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During the early part of the Great Inflation (1965-1975), the Federal Reserve undertook even-keel operations to assist the US Treasury's coupon security sales. Accordingly, the central bank delayed any tightening of monetary policy and permanently injected reserves into the banking system. Using real-time Taylor-type and McCallum-like reaction functions, we show that the Fed routinely undertook these operations only when it was otherwise tightening monetary policy. Using a quantity-equation framework, we show that the Federal Reserve's even-keel actions added approximately one percentage point to the overall 5.1 percent average annual inflation rate over these years.

Keywords: Even Keel, Great Inflation, Federal Reserve, US Treasury.

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Even Keel and the Great Inflation

1. Introduction

The Great Inflation was one of the Federal Reserve's (Fed) biggest policy failures. Between 1965 and 1980, headline CPI inflation cycled upward from 2 percent to 14 percent, with each successive peak and trough exceeding the previous one (Figure 1). The cumulative price rise was on par with some previous war-time inflations (De Long (1997), pp. 248-49). By 1976, worldwide confidence in the Fed's monetary policy was rapidly waning. Inflation and expectations of further inflation began to influence economic decisions in ways that threatened the nation's long-term growth and prosperity (Bordo and Orphanides (2013), pp. 2-6).

Economists have offered many explanations for the Great Inflation. Most find fault in an economic framework that downplayed money's causal role in the inflation process and emphasized instead such things as fiscal policy, union wage demands, corporate pricing power, and myriad idiosyncratic relative price shocks. Many economists also stress that policymakers, with vivid memories of the Great Depression, simply viewed unemployment as more socially disruptive than inflation (Mayer (1999), pp. 122-24; Hetzel (2008), pp. 65, 67, 111). A belief in a permanent Phillips curve tradeoff, especially before 1970, then leveraged this policy preference into higher inflation (Romer and Romer (2002)). This tilt in policy became possible, as Bordo and Eichengreen (2013) explain, because ad hoc policies to deal with US balance-of-payments problems weakened the Bretton Woods constraint on US monetary policy in the mid-1960s. Chari, Christiano and Eichenbaum (1998) describe how a revealed preference for real macroeconomic policy objectives and expectations subsequently interacted to heighten the costs of disinflationary policies, leaving policymakers all the more reluctant to pursue such a course. Complicating all of these factors was the stop-go approach to policy that characterized the era, instead of a credible, rules-based strategy. Others, notably Orphanides (2001, 2002, 2003, 2004), argue that persistent errors in the forecast of inflation, stemming from mismeasurement of potential growth and the natural rate of unemployment, contributed to the Great Inflation. Meltzer (2005) adds grist to the intellectual mill by also discussing how personalities, politics, and institutional relationships influenced US monetary policy.

Among these institutional relationships, Meltzer (2005, pp. 153, 168) highlights the Fed's even-keel operations, which consisted of postponing policy changes and permanently adding reserves during Treasury finance operations. As early as 1959, the Federal Open Market Committee (FOMC) expressed concern about the constraints that even-keel operations placed on monetary policy (US Congress (1959), p. 1785). In her comments on Meltzer (2005), however, Romer (2005, p. 180) finds the claim implausible, correctly noting that even keel had no such inflationary effects in the 1950s. Supporting her, Struble and Axilrod (1973, p. 236) had argued that the FOMC subsequently offset even-keel operations. (See also Garbade (2019), pp. 466-69).

We attempt to quantify the effect of the Fed's even-keel operations on inflation between January 1965, just prior to the start of the Great Inflation, and December 1975, shortly after the even-keel policy ended. If even-keel operations significantly contributed to the Great Inflation, they would have resulted in an overall monetary policy that was easier than otherwise would have been the case. We show that even-keel operations, because of their frequency and duration, made a significant contribution to the Great Inflation.

Our paper proceeds as follows: Section 2, a historical overview, describes the origins of the Fed's even-keel operations, their connection to the Treasury's use of fixed-price security offerings, and their particular importance when interest rates were rising. Section 3 explains our empirical methodology, including the construction of our even-keel dummy variable, our identification of monetary policy tightening, and the derivations of our real-time reaction functions. Section 4 uses the empirical results from Section 3 in a quantity-theory framework to estimate even keel's contribution to the Great Inflation. Section 5 concludes with an updated restatement of the Fed's even-keel policy, a comment about its effect on inflation, and a caveat about its causal relationship to inflation. The appendix provides stationarity and cointegration tests.

2. The Historical Development of Even-Keel Policy

Often throughout its history, the Fed viewed cooperation with the US Treasury as a necessary and mutually beneficial way to avoid financial-market disruptions, particularly during government debt-management operations. The weight of this cooperation, however, fell heavily on the Fed, particularly when the Treasury sold all of its coupon offerings at fixed prices, rather than at auction. Even keel was a post-Treasury-Federal Reserve Accord manifestation of this cooperation.

2.1. The Origin of Even Keel, 1913 – 1955

The authors of the original Federal Reserve Act, in making the Secretary of the Treasury the *ex officio* chairman and the Comptroller of the Currency an *ex officio* member of the Board of Governors, did not envision a central bank wholly independent of the US Treasury. Considerable overlap existed in their policy spheres, creating externalities for both agencies, especially with regard to the financing of government debt. Cooperation—specifically, avoiding financial-market disturbances—could be mutually beneficial and became the distant motivation underlying the Fed's even-keel philosophy.

The Treasury's decision in 1915 to sell all government securities at fixed prices would in time critically affect this cooperative relationship. The US had successfully auctioned its debt in the past, but these operations generally involved only large investors, like merchant banks (Garbade (2012), p. 4). Facing the prospects of the First World War, the Treasury began selling all government securities at fixed prices in order to attract a broader array of participants, notably small, unsophisticated investors.

Despite its potential for broader appeal, a fixed-price offering will be undersubscribed or "fail," if the Treasury sets a security price above the prevailing market equilibrium. More importantly, dealers, who underwrite and market government securities, must be confident that they will not incur capital losses or otherwise be unable to sell the securities because of an unexpected rise in market rates. Absent adequate dealer participation, markets become illiquid and less efficient. Early on, the Fed promoted a liquid dollar-acceptance market by assisting dealers in acceptances; this concern eventually extended to dealers in US governments securities (Board of Governors (1919), pp. 18-24; Ferderer (2003)).

During the 1920s, 1930s, and 1940s, the Fed's market assistance was *ad hoc*. It did not consist of even-keel-type operations because the Treasury underpriced its securities during the period, leaving them routinely oversubscribed. The Fed, however, occasionally entered the market when Treasury actions adversely affected bank reserves, or when disorderly market conditions threatened the success of a Treasury offering. One could claim that the two world wars offered an early example of even-keel writ large, as the Fed suspended monetary policy operations and injected substantial amounts of reserves to foster Treasury debt sales. But these operations, too, were *ad hoc* cooperative responses to existential threats.

After the Second World War, the Fed looked to shift its focus from debt management to preventing inflation, but the Treasury maintained that it could not possibly finance the unprecedented public debt at reasonable interest rates without the Fed's continued participation in the government securities market. By fiscal year 1946, Treasury debt had reached a record 115 percent of GDP. Fearful of being blamed for the failure of any fixed-price issuance, the Fed continued to support Treasury operations after the war, amid mounting inter-agency tensions.

These strains led to the Treasury-Fed Accord (Hetzel and Leach (2001); Moe (2013)). On March 4, 1951, the Secretary of the Treasury and the chairman of the Federal Reserve System issued the following statement: "The Treasury and the Federal Reserve System have reached full accord with respect to debt-management and monetary policies *to be pursued in furthering their common purpose to assure the successful financing of the Government's requirements* and, at the same time, to minimize monetization of public debt" (Board of Governors (1952), p. 4, *emphasis added*).

The accord freed the Fed from having to peg yields on Treasury securities, but not from assuring "the successful financing of the Government's requirements." The Fed continued to support the Treasury's debt operations by making purchases of Treasuries to "maintain an orderly market" (US Congress (1964), p. 2014). To accommodate debt rollovers, the Fed bought $3 billion worth of coupon securities between July 1, 1951 and September 30, 1952, and to assist new cash offers, the Fed bought an additional $35 million worth of intermediate and long-term Treasury securities over the same period (US Congress (1964), p. 2013). The Fed at times also purchased specific Treasury securities (Board of Governors (1952), p.106). "[I]t was not until December 1952, that a Treasury refunding operation was carried out without any support from the Federal Reserve" (FOMC (1954), p. 19). Even after 1952, the Fed "steadied the market" during periods of Treasury financing.

The FOMC continued in this manner after the accord, because the Fed routinely offered the Treasury advice—sometimes "forcefully"—about security prices, security types, and maturity dates (Rouse (1958), p. 16). The Treasury's acceptance of this advice implied that the FOMC would see "the financing through, more or less regardless of the effect on bank reserves or other aspects of general credit conditions" (Rouse (1958), p. 16).[1] The Fed did attempt to sterilize these security purchases in 1951 and 1952, resulting in monetary policy operations that primarily focused on withdrawing unwanted funds placed in the market to support Treasury debt sales (US Congress (1954), p. 21).

Chairman Martin wanted to further disentangle monetary policy from debt-management operations. He worried that market participants might interpret the Fed's continued support as a sign that it was still under pressure to peg yields, and he believed that the Fed's current practices created a "disconcerting degree of uncertainty" about when, how much, and where on the yield curve the Desk might intervene (FOMC (1953), p. 31; US Congress (1954), p. 16). According to Martin, the Fed's activities created inefficiencies that compromised the "depth, breadth, and resiliency" of the long-term securities market. Dealers had become reluctant to carry inventories and act as market makers; they were functioning merely as brokers (US Congress (1964), p. 2048). This was a monetary policy problem because the resulting distortions impaired the transmission mechanism and "weakened the effectiveness of open-market operations" (US Congress (1964), p. 2013).

[1] Robert Rouse was the manager of the System Open Market Account between 1940 and early 1962.

On May 17, 1951, the FOMC created an Ad Hoc Subcommittee to study its operations in the government securities market. In its report of November 12, 1952, the subcommittee recommended that the Fed restrict open market operations to the short end of the yield curve, bills preferably, and conduct operations only to add or subtract reserves consistent with the goals of monetary policy, not to affect specific government securities prices or yields. In accordance with the subcommittee's recommendation, the FOMC stopped offering financial advice to the Treasury, unless the latter specifically requested it. The subcommittee also recommended that the Desk manager become an employee of the FOMC to make the manager directly accountable to the Committee.

Despite these recommendations, the subcommittee believed that markets could occasionally become disorganized and authorized interventions to correct "a disorderly situation in the Government securities market." This language, in contrast to Fed's previous commitment to "maintain orderly conditions" in the market, signaled that the Fed would henceforth seldom support the government securities market (FOMC (1953), p. 32). The Fed would only act in rare cases when the market was not self-correcting, when selling fed on itself, leaving dealers afraid to act (US Congress (1964), p. 2016). Moreover, the Desk resolved to intervene only in the short end of the yield curve, preferably by buying Treasury bills (US Congress (1964), p. 2016; Rouse (1958), p. 18).[2]

2.2. Even-Keel Operations, 1955–1975

Although the Ad Hoc Subcommittee recommended a minimalist approach to distance monetary policy from debt management, its appendix endorsed a separate procedure that became

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[2] On two occasions, however, the Desk deviated from the bills preferable; see (Annual Report (1956), p. 8; Annual Report (1959), pp. 6-8).

known as “even keel.” The report advised that, when the Treasury conducts financing operations, the FOMC “agree to suspend … any open-market operations in which it might be engaged” and “take such steps as might be necessary to prevent a rise in open market Treasury bill rates” above levels that prevailed just prior to the Treasury’s announcement of its operations. Once the Treasury offering was complete, the FOMC “would be entirely free to engage in open-market operations to effectuate whatever credit policies it considered appropriate … without regard to the effects of such open-market operations on the prices of the newly offered or any outstanding securities” (US Congress (1964), p. 2052). The subcommittee report also included an important, but soon forgotten, admonition: “Assuming that Treasury financings are sufficiently infrequent” (US Congress (1964), p. 2052).

In 1953 and 1954, the FOMC expressed occasional concerns about Treasury financing, but an even-keel policy was not clearly in force. It was not particularly necessary at this time because economic activity contracted through the latter half of 1953 and the first half of 1954; policy eased and remained accommodative during these years (Board of Governors (1955), pp. 4-6). In this environment, government security dealers and investors faced few risks of capital losses.

In 1955, however, the Fed began “firming” monetary policy, and Treasury offerings increased, creating an atmosphere ripe for even-keel operations. (On this period, see also Garbade (2019), pp. 230-233). At the Executive Committee meeting on January 25, 1955, Chairman Martin suggested that Fed monetary policy actions have as little effect as possible on the Treasury’s upcoming financing operations and certainly “should not do anything … that would appear to interfere with the success of the Treasury’s forthcoming financing” (Executive Committee (1955a), p. 10). Rouse suggested a substantial injection of reserves and a “reasonably free" repurchase facility to aid dealers. Governor Robertson thought that the "objective ought to be to 'keep an even keel' throughout the Treasury financing" (FOMC (1955a), pp. 10-11). Robertson offered no definition for even keel, but Rouse suggested "leveling off around the current volume [of free reserves]" (FOMC (1955a), p. 11). Chairman Martin saw the fact that the "Treasury's offering should not appear either to be floated by the Federal Reserve or hindered by the Federal Reserve" as even keel's essential feature (FOMC (1955a), p. 13). By this he meant that monetary policy should not change and, if anything, Desk operations should err on the side of ease (FOMC (1955a), p. 14). The February 1955 Treasury financing went smoothly "with less [even-keel] provision of reserves than might have been thought necessary," and the Executive Committee pledged to add reserves during the March Treasury financing to maintain even keel (FOMC (1955b), p. 12).

Between early 1955 and mid-1975, even keel involved two distinct actions: First, the Federal Reserve delayed overt changes in all monetary policy instruments, unless such policy changes aided the Treasury's financing operations (Markese (1971), pp. 73-77). The Fed would maintain the existing degree of monetary ease or restraint particularly if it had been initiated and understood by the market in advance of the Treasury issuance (Axilrod (1971), p. 29). Second, the Federal Reserve would add reserves during the even-keel period to ensure that underwriters had adequate liquidity to finance their activities and to avoid temporary increases in money-market rates resulting because the security sale itself temporarily drained reserves (Axilrod (1971), p. 36; Markese (1971), pp. 73-77; Meltzer (2005), pp. 153-54).

The Fed exempted Treasury bill auctions from even-keel operations because bill auctions more readily captured prevailing market expectations about rates. Moreover, bill auctions were usually for relatively small amounts, and bills matured within a year, making their interest-rate risks minimal. Exceptions might occur if a bill offering was for new cash and particularly large, or if short-term money markets were under unusual strain (Axilrod (1971), p. 30).

The Fed's even-keel operations usually started shortly before the Treasury announced an offering, when officials began canvassing markets to set a price and coupon rate, and extended long enough to give dealers, who underwrote the operations, time to sell the new securities to the general public. If uncertainty pervaded financial markets prior to a Treasury offering, the Fed might start even-keel operations earlier than otherwise. If the Treasury offering was unusually large or if the market seemed slow to absorb the issuance, the Fed might extend its even-keel operations longer than normal. On the other hand, the Fed might shorten the length of an even-keel event if it urgently needed to change monetary policy (Struble and Axilrod (1973), p. 237).

All else constant, an occasional short delay in the imposition of monetary policy adjustments and temporary small injections of reserves should have had little effect on inflation, but even-keel events occurred frequently and lasted a long time. By our count (explained below) nearly half of the 132 months between 1965:1 and 1975:12 contained at least one even-keel event, and three months contained two even-keel events (Table 1). Moreover, a second consecutive even-keel month followed nearly one-third of all even-keel months in our sample. Each of these even-keel operations lasted roughly three weeks, but the variations in the operations were substantial. Axilrod (1971, Table 1) suggests that the average length of an even-keel event was 18 days, with a standard deviation of roughly 3 days between 1966 and 1968. The range of his estimates was 13 to 24 days. Gustus (1969, p. 8) finds that between 1959 and 1968, even-keel operations ranged from 19 days to 30 "or more" days, with a "heavy concentration" around 22 to 24 days. Markese (1971, pp. 65, 85) suggested that even-keel could run anywhere from 12 to 30 days, but estimated a mean of 22 days.

Overall even-keel operations looked to prevent unanticipated interest-rate changes that might cause a Treasury offering to fail, but more specifically and critically, they sought to protect government security dealers from incurring capital losses on any inventories that they maintain to accommodate customers (Gustus (1969), p. 6; Yohe and Gasper (1970), p. 106). Relatively few dealers handled large issues of government securities on thin margins (Gustus (1969), p. 6). The driving concern was to ensure that the government security dealers faced only "normal market risk," not the risk of unanticipated policy changes (Axilrod (1971), p. 28).

As noted, the Fed did not generally extend even-keel operations to Treasury bill auctions. Auctions freed the Treasury from having to guess a market clearing price for their securities prior to an issuance.[3] As inflation and nominal interest rates increased in the late 1960s and early 1970s, interest-rate volatility also increased and raised the likelihood that a fixed-price offer would fail or otherwise be mispriced (Garbade (2004), p. 34). In the 1970s, the Treasury began experimenting with auctions, working its way up the yield curve. "By mid-1973, auctions sales of notes and bonds had replaced fixed-priced offerings" (Garbade (2004), p. 37). The Treasury continued, however, to refine its auctions. By early 1973, as the Treasury polished its techniques, some FOMC participants wanted a looser application of even keel. The manager of the System Open Market Account, Alan Holmes, echoing their sentiments, noted that the Treasury's increasing use of security auctions allowed "even-keel constraints on open-market operations [to] be relaxed" (FOMC (1973), p. 38). The Fed then began to ease out of even-keel operations, which ended after July 1975.

[3] Garbade (2004) provides an excellent explanation of the Treasury's adoption of securities auctions.

3. Empirical Methodology and Results

The claim that even-keel operations contributed to the Great Inflation comprises two interrelated and testable suppositions: During even-keel periods, (1) the Fed routinely delayed discretionary changes in its policy and (2) *permanently* injected reserves into the banking system. In this section, we test both of these hypotheses using Taylor-type and McCallum-like reaction functions, taking into account the stance of monetary policy.

3.1. Taylor Rule Specification

Equation (1) is the general specification of a Taylor rule, ala Taylor (1993, 1999):

$$\overline{f_t} = \beta_0 + \beta_\pi(\pi_t - \pi^*) + \beta_u(u_t - u^*), \quad (1)$$

where: $\overline{f_t}$ is the federal funds rate target, which the public cannot directly observe; π_t and u_t are the current inflation and unemployment rates, respectively, and π^* and u^* are the corresponding inflation rate and unemployment rate targets. In a theoretical specification of equation (1), $\beta_0 = r_t + \pi_t$, where r_t is the real rate of interest. When $\pi_t = \pi^*$ and $u_t = u^*$, this theoretical specification implies that $\overline{f_t}$ equals the current natural rate of interest, r_t^*, plus the inflation target, π^*.

The FOMC adjusts the federal funds rate, f_t, which is publicly observable, to its target value, $\overline{f_t}$, with inertia (Goodfriend (1991); Struble and Axilrod (1973), p. 249):

$$f_t = \rho(f_{t-1}) + (1 - \rho)\overline{f_t}, \quad (2)$$

where ρ is the inertia parameter, the weight that the FOMC gives to not moving money market rates abruptly.

Our first even-keel hypothesis maintains that $\rho = 1$ during even-keel operations. We test this first proposition by estimating equation (1) and then by using the predicted values of $\overline{f_t}$ in the estimation of equation (2). We consider variations of equation (2) over periods characterized by the existence or absence of even-keel operations and by the stance of monetary policy.

Because even-keel operations lasted approximately three weeks on average, our specifications of equations (1) and (2) use monthly data. Following Orphanides (2001), we use real-time data for π_t and u_t, the data that were available to the FOMC when it made decisions about policy. Because the values for π_t and u_t for a given month were not reported until the subsequent month, we lagged these variables one period in our data set prior to any estimation to best reflect the FOMC's decision-making process. (Hence, we show them with a *t* time subscript.) We obtained real-time consumer price (CPI) and unemployment rate data from the Federal Reserve Bank of St. Louis's *ArchivaL of Federal Reserve Economic Data* (ALFRED). We measure inflation as the monthly percentage change in the headline CPI expressed at an annualized rate. Seasonally adjusted real-time CPI data are not available in ALFRED.[4]

Since we do not have *ex ante* monthly measures of expected inflation and unemployment, we do not estimate forward-looking reaction functions, as in Clarida, Gali, and Gertler (2000) and Orphanides (2001, 2002, 2003, 2004). This does not seem a significant shortcoming. A frequent criticism of the FOMC during the early part of the Great Inflation is that the Committee had a very short-term focus. They responded to the most recent data and did not closely relate this response to long-term objectives, according to Meltzer (2005, pp. 155-56). Consistent with a short-term focus, the FOMC averaged 14 meetings per year, including telephone conference calls, between 1965 and 1975. This is approximately one meeting every three weeks. Currently, the FOMC meets eight times per year, and conference calls were rare before the COVID pandemic.

[4] Applying our own seasonal adjustment to these data did not materially affect our results in early experiments.

The even-keel counts in Table 1 come from the “Record of Policy Actions,” which appears in the Board of Governors’ *Annual Reports*. They typically refer to ongoing or prospective Treasury operations and Desk actions. Sometimes determining even-keel events from the narrative can be difficult; hence, researchers’ opinions have differed. When we compared our counts to previous tallies, they disagreed with Yohe and Gasper (1970) in 5 of 60 overlapping sample months and with Markese (1971) in 8 of 72 overlapping sample months. Because of the forward-looking nature of the announcements and the typical three-week duration of the operations, we attribute an even-keel announcement that occurred before the 21st of a month to that month and those that fall on or after that date to the subsequent month, as in Yohe and Gasper (1970).

We estimate equation (1) using a sample of 132 observations from 1965:1 to 1975:12. The dependent variable, f_t, is the end-of-month value of the federal funds rate. We set $u^* = 4 \text{ percent}$ because the *Economic Report of the President* regularly mentions this rate as representing full employment over our sample period. As noted in Orphanides (2002), this real-time estimate of the natural rate of unemployment proved too low in hindsight.[5] Although the FOMC did not establish a formal target for inflation at the time, we set $\pi^* = 2$ percent. Altering either π^* or u^* changes neither of the estimated slope coefficients, nor the predicted values of $\overline{f_t}$. Doing so changes only the intercept.

After initially finding significant serial correlation and possible heteroscedasticity, we estimated a Taylor rule using least squares with robust standard errors following (Carvalho, Nechio, and Tristao (2018) and Andrews (1991). Equation (3) presents our results:

$$\underset{}{\overline{f_t}} = \underset{0.297}{4.960} + \underset{0.060}{0.468}(\pi_t - 2) - \underset{0.097}{0.317}(u_t - 4) + e_t, \quad (3)$$

[5] The Congressional Budget Office currently estimates the average natural rate of unemployment from 1965:Q1 though 1975:Q4 at 5.9 percent.

where $e \sim i.i.d. N(0, \sigma^2)$, and where robust standard errors appear below the respective regressor. The adjusted R^2 of equation (3) is 0.490; the standard error of the regression is 1.653. The constant term and all of the individual regressors are significant with p-values < 0.01, and they display the expected signs. The variables in equation (3) are cointegrated, allowing estimation in level form.

Our estimate of β_π suggests that the FOMC did not conform to the Taylor principle; that is, the FOMC raised its target federal funds rate on average by less than the inflation rate. Consequently, the *ex post* real federal funds rate generally fell as inflation increased, indicating that the Fed was unduly accommodative during the early part of the Great Inflation. This conclusion is consistent with that reached by Taylor (1999) and Clarida, Gali, and Gertler (2000) for the Great Inflation, but it differs from that found by Orphanides (2002, 2003, 2004). Orphanides finds that the Fed followed the Taylor principle under the Great Inflation but erred in using Greenbook estimates that consistently overstated potential GDP or understated the natural rate of unemployment.

Our estimate of β_u is substantially smaller than that in Orphanides (2002) for his 1960 - 1979 sample. When adjusted to a quarterly basis and converted to an output gap coefficient via Okun's law, our estimate of the gap coefficient is -0.127, which is again smaller than in Clarida, Gali, and Gertler (2002) and Orphanides (2004) for the Great Inflation period.[6]

3.2. The First Even-Keel Hypothesis: Did the Fed Hold Its Policy Rate Constant?

The first even-keel hypothesis maintains that during these operations, the Fed held its policy rate constant, implying that ρ, the inertial term, equaled one. To test this, we make

[6] Okun (1962) estimates: $U_t = 3.72 + 0.36(Y^*-Y_t)$, where U_t is the unemployment rate, Y^* is potential output, and Y_t is current output. We adjust our estimate to an output gap, using $(U_t – 4) = 0.4 (Y^*-Y_t)$.

multiple estimates of equation (2), each distinguished by an even-keel operation, or lack thereof, or the stance of monetary policy. To do so, we use the predicted values of $\overline{f_t}$ from equation (3). Accordingly, Table 2 records four sets of parameter values: those estimated in months involving no even-keel operations (column 1), all even-keel operations (column 2), only even-keel operations when the Fed was otherwise tightening monetary policy (column 3), and only even-keel operations when the Fed was not tightening monetary policy (column 4). All of the estimated parameters in Table 2 have the expected sign, and all are statistically significant, save $(1-\hat{\rho})$ in column 3, which our narrative anticipated and we explain below. The overall fit of the regressions is reasonable, and Wald tests support the assumed structure of equation (2), that the sum of the inertial weights equals one. Serial correlation and heteroskedasticity were not a problem, allowing estimation with OLS. The results suggest that the first even-keel hypothesis holds only for periods of tight monetary policy.

To isolate periods of tightening monetary policy, we constructed a dummy variable that takes a value of one in months when both the federal funds rate increased and net free reserves declined significantly (Figure 2).[7] During the 1960s and 1970s, the FOMC famously relied on various reserve and monetary measures to gauge monetary policy, notably net free reserves, but they also relied on money-market rates (Board of Governors (1961), pp. 211-12; Board of Governors (1974), pp. 57-58; Romer and Romer (2002), pp. 123-24). Our dummy variable also captures hikes in the discount rate and in reserve requirements. In months when policy initially changed or ended, net free reserves and the federal funds rate sometimes gave inconsistent signals as one variable lagged the other. When this happened, we consulted the annual reports of the Board of Governors or the minutes of the FOMC. Constructing any such policy variable

[7] Net free reserves equal total reserves less required reserves, which equal excess reserves, less borrowed reserves.

unavoidably involves a degree of subjectivity. We use this dummy variable to restrict our sample.

The results in Table 2 generally conform to the historical discussion in Section 2. All of the parameter estimates are statistically significant, except the one that we anticipated. Overall, the Fed demonstrated a fairly high degree of inertia with respect to changes in the federal funds rate between 1965:1 and 1975:12, whether it engaged in even-keel operations ($\hat{\rho}$ = 0.773) or not ($\hat{\rho}$ = 0.758). The estimated inertial parameters in columns 1 and 2, although statistically different from each other, are very similar in magnitude. Contrary to what one might have anticipated, the even-keel estimate of the inertial parameter (column 2) is slightly smaller than the no-even-keel estimate (column 1). This result reflects substantial variation in the Fed's even-keel behavior depending on the stance of monetary policy. During periods when the Fed was tightening monetary policy (column 3), the Fed conformed strictly to the hypothesized even-keel action. The inertial parameter, $\hat{\rho}$ = 0.830, is not statistically different than one, according to the Wald test, and the parameter $(1 - \hat{\rho})$ associated with the target federal funds rate, $\overline{f_t}$, is not statistically different from zero. This even-keel response sought to minimize the chances that dealers and investors would experience unanticipated, policy-induced capital losses, which might eventually lessen demand for government securities. During periods when it was not otherwise tightening monetary policy (column 4), however, the Fed did not behave in a manner consistent with our even-keel hypothesis. Then the estimated inertial parameter is even smaller than that found for the no-even-keel periods (column 1). Although still exhibiting a fairly high degree of inertia, $\hat{\rho}$ = 0.732, the Fed gave slightly more weight to the federal funds rate target than in previous periods. This, again, is entirely consistent with the Fed's history. When the Fed eased policy and lowered interest rates—as was typically the case when the central bank was not tightening (Figure 2)—

dealers and investors faced little risk of capital losses on their inventories of government securities. They may have even experienced capital gains. Then, the Fed could give somewhat greater weight to achieving its target federal funds rate, $\overline{f_t}$. Overall, the stance of the Fed's monetary policy conditioned how it acted during even-keel operations.

3.3. The Second Even-Keel Hypothesis: Did the Fed Permanently Inject Reserves?

The second part of the even-keel hypothesis maintains that the Fed *permanently* increased bank reserves during even-keel operations. We test this with McCallum-like reaction functions (McCallum (1988)). Because our narrative and the results in Section 3.2 indicate that the Fed conducted even-keel operations only when it was otherwise tightening monetary policy, we focus on these occasions and compare them with periods when the Fed ostensibly undertook even-keel actions but was not otherwise tightening monetary policy. The general form of our reaction function is:

$$R_{tot} = \beta_0 + \beta_{tr}(trend) + \beta_{ek}(D_{ek}) + \beta_{off}(D_{off}) + \beta_{\pi}(\Delta\pi_{t-1}) + \beta_u(\Delta u_t) + \gamma_t, \quad (4)$$

where $\gamma \sim i.i.d. N(0, \sigma^2)$.

In equation (4), R_{tot} is the average daily amount of bank reserves in each month from 1965:1 through 1975:12. As shown in the appendix, total reserves are trend stationary, allowing us to estimate the reaction function with total reserves in levels and with a trend line.[8] D_{ek} is a dummy variable that equals one in contemporaneous even-keel months. To test for the permanence of any reserve injection, D_{off} is a dummy that equals one in the first month after an even-keel event that contains no even-keel operations. This is the first month in which the Fed was likely to offset an even-keel injections of reserves. In Table 3, we present the even-keel

[8] Cointegration tests were mixed; we treated the variables as if they were not cointegrated.

dummy in two alternative ways: in columns 1 and 1', it equals one only for even-keel months when monetary policy in otherwise tightening, and in columns 2 and 2', the dummy equals one only for even-keel months when policy was not otherwise tightening. We include in the regressions the first difference of our real-time inflation and unemployment variables, which in this form are stationary (appendix). We lag $\Delta\pi$ one period because CPI data arrive late in a given month, and, therefore, the contemporaneous value likely had little, if any, influence on the average daily amount of reserves. We do not lag Δu because unemployment data come very early in a month. Table 3 shows our parameter estimates of equation (4) with robust standard errors. In columns 1 and 2, we estimate the model as given in equation (4); in the corresponding columns market 1' and 2', we drop all of the terms that proved insignificant in the initial pass. Doing so, improves the model's overall fit slightly.

Our statistical model suggests that the Fed permanently injected reserves to assist government security dealers during even-keel events, but only when the Fed was otherwise tightening monetary policy. The regression results in columns 1 and 1' indicate that, when monetary policy was otherwise tightening, the Fed added $448 million in reserves on average during each even-keel month. This amount is substantially above reserve injections associated with the trend growth in reserves, $125.6 million, and above the average and median reserve "injection" over the sample of $432 million and $358 million, respectively. The even-keel coefficient, β_{ek}, is significant at reasonable levels of confidence in both specifications, but especially so when the insignificant variables in the regression are removed, column 1'. (Collinearity is not a problem in the specification; variance inflation factors were no bigger than 1.8.) Equation 1 also indicates that the Fed did not offset its even-keel injections of reserves when it had the opportunity; the even-keel reserve injections were permanent, as Meltzer contended. During months when monetary policy was not tightening—and generally easing—the even-keel parameter, β_{ek}, is negative and insignificant (columns 2 and 2'). This result, however, is neither inconsistent with our historical narrative nor with the results in Table 2. When policy is easing, dealers and investors face little risk of capital loss, and the Fed has little need to inject reserves for even-keel purposes. All of the explanatory power of our models in Table 3 comes from the trend line and one of the even-keel dummies. Total bank reserves are insignificantly related to inflation and unemployment, although the signs of the coefficients are as anticipated.

During our sample period, the Fed often conducted open-market operations with non-bank security dealers using repurchase agreements (repos). In a repo, a dealer sold a security to the Fed under an agreement to repurchase the security within 15 days. This mechanism injected reserves only temporarily and "provided temporary financing of [non-bank] dealer inventories at a time when funds for dealer loans are not readily available" (Board of Governors (1963), p. 32). Repos therefore seem a likely vehicle for conducting even-keel operations without permanently increasing the amount of reserves in the banking system.

We found a significant increase in repos during even-keel operations when monetary policy was otherwise tightening. We estimated the models in first difference form for stationarity. As shown in columns 3 and 3', despite a significant relationship to our even-keel dummy, the explanatory power of our models was nil. After dropping insignificant terms, the estimated even-keel coefficient was mathematically equivalent to the average amount of a repo during an even-keel event, $71 million and suggests that this part of the $448 million reserve injection during a typical even-keel month when the Fed was otherwise tightening monetary may have occurred through repos. If true, this amount did not represent a permanent addition of reserves to the banking system. Otherwise, even-keel operations seem entirely unconnected to the Fed's repo operations.

4. Even Keel's Contribution to Inflation

Our analysis suggests that the Fed permanently added a substantial amount of reserves to the banking system on average during the 24 months between 1965:1 and 1975:12 in which it conducted even-keel operations when it was otherwise tightening monetary policy. We measure the contribution of these reserve injections to the early Great Inflation by using the quantity-theory equality in log-difference form:

$$\dot{\pi} = \left(\dot{m2} + \dot{v} - \dot{q}\right) = \left(\dot{b} + \dot{m} + \dot{v} - \dot{q}\right), \tag{7}$$

where $\dot{\pi}$ is the inflation rate, now measured by a GDP deflator, not the CPI; $m2$ measures money as cash, demand deposits, and liquid time accounts; b is the monetary base; m is the $m2$ money multiplier; v is $m2$ velocity, and q is Stock and Watson's monthly estimate of real GDP.[9] "Dots" indicate percent change in a variable.

The monetary base, b, is:

$$b = (c + r) = (c + r_{\text{nek}} + \Delta r_{\text{ek}}), \tag{8}$$

where c equals publicly held currency and r equals bank reserves. Reserves can be further broken down into reserves in the absence of even keel, r_{nek}, and any addition to reserves during even-keel events, Δr_{ek}.

We approximate even keel's contribution to inflation by first calculating equation (7) using normal monetary-base data, and then re-estimating equation (7) after subtracting even keel's contribution to reserves (Δr_{ek}) from the monetary-base data. In these calculations, we

[9] We calculate the GDP deflator from the Stock and Watson nominal and real GDP data.

hold the log-difference of velocity (*v*), the money multiplier (*m*), and output (*q*) constant at their average values from 1965:1 through 1975:12. These are 1.7 percent, 8.1 percent, and 3.3 percent, respectively. We make two calculations: one ignoring repos and one taking them into account.

The average annual inflation rate from 1965:1 through 1975:12, as measured by the GDP deflator, was 5.1 percent.[10] If the Fed had not conducted even-keel operations by permanently injecting reserves, the average inflation rate would have been 4.1 percent, 1.0 percentage point less than was actually experienced. This calculation assumes that the Fed permanently injected $448 million in reserves on average during each even-keel month when the Fed was otherwise tightening monetary policy.

We next assume that to accomplish this $448 million reserve injection during each tight-money even-keel month, the Fed used $71 million in repurchase agreements. In this case, the Fed would have *permanently* injected $377 million in reserves on average during even-keel months in periods of tight monetary policy. The effect of this assumption is minimal; the average inflation rate would have been 4.2 percent, or 0.9 percentage points lower than what was experienced.

5. Conclusion

Even-keel operations sought to maintain an ongoing demand for government securities by eliminating risks associated with policy changes during Treasury debt operations. More pointedly, the Fed acted primarily to protect government security dealers from incurring capital losses on their inventories between the time they bought the securities and the time they sold them to the general public. Dealers fostered the smooth functioning of the market, which

[10] The average inflation rate over the sample as measured by the CPI was 5.3 percent.

ultimately kept the costs of issuing debt to a minimum. The Fed did so through two actions: When the Treasury sold or rolled over securities, the Fed undertook no policy changes and permanently injected between $377 million and $448 million worth of reserves into the banking system to offset any drain that the Treasury sales might create and to provide adequate liquidity to the market. The Fed routinely undertook these even-keel operations only when it was otherwise tightening monetary policy. The Fed saw no need to regularly engage in even-keel actions when it was not tightening monetary policy—and generally easing policy—because the risk of capital losses to government security dealers was minimal. They might even experience capital gains.

Even-keel actions ultimately failed in their overarching goal because they appreciably added to inflation, which eventually raised the nominal interest costs of Treasury debt. Even-keel events offset needed Fed tightening between early 1965, when the Great Inflation started, and mid-1975, when even-keel operations ended, and raised the average inflation rate over the period approximately one percentage point, to 5.1 percent. This may seem large, a contribution of 20 percent to the rate of inflation, but the Fed injected a substantial amount of reserves and did so over 24 even-keel months, that is, 18 percent of the 132 months between 1965 and 1975 or two years in total. We have estimated, however, only the direct inflationary effects of even keel and say nothing about how these operations may have affected inflation expectations. In conducting even-keel, the Fed repeatedly sacrificed reasonable price stability in pursuit of a fiscal objective, suggesting a lack of monetary policy independence at a critical time. Even-keel operations also help explain why the Fed failed to conform to the Taylor principle over these years. In the inflationary atmosphere that characterized the era, this type of behavior may have heightened expectations and made inflation more intransigent.

Although significantly contributing to the Great Inflation, even keel was not itself a direct cause. The Desk at the Federal Reserve Bank of New York had the technical skill to monitor and manage reserves at a high frequency. We showed in Section 2.1 that the Fed offset injections of reserves related to Treasury financing in 1951 and 1952. The real question then is: Why did both the FOMC and the Desk fail to remove the excess-reserve injections associated with even keel? The monetary policy failure of the era resulted mainly from the factors that we listed in the introduction. For ten years prior to the Great Inflation, even keel operated without any dire consequences for inflation, as Romer (2005) observed. During the 1950s, unlike the late 1960s and 1970s, the FOMC had a "fundamental abhorrence" of inflation, as Romer and Romer (2002, p. 121) explain. The Committee believed that high inflation could fairly quickly have adverse effects on economic growth and employment, maybe to the extent of resulting in a recession (Romer and Romer (2002), pp. 18-19). Their performance made a commitment to low inflation credible, despite even-keel operations. This commitment faded in the early 1960s, leaving even-keel operations to now act more like fuel on a fire than a separate cause of that fire.

A.1. Appendix: Tests for Stationarity and Cointegration

Tests for stationarity and cointegration appear in Tables A.1 and A.2, respectively. Table A.1 reports the results of augmented Dickey-Fuller (ADF) tests for the federal funds rate, f, the inflation rate, π, the unemployment rates, u, total reserves, R, and repurchase agreements, *Repo*. The null hypothesis holds that a time series is non-stationary. The tests use the Akaike criteria to determine lag length. A positive τ-statistic implies explosive behavior in a time series. The tests apply MacKinnon one-sided p-values. All data are non-stationary in levels; u, R, and *Repo* are explosive. Total reserves, R, are trend stationary, and all variables are stationary in first-difference form.

Table A.2 reports Engle-Granger cointegration tests. The null hypothesis is no cointegration. The Engle-Granger test uses an ADF τ -statistic. The federal funds rate, inflation, and the unemployment rate are cointegrated according to the tests. Hence, we estimate both parts of the Taylor rule in levels. Total reserves, inflation, and the unemployment rate show mixed results. In the paper, we treat this combination as not cointegrated and estimate the McCallum-like reaction functions in a stationary form.

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Table 1: Even-Keel Counts

Year	Jan	Feb	Mar	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
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	9	5	1	9	6	3	8	5	2	10	5	2	65

Note: The starred values indicate even-keel months associated with a tightening of monetary policy.
Source: Board of Governors of the Federal Reserve System, Annual Reports.

Table 2: Inertial Taylor Rules' Response to Even-Keel Operations

	No Even Keel (1)	Even Keel (2)	Tight Policy[a] (3)	Not Tight Policy[b] (4)
	f_t	f_t	f_t	f_t
ρ	0.773	0.758	0.830	0.732
s.e.	0.081	0.071	0.135	0.086
p-value:	0.000	0.000	0.000	0.000
$(1 - \rho)$	0.209	0.267	0.209	0.283
s.e.	0.088	0.069	0.130	0.083
p-value:	0.020	0.000	0.123	0.002
observations:	70	62	24	38
adjusted R^2:	0.971	0.980	0.876	0.811
s.e. of the regression:	1.137	0.907	0.985	0.976
Wald Test[c], H_0: $\rho = 1$:	7.908	11.681	1.587	9.650
p-value:	0.005	0.001	0.208	0.002
Wald Test[c], H_0: $\rho+(1-\rho) = 1$:	0.673	1.780	2.155	0.336
p-value:	0.412	0.182	0.142	0.562

Notes:

a. Even-keel events in months when monetary policy is tightening.

b. Even-keel events in months when monetary policy is not tightening.

c. Wald χ^2 Test.

Table 3: Even Keel and Reserve Expansion

	Tight	Tight	Not Tight	Not Tight	□Repos	□Repos
	1	1'	2	2'	3	3'
β_0	20536.70	20526.36	20718.31	20620.39	-13.92	
s.e.	*219.36*	*204.08*	*201.46*	*193.12*	*24.25*	
p-value:	*0.000*	*0.000*	*0.000*	*0.000*	*-0.566*	
β_{trend}	124.58	124.95	124.33	124.80		
s.e.	*4.99*	*4.42*	*4.99*	*4.59*		
p-value:	*0.000*	*0.000*	*0.000*	*0.000*		
β_{ek}	478.86	448.37	-104.40	-7.81	82.93	71.04
s.e.	*247.92*	*202.65*	*142.57*	*122.13*	*33.66*	*19.05*
p-value:	*0.053*	*0.027*	*0.464*	*0.949*	*0.014*	*0.000*
β_{off}	3.01		-158.74			
s.e.	118.14		118.55			
p-value:	0.980		0.181			
$\beta_{\pi-1}$	-3.68		0.72		11.81	
s.e.	*7.02*		*5.50*		*5.50*	
p-value:	*0.600*		*0.896*		*0.167*	
βu	320.89		256.77		126.19	
s.e.	*533.44*		*478.15*		*103.00*	
p-value:	*0.547*		*0.591*		*0.221*	
Obs.:	132	132	132	132	131	131
E-K mos.:	24	24	38	38	24	24
Std. error:	917.8	910.2	934.0	926.9	321.40	322.00
Adj. R^2 :	0.964	0.965	0.963	0.964	0.013	0.001

Table A.1: Augmented Dickey-Fuller Tests for Stationarity, 1965:1 – 1975:12

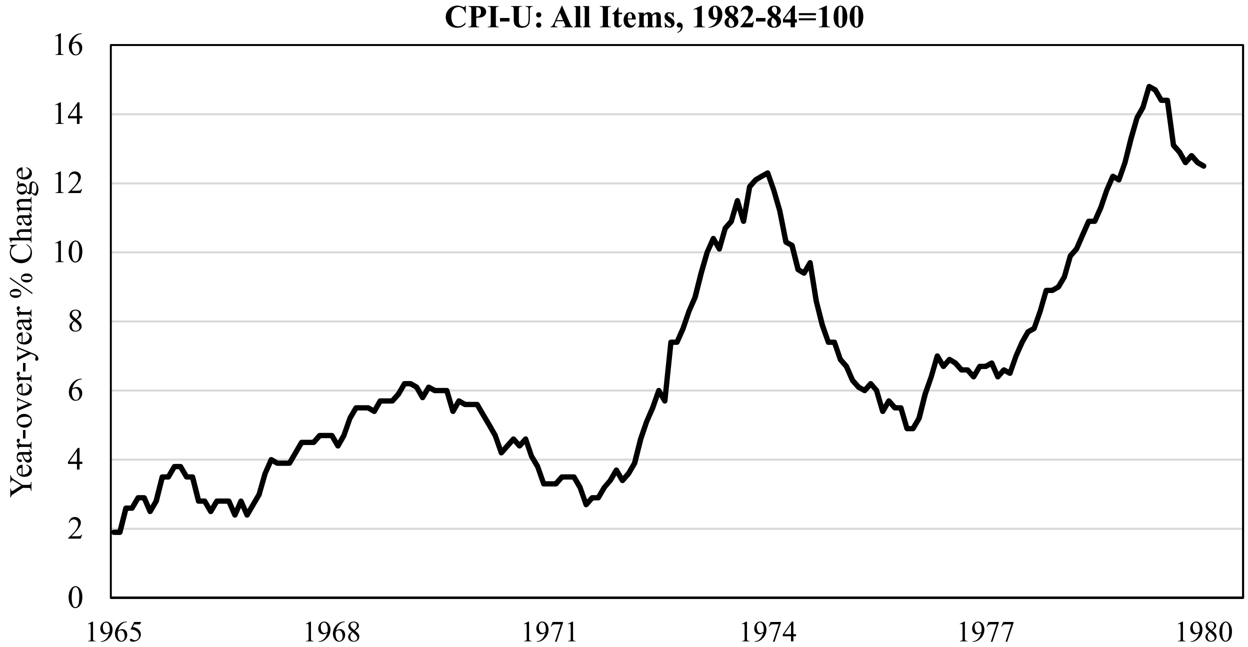
LEVEL	f	π	u	R	REPO
ADF τ-statistic:	-0.76	-0.27	0.40	3.74	3.61
AIC lag length = :	3	5	4	19	11
5 percent tau value:	-1.95	-1.95	-1.95	-1.95	-1.95
10% tau value:	-1.62	-1.62	-1.62	-1.62	-1.62
DRIFT (intercept)	f	π	u	R	REPO
ADF τ-statistic:	-2.60	-1.54	-1.16	-0.18	2.87
AIC lag length = :	3	5	4	19	11
5% tau value:	-2.88	-2.88	-2.88	-2.88	-2.88
10% tau value:	-2.57	-2.57	-2.57	-2.57	-2.57
TREND	f	π	u	R	REPO
ADF τ-statistic:	-2.72	-2.19	-2.72	-4.19	0.83
AIC lag length = :	3	5	4	12	11
5% tau value:	-3.43	-3.43	-3.43	-3.43	-3.43
10% tau value:	-3.13	-3.13	-3.13	-3.13	-3.13
FIRST DIFFERENCE	Δf	Δπ	Δu	ΔR	ΔREPO
ADF τ-statistic:	-5.38	-8.74	-3.52	-2.17	-4.41
AIC lag length = :	2	4	3	11	11
5% tau value:	-2.88	-2.88	-2.88	-2.88	-2.88
10% tau value:	-2.57	-2.57	-2.57	-2.57	-2.57

Note: R and REPO lose one observation to differencing.

Table A.2: Engle-Granger Cointegration Tests, 1965:1 – 1975:12

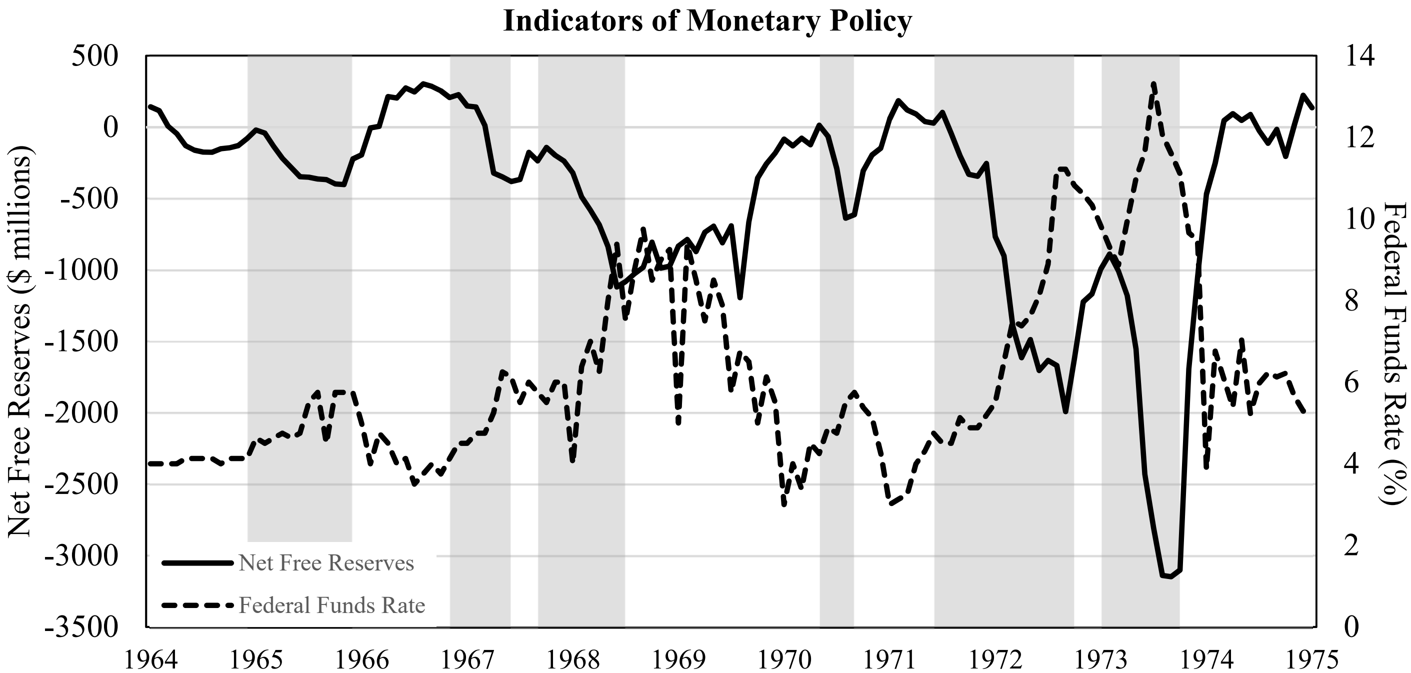
f, π, u	no constant	constant
test statistic:	-2.86	-2.85
AIC lag length = :	4	4
cointegrated:	yes	weak
5% tau value:	-1.95	-2.88
10% tau value:	-1.62	-2.57
R, π, u		
test statistic:	-2.13	-2.18
AIC lag length = :	4	4
cointegrated:	yes	no
5% tau value:	-1.950	-2.88
10% tau value:	-1.620	-2.57
REPO, π, u		
test statistic:	-2.08	-2.06
AIC lag length = :	8	8
cointegrated:	yes	no
5% tau value:	-1.950	-2.88
10% tau value:	-1.620	-2.57

Figure 1: The Great Inflation.



Source: US Bureau of Labor Statistics. Haver Analytics.

Figure 2: Monetary Policy Indicators, Federal Funds Rate and Net Free Reserves.



Note: The shaded gray regions indicate periods of tightening monetary policy.

Source: Board of Governors of the Federal Reserve System, Haver Analytics.