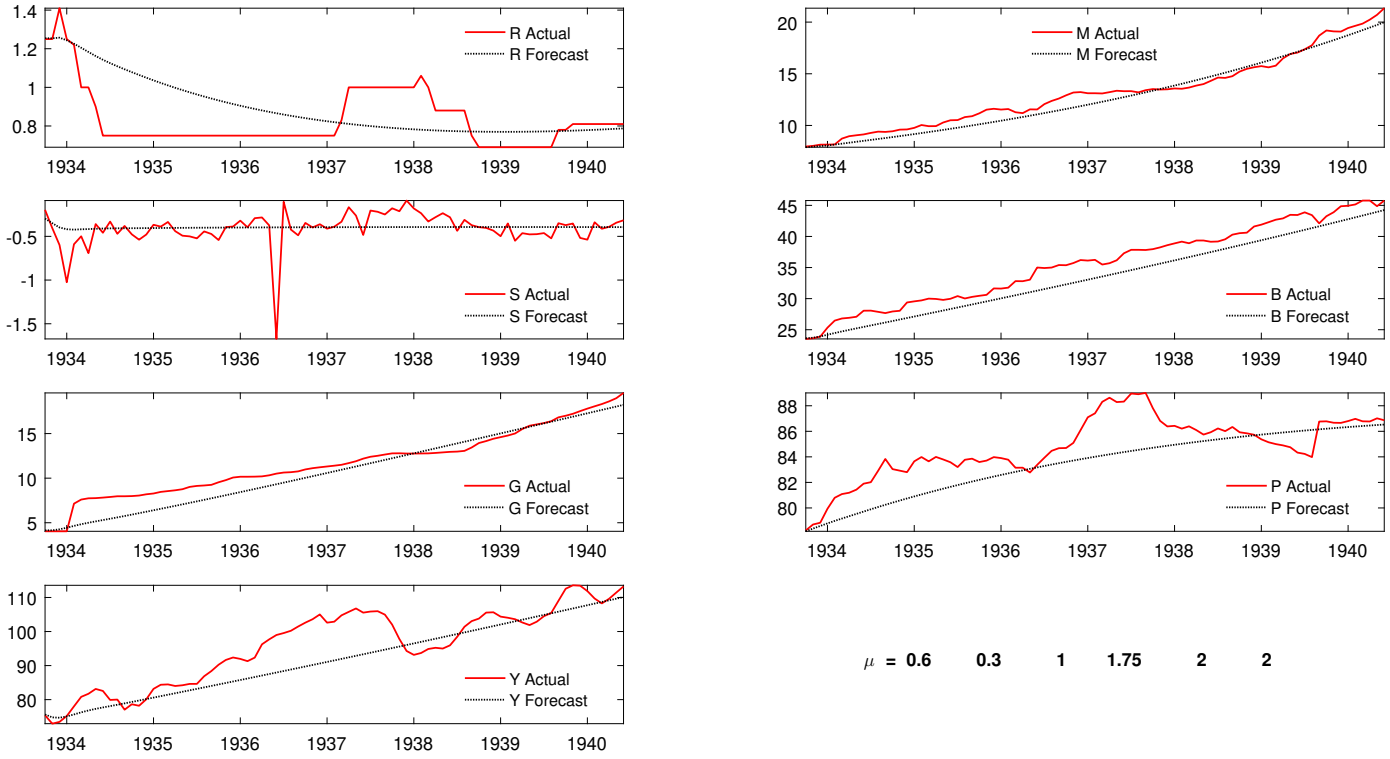

Figure 37: Actual and unconditional forecasts of variables in VAR using the hyperparameters $\lambda_0 = 0.6, \lambda_1 = 0.3, \lambda_3 = 1.0, \lambda_4 = 1.75, \mu_5 = \mu_6 = 2.0$, in the notation of Sims and Zha (1998).

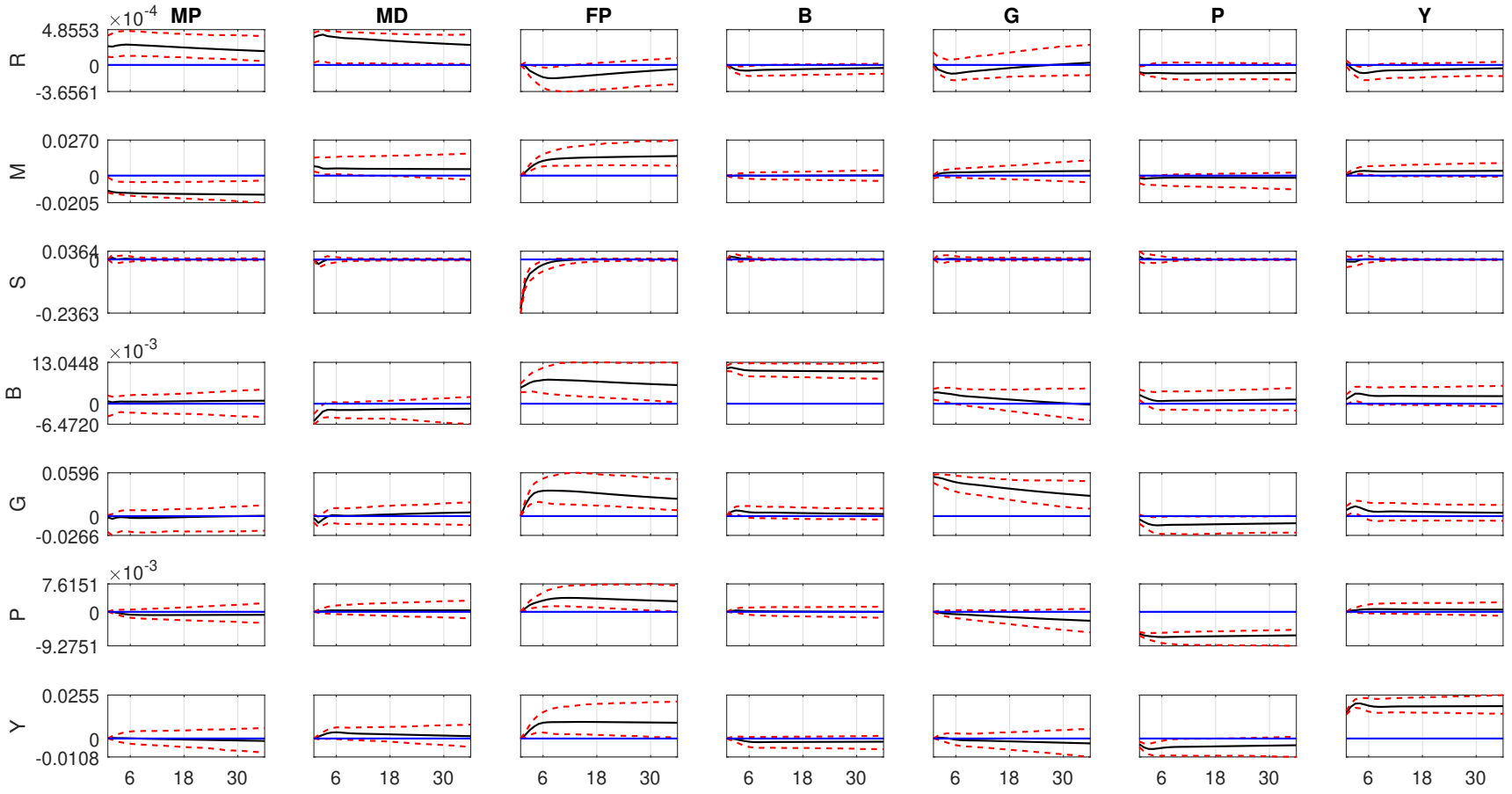

Figure 38: Full moving average representation of the identified VAR estimated over the unbacked fiscal expansion period (April 1933 to June 1940). Solid lines are maximum likelihood estimates; dashed lines are 68 percentile probability bands based on 1000 draws from the posterior distribution of all the VAR parameters.

D Fiscal Implications of Gold Sterilization

D.1 Gold Sterilization during the Great Depression

Gold imports have the potential to increase the monetary base of an economy following the classical gold standard or the gold exchange standard. Policymakers can counteract the increase in the monetary base by sterilizing gold inflows which entails paying for imported gold in government securities rather than bank reserves. Prior to 1933, the Federal Reserve conducted gold import operations and sterilization decisions. By June of 1934, these responsibilities shifted to the Treasury as the result of a series of presidential proclamations, executive orders, joint-resolutions, and Acts that culminated in an embargo on gold exports[43] and the Treasury seizing the entire monetary gold stock including coins and bullion held by private citizens, business, and the Federal Reserve Banks.[44]

Massive gold imports more than tripled the monetary gold stock from $4.25 billion at the start of 1933 to $14.42 billion at the end of 1938. Meltzer (2003, p. 459) notes that the Treasury purchased more than $4 billion of gold from 1934-1936. Friedman and Schwartz (1963, p. 545) attribute the gold inflows throughout this period to the depreciation of the dollar, Hitler's rise to power, and the outbreak of war in Europe. Studenski and Krooss (1952, p. 394) include the Treasury's $35 an ounce purchase price for gold, favorable trade balances, and the creditor position of the United States as additional factors that increased gold imports. To our knowledge, the Gold Reserve Act of 1934's ban on private citizens holding monetary gold required banks to sell newly imported gold to the Treasury.[45] With gold inflows pushing up excess reserves, policymakers feared that the growing monetary base could ignite inflationary forces [Jaremski and Mathy (2016)]. To curb the growth of excess reserves and hence the monetary base, the Treasury sterilized gold imports from December 1936 to April 1938.

Expanding on the example provided by Johnson (1939, p. 144), we illustrate the effects of the Treasury's non-sterilized and sterilized gold purchases on the balance sheets of the Treasury, the Federal Reserve, and member banks.

[43] Executive Order 6111 on Transactions in Foreign Exchange was implemented on April 20, 1933. See http://www.presidency.ucsb.edu/ws/index.php?pid=14621

[44] See Bordo, Humpage, and Schwartz (2015, pp. 56–57) for a detailed time line of events. Jaremski and Mathy (2016, p. 6) report that most gold imports came through New York City's gold market and New York City banks continued to sell their gold to the Federal Reserve Bank of New York who acted as fiscal agent to the Treasury, the ultimate purchaser of the gold.

[45] Bordo, Humpage, and Schwartz (2015, p. 65) explain that the Treasury issued special licenses for commercial banks to obtain gold for customers. This suggests that banks were not allowed to keep gold on their balance sheets.

1. Gold Imported by Member Banks Member banks import $1,000 worth of gold and fund it by issuing $1,000 worth of deposits. Member bank assets and liabilities rise by $1,000.

Treasury

Assets	Liabilities

Federal Reserve

Assets	Liabilities

Member Banks

Assets	Liabilities
+$1,000 gold	+$1,000 deposits
+$1,000	+$1,000

2. High Powered Money Creation Member banks sell their imported gold to the Federal Reserve for $1,000. The Federal Reserve pays for the gold by issuing reserves to member banks which increases high-powered money by $1,000. For member banks, gold is swapped for reserves and their aggregate asset position is unchanged –both assets and liabilities remain elevated by the original $1,000 injection. If the Federal Reserve did not want to sterilize and they were responsible for sterilization decision, this would be the final step. Skip to step 2b at the end of this Appendix for the effects of Federal Reserve sterilization.

Treasury

Assets	Liabilities

Federal Reserve

Assets	Liabilities
+$1,000 gold	+$1,000 reserves
+$1,000	+$1,000

Member Banks

Assets	Liabilities
-$1,000 gold +$1,000 reserves	$1,000 deposits
$1,000	$1,000

3. Gold Transferred to Treasury Under the Gold Act of 1934, gold could not be exported and any imported gold had to be turned over to the Treasury. As noted by Jaremski and Mathy (2016, p. 6), the Federal Reserve would then transfer the gold to the Treasury who paid for the gold by drafting on its balances at the Federal Reserve. Although the aggregate value of the balance sheets of the Treasury and the Federal Reserve are unchanged, the composition of their balance sheets change.

Treasury

Assets	Liabilities
+$1,000 gold -$1,000 due from Fed	

Federal Reserve

Assets	Liabilities
-$1,000 gold	$1,000 reserves -$1,000 due to Treasury

Member Banks

Assets	Liabilities
$1,000 reserves	$1,000 deposits
$1,000	$1,000

4a. No Sterilization Under the Treasury: The Treasury replenishes its balances at the Federal Reserve by issuing gold certificates and depositing them at the Federal Reserve as the final payment for gold purchases. Non-sterilized gold imports ultimately increase the balance sheets of the Treasury, the Federal Reserve, and member banks and leave the amount of free-gold at the Treasury unchanged. The Treasury does not offset the creation of high powered money by retiring the newly created reserves as will be the case with sterilization.

Importantly, in the case of no sterilization, there is no increase in Treasury indebtedness to the private sector because the Treasury creates "money" through gold certificates.

Treasury		Federal Reserve		Member Banks	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
+$1,000 due from Fed	+$1,000 gold certificates to Treasury	+$1,000 gold certificates from Treasury	$1,000 reserves	$1,000 reserves	$1,000 deposits
+$1,000	+$1,000	+$1,000	+$1,000	$1,000	$1,000

4b. Sterilization Under the Treasury: When sterilizing gold imports, the Treasury replenishes balances at the Federal Reserve by selling government securities to member banks rather than issuing gold certificates and depositing them at the Federal Reserve. The Federal Reserve again settles the transaction between the Treasury and member banks through reserves. Member banks pay for security sales by retiring reserves outstanding at the Federal Reserve. The Federal Reserve then offsets this transaction by crediting their balance due to the Treasury/debiting the Treasury's balances held at the Federal Reserve. Sterilization increases the aggregate balance sheets of the Treasury and member banks, but not the Federal Reserve.

In this case, there is an increase in Treasury indebtedness to the private sector and there is no increase in bank reserves.

Treasury		Federal Reserve		Member Banks	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
+$1,000 due from Fed	+$1,000 gov't securities		-$1,000 reserves +$1,000 due to Treasury	-$1,000 reserves +$1,000 gov't securities purchased from Treasury	$1,000 deposits
+$1,000	+$1,000			$1,000	$1,000

2b. Sterilization Under the Federal Reserve When sterilizing gold imports, the Federal Reserve pays for gold by selling government securities to member banks rather than creating reserves as seen in step 2. Sterilization leaves the aggregate balance sheets of the Federal Reserve and the Treasury unchanged while the balance sheet of member banks is expanded. In the case of Federal Reserve sterilization, there is no increase in Treasury indebtedness. Because security sales by the Federal Reserve prevent the creation of reserves, sterilization by the Federal Reserve is equivalent to contractionary open market operations.

Treasury

Assets	Liabilities

Federal Reserve

Assets	Liabilities
+$1000 gold	
-$1000 gov't securities	

Member Banks

Assets	Liabilities
-$1000 gold	$1000 deposits
+$1000 gov't securities	
$1000	$1000

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