Preliminary Draft

EVEN KEEL AND THE GREAT INFLATION

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ABSTRACT

Using IV-GMM techniques and real-time data, we estimate a forward looking, Taylortype reaction function incorporating dummy variables for even-keel operations and a variable for foreign official pressures on the U.S. gold stock during the Great Inflation. We show that when the Federal Reserve undertook even-keel operations to assist U.S. Treasury security sales, the FOMC tended to delay monetary-policy adjustments and to inject a small amounts of reserves into the banking system. The operations, however, did not contribute significantly to the Great Inflation, because they occurred during periods of both monetary ease and monetary tightness, at least in the FOMC's view. Moreover, the average federal funds rate during months containing even keel events was no different than the average federal funds rate in other months, suggesting that even-keel had no effect on the thrust of monetary policy. The Great Inflation resulted because the FOMC failed to follow the Taylor principle. This behavior had an international aspect: We show that prospective gold losses had no effect on the FOMC's monetary-policy decisions in the 1960s and early 1970s.

Keywords: Even Keel, Gold Reserves, Taylor Rule, Federal Reserve, U.S. Treasury. *JEL classification*: E5, N1, F3.

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Even Keel and the Great Inflation

1. Introduction

The great inflation was one of the Federal Reserve System's biggest policy failures. From 1965 through 1980, headline CPI inflation cycled upward from less than 2 percent to 14 percent with the each successive peak and trough exceeding the previous one. The cumulative price rise was on a par with previous war-time inflations, as De Long (1996) shows. By 1976, worldwide confidence in the Federal Reserve System's monetary policy was rapidly waning. Inflation and expectations of further inflation began to influence economic decisions in ways that threatened nation's long-term growth and prosperity.



Figure 1: Inflation and interest rate in U.S. from 1965-1980

Economists have offered many explanations for the Great Inflation. Bordo and Eichengreen (2008) describe how *ad hoc* policies to deal with U.S. balance-of-payments problems weakened the Bretton Woods constraint on U.S. monetary policy. Most explanations, center on discredited economic beliefs, particularly about the nature of the Phillips Curve, distinct types of inflation, and the relative contributions of monetary and fiscal policies to the inflation process. De Long (1996), Romer and Romer (2002), Nelson (2005), and Hetzel (2008) are noteworthy examples.¹ Within this genre, some economists also emphasize that policy makers, with vivid memories of the Great Depression, simply viewed unemployment has more socially disruptive than inflation (Mayer 1999. pp. 122 – 24, Hetzel 2008, pp. 65, 67, and 111). Chari, et al. (1998) and Christiano and Gust (2000) explain how real macroeconomic policy objectives and expectations interacted to produce inflationary outcomes. Others, notably

Orphanides (2002, 2003), argue that persistent errors in the measurement of the natural rate of unemployment or the growth of potential output were a key cause of the Great Inflation. Meltzer (2005, 2009) also describes how personalities, politics, and institutional relationships influenced U.S. monetary policy and factored into the Great inflation. His accounts suggest how the Federal Reserve's even-keel policy adversely influenced monetary policy and how gold losses failed to constrain the Federal Open Market Committee (FOMC).

In this paper, we estimate a real-time, forward-looking, Taylor-type reaction function to determine how even-keel operations and the pressures of a dwindling U.S. gold stock may have affected the Federal Reserve's monetary-policy actions between 1960:1 and 1980:12. Our estimates use instrumental-variables and general-method-of-moments (IV-GMM) techniques. Our reaction function indicates that during the Great Inflation, the FOMC systematically delayed monetary-policy adjustments and added reserves to the banking system to facilitate the U.S. Treasury's debt-funding operations. Although significant in our estimated reaction functions, these even-keel events do not explain why the FOMC failed to tighten monetary policy sufficiently to prevent a rising inflation rate. In addition, we find no evidence that gold losses systematically influenced the Federal Reserve System's monetary-policy actions during the 1960s and early 1970s. U.S. monetary policy focused solely—but imperfectly—on domestic unemployment and inflation objectives.

The remainder of this paper proceeds as follows: Section 2 provides background on both the Federal Reserve's even-keel operations and on the U.S. gold losses. Both events merit attention for rounding out our understanding of monetary policy during the Great Inflation. Section 3 explains the derivation of our reaction function and our empirical methodology. Second 4 describes our empirical results. Here we explain why even-keel operations did not contribute to the Great Inflation even though they prove significant in our estimated reaction function. Section 5 concludes with a brief discussion of the broader importance of the Federal Reserve's even keel operations.

2. Background.

Although economic historians, notably Meltzer 2005 and 2009, have explained why a consideration of the Federal Reserve's even-keel operations and U.S. gold losses under Bretton Woods can enhance our understanding of U.S. monetary policies, empirical estimates of monetary-policy reaction functions over the Great Inflation era have generally ignore them—particularly even keel. This section briefly describes their historical importance as prelude to our empirical estimates.

Pre-Accord Debt Operations

The even-keel operations of the Great Inflation era were a vestige of the Federal Reserve's pre-Accord relationship with the U.S. Treasury, which often subordinated monetary policy to Treasury debt-management objectives. Although the Accord reaffirmed the Federal Reserve's statutory independence for monetary policy, the System, nevertheless, interpreted that independence conditionally: The FOMC should avoid policy actions that might interfere with government operations, particularly the Treasury's debt-funding plans. This interpretation of independence reflected not only political thinking but also a macroeconomic belief prevailing in the 1950s and 1960s, which held that monetary policy should generally support fiscal policy (Meltzer 2003, p. 581).

During the Second World War, the FOMC's open-market operations focused solely on facilitating the U.S. Treasury's huge credit needs by limiting yields on U.S government securities.² Doing so would make credit available to the Treasury on favorable terms, would encourage immediate participation in bond drives by signaling that yields would not rise further, and would protect investors from the possibility of subsequent capital losses.

In April 1942, the Federal Reserve—with the Treasury's approval—announced that it would fix the yield on U.S. Treasury bills at 0.375 percent. To do so, the System would buy all bills on offer and would also allow sellers to repurchase bills, if they so desired. In addition, the System would set ceilings on the yields of all other Treasury securities. These ranged from 0.875 percent for Treasury certificates on up to 2.5 percent for Treasury bonds.³

By historical norms, these yields were unusually low—stemming, as they did, from the Great Depression and a recent inflow of gold—and the yield curve was "exceedingly" steep (Walker 1954, pp. 24 - 25). The steep yield curve encouraged banks—particularly after 1942—to shift their portfolios from Treasury bills, which they traditionally preferred, into long-term Treasury bonds. With the yield curve credibly set and bond prices unlikely to fall, long-term securities became virtually as liquid as short-term securities. To keep yields on Treasury bills and certificates from rising, the Federal Reserve had to acquire a large share of the short-term market, particularly bills, as banks shifted to longer maturities. Between 1942 and 1945, the System acquired 75 percent of all outstanding Treasury bills.

With the term-structure essentially fixed, the Treasury could expand the U.S. monetary base by issuing debt (Walker 1954, p. 34). Money growth, M2, averaged 17 percent during the war years and reached a high of 22 percent in 1943. Inflation spiked to 13 percent in May 1942, but price controls, rationing, and credit restrictions distorted price information throughout the war.

The Federal Reserve accepted its role in wartime finance, but as the war in Europe began to wind down, the System sought more flexibility in its operations. With the shift to peacetime production, the United States enter a brief recession lasting from February to October 1945. In late 1944, as economic activity slowed, long term interest rates fell below their 2.5 percent ceiling and stayed there through late 1947, even as inflation rose sharply. The FOMC continued to acquire Treasury bills, but offset their purchases during 1946 by allowing other instruments to roll off the System's balance sheet.

In the second half of 1946, inflation skyrocketed. In early July 1947, with the Treasury's endorsement, the Federal Reserve stopped pegging the yield on Treasury bills at 0.375 percent and ended its ceiling on Treasury certificates a month later.⁴ The Treasury, however, continued to maintain considerable leverage over the Federal Reserve, even in the bills market, because the Treasury set coupon yields, which the Federal Reserve—not wishing to interfere with debt refunding—felt compelled to maintain at, or above, par. The Federal Reserve and the Treasury subsequently agreed to a series of increases in the bill rate, which reached 1 percent by early 1948. The Federal Reserve and the Treasury also loosened ceilings on other instruments—save long-term Treasury bonds.

Both the Federal Reserve and the Treasury thought that maintaining the ceiling on longterm Treasury bonds was vital, even if doing so limited whatever flexibility the FOMC had gained at the short end of the yield curve (Chandler 1949, Hetzel and Leach 2001, p. 36). Higher yields on long-term Treasury's would raise the cost of Treasury debt and could risk capital losses, all of which might damage the market for Treasury securities. Moreover, because banks now held substantial amounts of long-term Treasury bonds, any capital losses resulting from a rise in their yield might weaken the banking system.

With the rise in short-term rates, individuals and banks began to liquidate their holding of long-term securities, while the Treasury was still selling substantial amounts of them. Long-term yields began to rise, requiring the Federal Reserve to make large purchases of long-term Treasuries between October 1947 and December 1948 (Walker 1954, p. 41). To minimize the impact on its balance sheet, the Federal Reserve sold nearly an equal amount of short-term securities, but on net the monetary base increased. Inflation, which surged in 1946, though much lower, remained uncomfortably high. Although the FOMC could not independently raise interest rates, the Federal Reserve requirements.

Tensions between the Treasury and the Federal Reserve eased in 1949, as the economy slipped into recession and prices generally fell, but as economic activity improved and prices again firmed, policy conflicts returned. The Federal Reserve anticipated higher market interest rates and asked the Treasury to postpone announcing low coupon rates on new issues, which FOMC was compelled to support. The Treasury, however, refused to accommodate the System.

The outbreak of the Korean in June 1950 caused a surge in speculative buying. The FOMC worried about inflation, which already was accelerating. In August 1950, the FOMC announced that it would use policy to fight inflation, imply short-term interest rates would rise. In response, the Treasury issued new 13-month certificates at a relatively low rate currently existing in the market. To prevent the operation from failing, the Federal Reserve bought all of the new issues at par, but simultaneously sold other short-term securities at a new, lower price consistent with the higher yield (Hetzel and Leach 2001, pp. 37 – 38). The System also raised the discount rate.

Exercising any capacity it had to raise short rates only complicated the FOMC's efforts to maintain the 2.5 percent ceiling on Treasury bonds. By late 1950, the Federal Reserve was adding longer-term Treasury securities—certificates, notes, and bonds—to an expanding balance sheet. Inflation continued to rise. The FOMC's attempts to rein in inflation would remain ineffective as long as it had to cap yields on long-term securities. The policy spilled into the open after the Whitehouse announced that the Federal Reserve had agreed to support the Treasury's debt-financing policy. Federal Reserve officials denied this and stated that as of 19 February 1951, they would no longer set a ceiling on Treasury bond yields.

In March 1951, the Federal Reserve and the Treasury signed the Accord which resolved the conflict between monetary policy and debt-management operations by ending the FOMC's obligation to defend a price for Treasury securities. By allowing greater flexibility in yields, the Accord enhanced the effectiveness of monetary policy. The agreement, however, did not represent the Federal Reserve's complete withdrawal from Treasury debt operations, as the System soon revealed.

To minimize bondholders' losses, as long-term yields rose after the Accord, the Treasury substituted nonmarketable bonds yielding 2.75 percent for the long-term marketable bonds then yielding 2.5 percent. The Treasury also offered to subsequently exchange these nonmarketable bonds for marketable 5-year bonds at 1.5 percent. The Federal Reserve facilitated the exchange,

which took place between 26 March 1951 and 6 April 1951, by supporting the price of 5-year bonds up to a limit of \$200 million dollars. The Fed reached that limit on the first day (Hetzel and Leach 2001, pp. 50 - 52).⁵

That the Federal Reserve waited until early 1951 to assert its statutory independence for monetary policy, instead of doing so earlier in the five years since the war's end is a considerable puzzle. Eichengreen and Garber (1990, p. 28 - 33) show that as long as banks held substantial amounts of long-term Government bonds, their balance sheets were vulnerable to capital losses. "[E]ven a relatively small rise in interest rates could wipe out the banks' capital funds." (Eichengreen and Garber 1990, p. 30) By 1951, banks' had reduced their holdings of bonds and, consequently, their vulnerability to capital losses on Treasuries. This allowed the Federal Reserve to assert its monetary-policy independence.

Even Keel

Although the Accord freed the System from its obligation to peg interest rates, the FOMC continued to aid Treasury debt operations through its even-keel policy from 1955 until the end of 1975. The overall objective of even keel was to avoid disorderly money-market conditions from the time that the Treasury announced a security offering until private underwriters had an opportunity to place the paper. Changeable market conditions—particularly a rise in rates—might generate low participation in Treasury financing operations, thereby raising debt-management costs. Markese (1971, pp. 65 & 82) suggested that even-keel operations could run anywhere from 12 to 30 days, but he estimated a mean of 22 days. Gustus (1969, p.8) estimates a similar central tendency. The Federal Reserve claimed that during even-keel events it did not attempt to peg, *ex ante*, a particular price for Treasury securities or otherwise create artificial market conditions; it just stabilized market-determined rates.⁶

Even keel was necessary, as Meltzer 2005, 2010 notes, because the Treasury did not auction its securities, other than Treasury bills.⁷ The Treasury announced coupon rates on its note and bond offerings and accepted bids until the issue was fully subscribed. Under such a procedure, an unanticipated increase in interest rates would impose a loss on buyers. This was especially crucial for the banks and security dealers who effectively underwrote Treasury sales. Capital losses might curtail their future participations in Treasury sales, making it all the more difficult for the Treasury to raise low-cost funds. The Treasury began experimenting with auctions in the 1970s. We find no evidence of even-keel events after 1975, suggesting that the Treasury routinely auctioned its debt after that date. Wallich (1979) seems to confirm our finding.

Even keel often involved two things: First, the Federal Reserve delayed overt changes in monetary-policy instruments (the discount rate, reserve requirements, or open-market operations) during the even-keel periods, unless—and this was pretty rare—such changes aided the Treasury's financing operations.⁸ This mandate especially applied to any FOMC open-market sales of Treasuries. Second, the Federal Reserve would typically add reserves through open-market operations during the even-keel period. Adding reserves insured that underwriters had adequate liquidity to finance their purchases and avoided any temporary increases in money-market rates resulting directly from the Treasury's actions, since the sale itself would temporarily drain reserves (Markese 1971, pp. 73-77; Meltzer 2005. pp 153-54). As Gustus (1969, p.6) claims, the aim was to keep free or net borrowed reserves and the federal funds rate fluctuating

in a narrow range. Yohe and Gasper (1970, p 105) also suggest that preventing a rise in money market interest rates above their recent high was an particular operating goal.

All else constant, an occasional couple-weeks delay in the imposition of a monetarypolicy adjustment should not matter much for inflation and inflation expectations, particularly given the lags intrinsic to monetary policy, but even-keel events occurred quite frequently during the Great Inflation. By our count, 47 percent of the months between 1960 and 1975 involved at least one even-keel event. (Seven of 192 months included two even-keel events.) Consequently, even keel operations had the potential to contribute to the Great Inflation.

We obtained meeting-to-meeting information on even keel operations from the *Record of Policy Actions of the Federal Reserve System* contained in the Board of Governor's *Annual Reports*. We converted this information into a monthly bivariate variable that takes a value of one during months in which the System undertook even-keel operations. Since even-keel operations can span a few weeks, assigning some events to a specific month is problematic. Following Yohe and Gasper (1970), we attribute an even keel announcement that occur before the 21st of a month to the current month and those that fall on, or after, that date to the subsequent month. This procedure seems appropriate given the mean duration of even-keel events and because FOMC announcements of even-keel operations were often indefinite, and forward looking:

"...throughout this period [the roughly three weeks to the next FOMC meeting] the Treasury would be in the market with large and complex new cash and refinancing operation. This circumstance suggested the desirability of a steady money market."

(6 June 1961 FOMC meeting, Annual Report for 1960,)

Table 1 (below) presents our even-keel counts for each month from 1960:1 through 1975:12.

Sometimes determining whether an even-keel operation took place from the narrative in the *Record of Policy Actions* is difficult; hence researchers' opinions can differ somewhat. When compared over the similar sample periods, our counts match 90% of the counts in Yohe and Gasper (1970) and 88% of the counts in Markese (1971). In both comparisons, we count four fewer even keel events than these researchers.

						Month							m 1
Year	Jan.	Feb.	Mar.	Apr.	Mav	June	Julv	Aug.	Sept.	Oct.	Nov.	Dec.	Total Even Keels
1960		1	1.10011	1	1.1009	0 0110	<i>•••••</i>	1	1	1	1	2	6
1961						1			1	1			3
1962	1	2		1							1		5
1963	1	2	1	2				1	1		1		9
1964	1	1		2	1	1	1	1		1	1		10
1965	1			1	1		1	1		2	1	1	9
1966	1	1		1	1			1		1	1		7
1967	1	1			1	1	1	1		1	1		8
1968					1		1			1	1		4
1969	1	1					1		1				4
1970	1	1		1	1			1		1			6
1971	1			1	1			1		1	1		6
1972	1			2		2	1			1		1	8
1973	1			1			1		1	1			5
1974		1	1	1			1			1			5
1975	1			1			1						3
Total	12	11	2	15	7	5	9	8	5	13	9	2	98

Source: Board of Governors of the Federal Reserve System, Annual Report, 1960-75; Federal Open Market Committee Minutes, 1960-75

Gold Losses and Bretton Woods

Under Bretton Woods, the United States pegged the dollar to gold at \$35 dollars per ounce and promised to buy or sell the metal at that price. At the prevailing official gold price, however, the supply of gold did not keep pace with the demand for gold reserves (Bordo, et.al 2011). Consequently, the dollar served as an official reserve asset along with gold, and the United States supplied dollar reserves through persistent balance-of-payments deficits. Absent dollar reserves, countries facing *temporary* balance-of-payments deficits would either have had to tighten their macroeconomic policies, impose disruptive restraints on trade and financial flows, or devalue their currencies. As the United States supplied the needed dollar reserves, however, the stock of outstanding dollar claims on the United States rose faster than the U.S. gold stock and eroded confidence in the official price. Triffin (1957, 1960) recognized the paradox in this arrangement. By 1965, outstanding official dollar claims exceeded the U.S. gold stock. Rising U.S. inflation after 1965 only worsened this problem. Remedying this situation required a real dollar depreciation, but this was problematic: A nominal dollar devaluation could destroy confidence in any future official U.S. gold price and, therefore, Bretton Woods itself. With the nominal dollar peg unbreakable and with foreign countries reluctant to inflate, the Federal Reserve could only achieve a real dollar depreciation by tightening monetary policy. This, however, might jeopardize the attainment of domestic objectives.

We test whether actual and potential claims on the U.S. gold stock significantly and systematically affected the Federal Reserve's policy decisions between 1960 and 1975. The terminal date is shortly after the advent of generalized floating in early 1973. Hetzel (1996) suggests that the FOMC allowed short rates to rise somewhat in 1961 and 1962 because of concern about external deficits. Meltzer (1991) believes that the 1961-62 period might represent a "possible exception"—one motivated by international concerns—to an overall excessively accommodative monetary policy in the early 1960s. Pauls (1990) contends that a discount rate hike in July 1963 was designed to offset financial outflows stemming from higher rates abroad. Maisel (1973), however, claims that during his tenor as a Federal Reserve governor (1965-1972), international considerations had little overall effect on FOMC directives. Recently, Bordo and Eichengreen (2008) have argued that Bretton Woods constrained Federal Reserve behavior prior to 1965, but, thereafter, as responsibility for defending the dollar shifted to the Treasury, the Bretton Woods constraint quickly eroded.

We measure actual and potential claims on the U.S. gold stock as the difference between the U.S. gold stock and outstanding dollar claims held by foreigner official institutions. Data for U.S. gold reserves and total U.S. liabilities to foreign official institutions come from the Board of Governors' *Banking and Monetary Statistics* (1960-1980). As shown in figure 2, the U.S. gold stock fell during the Bretton Woods era and dollar claims rose sharply. After 1965, outstanding official dollar claims exceeded the U.S. gold stock, implying that the United States could not fully meet its Bretton Woods commitment. President Nixon refused to convert foreign dollar reserves into gold on 15 August 1971, eliminating gold as a potential constraint on Federal Reserve policies.⁹ Our data on U.S. dollar liabilities to foreign official institutions end in 1975:12, but by this time the advanced nations had accepted the permanence of floating.



Figure 2: U.S. gold reserves and total U.S. liabilities to foreign official institutions

3. Empirical Methodology

In this section, we estimate a forward-looking, Taylor-type reaction function for the Federal Reserve that incorporates real-time data, dummy variables for even-keel events, and a measure of pressure on the U.S. gold stock prior to the closing of the U.S. gold window. We estimate this model using Hansen's (1982) instrumental-variables, general method of moments (IV-GMM) technique at a monthly frequency from 1960:1 through 1980:12.

Our specification assumes that the federal funds rate is an adequate proxy for the FOMC's operating instrument and, therefore, measures the intended thrust of policy over this time period. To be sure, the Committee often considered various reserve and money aggregates when formulating and explaining monetary policy and did not focus on a federal-funds-rate target in its directive to the Desk. Still, overnight interest rates should react quickly and in a consistent manner to changes in the availability of bank reserves.

Monetary-Policy Reaction Function

The specification of our reaction function combines elements of both Clarida, et al. (2000) and Orphanides (2002, 2003). Accordingly, equation 1 specifies the federal-funds-rate target as:

$$i_{t} = \beta_{\pi} (E_{t} \pi_{t+1} - \pi^{*}) + \beta_{u} (u_{t} - u^{*}) + \beta_{g} (D_{bw}^{*} \Delta g_{t}) + \beta_{ek} (1 - D_{ek}) + \varepsilon_{t}.$$
(1)

In equation 1, $\overline{i_t}$ is the FOMC's federal-funds-rate target, which the public cannot directly observe; π is the observed inflation rate, and π^* is the inflation target, which we assume to be 2 percent over the estimation period. Similarly, u is the actual unemployment rate, and u^* is the

target unemployment rate, which we set at 4 percent. The dummy variable, D_{bw} , takes a value of one during the Bretton Woods era through the G7 Rambouillet meeting, 1960:1 through 1971:8.¹⁰ Our gold pressure variable, Δg , is the difference between official U.S. gold reserves and total U.S. liabilities to foreign official institutions as shown in figure 2. The dummy variable, D_{ek} , takes a value of one in months when the Federal Reserve undertook an even-keel operation and zero otherwise. Because the Federal Reserve allegedly injected reserves into the banking system during even-keel operations, we expect the target interest rate, $\overline{i_t}$, to be higher in months when the Federal Reserve undertook no even keel operations, than in months with evenkeel events. We capture this in the β_{ek} $(1 - D_{ek})$ term in equation 1.

Conventional wisdom and strong empirical evidence indicate that the FOMC adjusts the federal funds rate (i_t) , which is an operating instrument and is publicly observable, to its target value $(\overline{i_t})$ with inertia (see Goodfriend 1991, Clarida et al. 1998, 2000 and Woodford 1999).¹¹ When the FOMC undertook an even-keel operation, it presumably kept the federal funds rate unchanged. Equation 2 embodies both of these ideas:

$$i_{t} = \rho_{ek} (D_{ek} * i_{t-1}) + (1 - D_{ek}) * [\rho * i_{t-1} + (1 - \rho)i_{t}] + \omega_{t}$$

$$\tag{2}$$

When D_{ek} equals one, implying an even keel event, i_t depends only on i_{t-1} , and we expect the adjustment parameter ρ_{ek} to be close to one. When D_{ek} equals zero, implying no even keel, the federal funds rate depends on a weighted average of its lagged value (suggesting inertia) and its current target value, $\overline{i_t}$. If the Federal Reserve achieves its inflation and unemployment-rate objectives, if claims on gold remain unchanged at their average value, and if an even-keel operation is not in play, the target interest rate $\overline{i_t}$ equals zero in equation 1, and the actual federal funds rate depends only on its past value in equation 2.

Combing equations 1 and 2, our estimating equation is as follows:

$$i_{t} = \rho_{ek}(D_{ek} * i_{t-1}) + \rho[(1 - D_{ek}) * i_{t-1}] + (1 - \rho)\beta_{\pi}[(1 - D_{ek}) * (E_{t}\pi_{t+1} - \pi^{*})] + (1 - \rho)\beta_{u}[(1 - D_{ek}) * (u_{t} - u^{*})] + (1 - \rho)\beta_{g}[(1 - D_{ek}) * D_{bw} * \Delta g_{t}] + (1 - \rho)\beta_{nek}(1 - D_{ek})^{2} + \upsilon_{t}$$
(3)

where v is the disturbance term, and $v_t \sim i.i.d.(0, \sigma_v^2)$. Consistent with the narrative in section 2, equations 1 and 2 introduce even keel into our estimating equation 3 in two ways: as a reduction in the target interest rate—stemming from an injection of reserves—and as a delay in any adjustment of the federal funds rate to its target value.

Data Description

Whereas most studies employ quarterly data, our time series data set consists of monthly observations. A monthly frequency is necessary to investigate even-keel. It requires us to proxy real economic activity with the unemployment rate. The estimation period—1960:1 through 1980:12—begins when gold problems started to become critical for the United States, which is $5\frac{1}{2}$ years before inflation starts to rise precipitously, and ends after inflation passes its peak value in early 1980.

We also employ real-time data and a forward looking reaction function to capture FOMC's decision-making process in our estimated model. Orphanides (2001) shows that policy reaction functions that are based on *ex post* revised data and fail to incorporate expectations provide inaccurate descriptions of historical policy decisions. Monetary policy affects macroeconomic target variables with a lag, so policy makers must be forward looking in the policy formulation. Moreover, when formulating policy, the FOMC does not know the current state of the macroeconomic economy with certain—let alone its future state—but must depend on partial information about current variables and forecasts of future variables. Therefore, one cannot adequately captures the policy makers information set unless one uses real time data—data actually available to policy makers—and forecast of instruments.

We obtained real time data for the consumer price index, and the unemployment rate from the Federal Reserve Bank of St. Louis' *ArchivaL of Federal Reserve Economic Data* (ALFRED). Revisions in the unemployment rate data, unlike revision in actual or potential GDP, are relative few and small, never exceeding 0.3 percentage points. We measure inflation as the monthly log difference of the headline consumer price index (CPI) multiplied by 12 to express it an annual rate. Revisions in the CPI can be substantial. Since we do not have *ex ante* measures of expected inflation ($E_t \pi_{t+1}$) over our estimation period, we use the actual one-monthahead inflation rate as a proxy for expected inflation. We assume that the target inflation rate, π^* , is 2 percent. We construct the unemployment gap by subtracting an assumed 4 percent natural rate of unemployment from the real time actual unemployment rate. A 4 percent natural rate of unemployment is consist with definitions of full employment found in the *Economic Report of the President* over our estimation interval.

Stationarity in the Data

Most time series data contain a unit root. Therefore, we test for non-stationarity in the federal funds rate (i_t) , the expected inflation deviation $(E_t \pi_{t+1} - \pi^*)$, the unemployment gap $(u_t - u^*)$, the difference between gold reserves and total U.S. liabilities to the foreign official institutions (Δg_t) , and the interaction terms, $(D_{ek} * i_{t-1})$, $[(1 - D_{ek}) * i_{t-1}]$,

 $[(1-D_{ek})*(E_t\pi_{t+1}-\pi^*)], [(1-D_{ek})*(u_t-u^*)], and [(1-D_{ek})*D_{bw}*\Delta g_t]$ using Augmented Dickey Fuller (ADF) tests. The null hypothesis of ADF test is that each individual series is nonstationary. Since the data are at a monthly frequency, the ADF tests start with 20 lags for each data series. We then decrease the number of lags until the test-statistic is significant. Moreover a constant term and a drift term are included in the test. Table 2 summarizes the results from the ADF tests. The first column in Table 2 denotes the variable, the second column shows the number of lags in the text, and the third column reports the ADF test statistic with its p-value.

We are able to reject the null hypothesis of non-stationarity in all cases. All of the variables are stationary over our sample period.

Variable	Lags	$ au_{ADF}$ (p - value)
i,	16	-1.309* (0.09)
$(E_t\pi_{t+1}-\pi^*)$	20	-1.727** (0.04)
$(u_t - u^*)$	19	-1.777** (0.03)
Δg_t	20	-1.818** (0.03)
$D_{ek} * i_{t-1}$	16	-1.695** (0.04)
$(1 - D_{ek}) * i_{t-1}$	3	-2.222**(0.01)
$(1-D_{ek})*(E_t\pi_{t+1}-\pi^*)$	5	-1.732** (0.04)
$(1-D_{ek})*(u_t-u^*)$	1	-1.785** (0.03)
$((1-D_{ek})*D_{bw}*\Delta g_t)$	20	-1.886** (0.03)

Table 2: Stationarity test results

Note: * and ** indicate statistical significance at the 10 percent and 5 percent levels, respectively.

Estimation Technique

To estimate equation (3), first, we assume that the error term is independently and identically distributed [$v_t \sim i.i.d.(0, \sigma_v^2)$]. In a forward looking version of the Taylor rule, endogeneity can arise because the federal funds rate may also affect the unemployment gap and the deviation of expected inflation from its target. One way to estimate the model in the presence of endogeneity is to use lagged values of the endogenous variables as instruments. In our model, the number of instruments—and hence the orthogonality conditions—will exceed the number of regressors, which can lead to over-identification. Consequently, we use Hansen's (1982) instrumental-variables, general method of moments (IV-GMM) technique, which allows for parameter over-identification and obtains an optimal weighting matrix for a set of population moments. Moreover, the IV-GMM weighting matrix can account for heteroskedasticity and serial correlation of unknown form. Here we use 4 lags of inflation deviation and 4 lags of unemployment gap as instruments.

4. Estimation Reaction Function

Table 3 summarizes the coefficient estimates for our reaction function, equation (3), with the robust standard errors in parenthesis:

Coefficient	Estimates	Estimates		
	(Robust Std. Err.)	(Robust Std. Err.)		
_	(I)	(II)		
$ ho_{\scriptscriptstyle ek}$	1.007***	1.006***		
	(0.0131)	(0.0130)		
ρ	0.764***	0.747***		
	(0.089)	(0.088)		
в	0.970***	0.800**		
Γπ	(0.298)	(0.343)		
β	-0.708***	-0.820***		
r u	(0.251)	(0.231)		
β.	0.042***	0.0476***		
r nek	(0.016)	(0.0145)		
$oldsymbol{eta}_{s}$		-2.54e-07		
		(2.82e-07)		
N	251	192		
R^2	0.98	0.99		
χ^2 p-value for <i>l</i> -test	0.24	0.22		
χ^2 p-value for Hansen <i>J</i> -	0.19	0.27		
test				

Table 3: The effect of even keel on the federal funds rate

* Significant at 10%, ** significant at 5%, *** significant at 1%.

Column (I) reports the estimated coefficients and the robust standard errors for the model without our measure for pressure on the gold stock, Δg_t . Column (II) repeats the estimation with Δg_t in the regression equation. We estimate equation I without Δg_t from 1960:1 through 1980:12, giving us 251 observations (N), and we estimate equation II with Δg_t from 1960:1

through 1975:12, giving us 192 observations. The R^2 s for the estimated regression equations are 0.98 and 0.99, respectively.

We have assumed that the error terms in our two estimated equations are distributed $i.i.d.(0, \sigma_v^2)$, but with the dependent variable regressed on one lag of itself, the error term may follow an autoregressive process of order one, AR(1). We, therefore, test for the presence of autocorrelation using the Cumby and Huizinga (1992) *l*-test.¹² The null hypothesis (H_0) of the test is that the errors are not AR(1). Our estimates of the *l*-statistic are 1.35 for the model in column (I) of table 3 and 1.52 for the model in column (II). Under H_0 , the p-values for the calculated χ^2 are 0.24 and 0.22 respectively. We fail to reject H_0 that the errors not AR(1), which allows us to use lagged values of the endogenous variables as instruments for the estimation.¹³ We further test the validity of the instruments using Hansen's test of the over-identifying restrictions. The null hypothesis is that the instruments used in the IV-GMM estimation not correlated with the error term. Our estimated Hansen J statistics have p-values of 0.19 in column (I) and 0.27 in column (II) and cannot reject the H_0 in either case, giving us greater confidence that the instrument set is appropriate.

Description and Interpretation of the Coefficients

Our estimated reaction function (table 3) suggests that the Federal Reserve conformed to postulated even-keel practices during the Great Inflation. When the FOMC expected the U.S. Treasury to sell securities, it delayed changing the federal funds rate and injected reserves into the banking system. The estimated coefficient, ρ_{ek} , is significantly different than zero and equal to one in both equations I and II. This suggest that during 91 months containing even keel events, the FOMC, in an effort to facilitate the Treasury's securities sales, tended to stabilize the federal funds rate at its previous value despite deviations in either the inflation rate or the unemployment rate from its target value (see table 1).¹⁴ Also consistent with the hypothesized even-keel behavior, the estimated coefficient, β_{nek} , which is attached to the $(I-D_{ek})$ dummy for no even keel in both models, is approximately 0.05 in both equations I and II, suggesting that—all else constant—during even keel events the federal funds rate is 5 basis points lower than during non-even-keel events. This coefficient value suggests that the Federal Reserve added a small amount reserves to provide liquidity to underwriters during Treasury security sales.

Model II also suggests that concerns about mounting foreign official claims on the U.S. gold stock did not affect the FOMC's behavior between 1960, when confidence in the gold price started to weaken, and 1975, shortly after the G7 acceptance of generalized floating. The coefficient β_g is not significantly different from zero in model II. In theory, concern about U.S. gold losses should have driven the FOMC to maintain a tighter monetary policy, all else constant. The result seems to confirm Maisel's (1975) claim that international matters had little effect on FOMC decisions, but it does not disprove Meltzer's (1991) and Hetzel's (1996) claims that the FOMC reacted to international concerns in 1960 and 1961. Nor does it disprove Paul's (1990) observation that the Board raised the discount rate in 1963, to stem financial outflows.

We also found that the FOMC reacted in a manner consist with interest-rate smoothing or policy inertia—between 1960 and 1980, even when they were not undertaking even-keel operations. Our coefficient for inertia, ρ , is statistically significant with a value of 0.76 in model I and 0.75 in model II. The high value on ρ suggests that the FOMC was slow to change monetary policy to evolving economic conditions.

Like Clarida et al (2000) and Orphanidise (2002, 2003), we find that the FOMC did not conform to the "Taylor principle" during the Great Inflation. The coefficient on deviations between actual and target inflation rates, β_{π} , is 0.97 in model I and 0.80 in model II. Both estimates is statistically significant. The upper ends of the 95 percent, confidence intervals for these two estimated coefficients are 1.007 and 0.849, respectively. Although the upper end of confidence interval on β_{π} in model I exceeds one, it barely does so. These coefficients indicate that—even in the absence of even-keel—the FOMC did not foster a monetary policy sufficiently restrictive to dampen aggregate demand in the face of inflationary pressures. The nominal federal funds rate kept in step with above target inflation, leaving the real federal funds rate unchanged.

The estimated coefficient on the unemployment gap, β_u , is -0.71 in model I and -0.82 in model II and is statistically significant in both cases. The negative coefficient indicates that the FOMC took actions that lower the federal funds rates when the actual unemployment rate rose above 4 percent, the then-prevalent estimate of the natural rate of unemployment.

5. Did Even-Keel Operations Promote the Great Inflation?

Our reaction-function estimates indicate that the FOMC engaged in even-keel operations in 91 months between 1960 and 1980. When the Treasury issued debt securities, the Committee delayed monetary-policy adjustments that might affect money-market interest rates and injected a small amount of reserves into the banking system to provide liquidity for the operations. The reaction-function estimates, however, have little to say about the inflationary consequences of these operations.

Between 1960 and 1980, the FOMC engaged in even-keel operations during periods of both relative monetary tightness and monetary ease—at least as judged by FOMC participants. In June 1961, for example, the FOMC undertook an even-keel operation, delaying any further easing, during a period in which the Committee general sought to encourage the expansion of bank credit:

"In view of impending U.S. Treasury financing,...the Committee concluded that in the period until the next meeting it would be desirable to maintain approximately the *same degree of ease* as had prevailed recently, resolving any doubt on the side of ease and clearly avoiding any lessening of the availability of reserves." (*Annual Report* 1962, p. 61, emphasis added)

Figure 3 (below) shows how all of the even-keel events between 1960 and 1975 compare with the FOMC's opinion about the thrust of monetary policy. The figure counts instances when even-keel operations were associated with monetary ease, monetary tightness, or merely standing pat.¹⁵ In 1971, for example, the FOMC engaged in even-keel operations during six months of that year. Of these six, three were associated with an overall easing in monetary policy in the FOMC's view. Two others seemed associated with a tightening of policy, and one was associated with no apparent change in policy at all. In 1964 and 1967, all even-keel events delayed changes in a policy that FOMC participants described as otherwise seeking monetary

ease. In 1963 and 1966, on the other hand, all even-keel events seemed to delay actions consistent with the Committee's seeking tighter monetary conditions.



Source: Board of Governors Annual Reports 1961-1976

If even-keel events were inherently inflationary in their implementation, we would expect them to be consistently associated with lower federal funds rates than non-even-keel events. On average, this was not the case. Between 1960 and 1975, the federal funds rates during even-keel months averaged 5.07 percent, while the federal funds rate associate with non-even-keel months average 5.32 percent. The difference between these numbers is not statistically significant. The evidence suggests that even-keel did not contributed importantly to the Great Inflation.

6. Even Keel, Inflation, and Monetary-Policy Credibility

During the Great Inflation era, the Federal Reserve frequently delayed policy changes and injected a small amount of reserves into the banking system with an eye toward assisting the U.S. Treasury's debt-financing operations. By keeping money-market yields from rising for roughly three weeks after the Treasury announced an offering, the Federal Reserve prevented underwriters from taking capital losses on their positions. Capital losses could drive banks and securities dealers from the market and push up the costs of financing the nations' debt.

Nevertheless, we find little evidence that even-keel operation contributed *directly* to the Great Inflation. Even keel events occurred both during periods of relative monetary tightness and ease, at least in the FOMC's view. The average federal funds rate during even-keel events

was not substantially different than the average federal funds rate during non-even-keel periods. At a most basic level, the Great Inflation resulted because the FOMC did not act in accordance with the Taylor principle, and economists have offer many other explanations for the Committee's behavior.

Although even-keel might not have *directly* contributed to the Great Inflation in terms of excessive reserve growth, it may have done so *indirectly* by undermining of the Federal Reserve System's credibility. As these even-keel operations show, the System interpreted its monetary-policy independence conditionally after the Accord. Concern that the FOMC might delay a needed monetary response at the Treasury's behest, whether for even keel or for some other reason, may have affected inflation expectations. Deeper ingrained inflation expectations would worsen the short-term real costs of ending inflation, thereby feeding back and contributing to the FOMC's reluctance to follow the Taylor principle. By interpreting its independence conditionally, the FOMC was also conditioning its willingness to attain its stated macroeconomic policy objectives. (see Bordo, et al. 2010).

The same factors that explain the FOMC's failure to follow the Taylor principle should help explain the Federal Reserve's unwillingness to address the country's prospective gold losses. The Great Inflation aggravated Triffin's paradox and ultimately ended the Bretton Woods system.

7. References

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8. Endnotes

² There were some *ad hoc* pre-war antecedents, as explained in Eichengreen and Garber (1990) and Chandler (1949): In 1935, the Federal Reserve bought long-term Treasury securities to dampen a rise in bond yields—an even-keel like event. In 1937, the Federal Reserve bought long-term bonds to limit a rise in their yields. This policy, which the System nominally extended through early 1939, was primarily intended to help banks manage their excess reserve positions. As war broke out in Europe, the System lent Treasury bonds to banks in hopes of minimizing the impact of yield fluctuations. In late 1939 and early 1940, the System again bought Treasury bonds to prevent a decline in their prices. Eichengreen and Garber (1990, p.4) note that the Glass-Stegall Act of 1932 first allowed the Fed to buy large amounts of Treasury debt.

³ Friedman and Schwartz (1963. p. 562, fn 10 &13) provide a nice description of these Treasury securities.

⁴ To secure the agreement with the Treasury the Federal Reserve agreed to renew the 90 percent franchise tax on its earnings.

⁵ Following the Accord, Treasury Secretary Synder told President Truman that he could no longer work with Federal Reserve Chairman McCabe, prompting McCabe's resignation. Truman appointed William McChesney Martin in his stead expecting Martin to swing the Federal Reserve back under Treasury control. To Truman's chagrin, Martin support Federal Reserve independence (Hetzel and Leach 2001, p. 51 – 52).

⁶ "While the System has believed that its power to create money should not be used to support these [Treasury] financings, it has recognized that concurrent monetary action may affect their success. Consequently, the Federal Reserve has come to pursue whenever feasible what is known as an even keel monetary policy immediately before, during, and immediately after Treasury financing operations." Board of Governors quoted in Gustus (1969).

⁷ The System did not extend even keel operations to the Treasury's regular weekly sales of bills (Markese 1971, pp. 59 -60). Treasury bill carried no coupon rates, and the Treasury made no announcement of terms. In addition, interest-rate fluctuations were not a big problem for investors because bills had a short maturity,

⁸ Markese (1971, 73-77) suggests that if—on rare occasion—the Federal Reserve either changed the discount rate or reserve requirements during a Treasury financing, it has done so in a direction that makes funds more readily available to the banking sector, thereby aiding the sale of the Treasury's offer.

⁹ In March 1968, the G7 suspended their gold pool operations. The gold pool bought and sold gold in an attempt to stabilize its price at the official price. They agreed thereafter to a two-tier gold market in which central banks would only sell gold at the official price among themselves. The market price could then diverge from the official price.

¹⁰ The G7 Rambouillet meeting (15 -17 November 1975) ended discussion of a return to fixed exchange rates.

¹ See Bordo and Orphanides (forthcoming).

¹¹ In contrast Rudebusch (2002) argues that a large and significant coefficient on the lagged interest rate reflects serially correlated variables that are incorrectly omitted from the reaction function. Studies, such as Castelnuovo (2003), English et al. (2002), Gerlach-Kristen (2004), that investigate the relative importance of policy inertia and omitted variables conclude that both mechanisms are at play. Our empiric methodology adjusts for serial correlation.

¹² When a regression containing endogenous variables is estimated using instrumental variables, the three popular tests for autocorrelation, Box and Pearce (1970) test, Durbin (1970) h test and the Lagrange multiplier test described by Godfrey (1978) are not valid.

¹³ If the p-value for the calculated χ^2 is p < 0.005, we reject the null hypothesis in favor of the alternative.

¹⁴ The mean absolute value of changes in the actual federal funds rate during even-keel months is 0.26 and the mean absolute value of changes in the actual federal funds rate during non- even-keel months is 0.34. We can reject the H_0 that these values are the same in favor of H_a that the mean absolute value of changes in the federal funds rate is smaller during even-keel events than otherwise only with a p-value of 0.159 percent.

¹⁵ In periods that are associated with no change in monetary policy, FOMC statements either gave no clear indication of whether policy was easy or tight, or FOMC participants were so divided about what the thrust of policy should, they did nothing.