The Mystery of the "Greenback Era" Interest Rates: What Does the New York Money Market Have to Tell?

by

Oleksandr Zhylyevskyy*

*I am grateful to T. Wake Epps and John James for a thorough review of an earlier draft, to Marco Cagetti and Ronald Michener for helpful comments, and to Serguey Khovansky for bitter, but constructive criticism. *Correspondence*: Department of Economics, University of Virginia, P.O. Box 400182, Charlottesville, VA 22904-4182. E-mail: oz9a@virginia.edu.

Abstract

The behavior of interest rates is one of the most striking features of the "Greenback Era" (1862 – 1878) in the U.S. financial history. Previous research attempted to solve the puzzle by suggesting that people failed to foresee dramatic price swings. An alternative story is that foreign capital flows produced a mitigating supply effect. Unlike the existing literature on the issue, this paper directly asks whether the observed returns were consistent with rational behavior on part of the money market investors. I fail to find persuasive evidence that the money market of that time systematically admitted arbitrage opportunities.

I. Introduction

The "Greenback Era" (1862 – 1878) was a period in the U.S. history[1] marked by momentous political events, large-scale military operations, and unprecedented economic activity of the government. It was the longest time span in the 19th century when the specie standard was suspended[2] and the first instance since the War of Independence when paper notes (popularly nicknamed as "greenbacks"[3]) served as the country's *legal tender* currency.

The behavior of interest rates is one of the most striking puzzles of that time. If one assumes that people's beliefs must, overall, be in line with reality, then one should expect an upward swing in nominal short-term rates during the Civil War and a decline afterwards.

As shown in Figure 1, the wholesale price index more than doubled in the course of the war. Subsequently, it underwent a secular decline and returned to the prewar level in late 1870s. Figure 2 plots nominal short-term interest rates. As can be seen, the money market rates were surprisingly moderate and relatively stable until 1867. Financial disturbance is a characteristic feature of subsequent years. In September, 1869, the market was very "tight" in view of the Gould–Fisk scheme to corner gold. In September, 1873, the market collapsed after the failure of Jay Cooke and Co.,

[1] Authoritative and comprehensive treatments of the U.S. financial history during the "greenback standard" period may be found in Dewey (1939), Mitchell (1903), or Studenski and Krooss (1963).

[2] A suspension of specie payments was declared by a group of New York banks on December 30$^{\text{th}}$, 1861. Banks in other parts of the country (except California) and the U.S. Treasury suspended on the following day. Immediately after the Civil War, attempts to quickly resume failed. Thirteen years that followed witnessed a bitter public debate on the need to return to the constitutional currency (i.e., specie). The Resumption Act (January 14$^{\text{th}}$, 1875) was widely regarded as an empty promise until the Treasury began accumulating gold reserves in late 1877. The resumption was successfully accomplished on January 1$^{\text{st}}$, 1879.

[3] In this paper, such terms as "legal tender paper notes", "paper currency", and "greenbacks" are used interchangeably.

the country's preeminent investment banking concern. Overall, despite deflation, the rates do not show even a slight tendency to decline until the winter of 1874.

While the pattern of the money market rates after 1867 may be, in part, attributed to financial speculations, relative stability of the rates during the first years of the "Greenback Era" looks paradoxical. The Treasury heavily borrowed to finance the war spending. Total public interest-bearing debt grew from mere $64.7 million in 1860 to about $2.2 billion in 1865, that is more than 34 times. Secretaries of the Treasury were often embarrassingly unsuccessful in selling long-term bonds to non-banking public and resorted to massive short-term borrowing. Such policies should have disturbed the money market. However, there is no evidence of this in the data.

In this paper, I focus on the nominal returns on privately-issued short-term fixed-income securities. In comparison with such question as the behavior of the government and railroad bond yields, the pattern of the money market rates has received little attention in the literature. Still, the money market was an important segment of the economy in the second half of the nineteenth century. It was the market where banks lent and borrowed funds to attain the desired level of reserves and firms obtained short-term credit to facilitate business transactions.

Since many factors simultaneously affected the demand and supply of funds in the money market at each instant of time, it is prohibitively difficult to literally *explain* the course of the rates. The primary objective of this paper is less ambitious. I attempt to evaluate whether the observed returns were consistent with rational trading on part of the investors.

Given the striking behavior of the rates, a reasonable question to ask is whether the money market admitted arbitrage. There is evidence that in the contempora-

neous market for government debt, a non-trivial portion of trading was conducted for reasons other than profit. Historical sources abound in examples of "patriotic" purchase of government bonds as a means of voluntary "taxation" at the initial stages of the Civil War. It is doubtful that "patriotic" trading took place at any time in the money market with professional traders. However, if the money market investors deliberately abstained from bidding up the price of government short-term borrowing, unexploited arbitrage opportunities might have been behind the puzzle.

A priori the possibility of arbitrage cannot be entirely ruled out for another reason. In a study of the workings of the U.S. financial system at the turn of the 20th century, Clark (1984) finds persistent violations of gold points. He shows that profit opportunities were not always eliminated quickly and gold occasionally flowed in unprofitable directions. Presumably, technical progress increases the overall efficiency of financial systems over time. So, the puzzle of interest rates during the "Greenback Era", which preceded the "inefficient" gold standard system, may be attributed to possible "arbitrage" driven by market imperfections.

The rest of this paper is organized as follows. In Section II, I review several previous attempts to solve the puzzle. In Section III, I describe the data. In Section IV, I outline the methodology and "scan" the data for arbitrage opportunities. In Section V, I conclude.

II. Literature Review

One of the earliest attempts to explain the unexpected behavior of short-term interest rates is due to Mitchell (1903). He analyzes data compiled from the Civil War periodic

press (Table LVIII, p. 367). Mitchell recognizes that "persons who derived their income from capital lent at interest for short terms were injured by the issues of the greenbacks" (p. 368). However, he is puzzled since these "injuries were more serious than those suffered by wage-earners" (p. 368).

One possible explanation could be that lenders failed to foresee the extraordinary rise in prices. However, Mitchell remarks that an appeal to faulty expectations looks insufficient. He discusses at length a weak bargaining power of money-lenders. Lastly, he outlines what may be called a demand effect. "Cash business increased in importance and credit operations diminished ... as early as August, 1862" (p. 375). Despite unusually large profits during the war, businessmen anticipated fluctuations in prices and "sought protection against these changes by limiting their future pecuniary obligations as narrowly as possible" (p. 375).

A distinctly different explanation is offered by Friedman and Schwartz (1963). In their view, "the level of interest rates is ... explained by speculative capital movements induced by the rise in the greenback price of gold" (p. 70). In short, foreign investors understood that the price of gold was at a high *level*, rather then trending upward. Anticipating it to fall, the investors took advantage of buying "cheap" greenback-denominated assets that would eventually appreciate in terms of gold. This high supply of loanable funds kept interest rates low.

Roll (1972) analyzes the link between expectations and interest rates in a considerably more rigorous manner than Mitchell. He puts forward an assumption of "efficient market" in gold trading, which can be verified empirically. Then, Roll deduces anticipated gold price changes from bond prices. Finally, he concludes that "the evidence strongly suggests gold price decreases were expected on average by

investors from 1862 to 1865. Subsequent years did not alter these opinions" (p. 497).

Calomiris (1988) supports "the basic approach taken by Mitchell and others who concentrate on expectations of government fiscal and resumption policies during the Greenback Era as the main determinants of exchange rates and prices, and through them, money" (p. 747). He claims that the money supply at that time was endogenous and adjusted to the level demanded given the predetermined nominal interest rate and price level. Interest rates per se are not the main focus of his paper.

III. Data

Data employed in this paper comes from several sources. Call loan and commercial paper rates in New York City, the rate on banker's bills in London,[4] monthly U.S. railroad stock price indices, and monthly Warren–Pearson index of wholesale prices in the U.S. come from the NBER database.[5] The original source of call loan, commercial paper, and stock index data is Macaulay (1938).

Boston first-class bankable paper rate is obtained from Martin (1898). Gold price series comes from Mitchell (1908).

All series run without interruption starting January, 1857. I confine myself to the period from January, 1857, through December, 1879. Data summary statistics are presented in Table 1.

A few comments on the data series and institutional details on particular financial markets are worth making.

Throughout the period of interest, the U.K. was on the gold standard with the

[4] All rates are averages of respective market quotations in a given month.
[5] Datasets are available at: http://www.nber.org/databases/macrohistory/contents/.

mint par value of £1 per *gold* $4.8665. In the U.S. under the "greenback standard", no separate market for foreign exchange in terms of greenback dollars existed. Foreign currencies were invariably quoted in gold dollars. When a domestic currency holder wanted to buy pounds, she first bought gold with her greenbacks and then took the gold to a foreign-exchange dealer. Empirical evidence shows that deviations from the par value were small and the price of gold can be analyzed as a flexible foreign-exchange rate.[6]

A standard call loan was based on "mixed" collateral, usually worth 130 percent of the amount of the loan. As a rule, call loans were made to stock or bond brokers who placed the collateral in the hands of the lenders. The proceeds of call loans were used for most part to finance speculative operations in the financial market or the distribution of new issues of securities. The loans had a unique feature of being callable by the lender at any time of his choosing. Banks actively employed call loans to adjust reserves to a desired level. Typically, a bank operated a rolling portfolio of call loans by gradually retiring older loans and arranging for new ones.

Commercial paper was usually regarded as speculative investment. The term is generically applied to promissory notes on which merchants and manufacturers borrowed money (no collateral) for use in the ordinary course of their business for 60–90 days.

The railroad stock price index is an average of common stock quotations weighted by the number of shares outstanding at the beginning of each year. According to Macaulay (1938, Table 15), in 1862 – 1878, equities of 47 railroad companies were traded on the market. Common stocks of 18 such companies were quoted contiguously

[6]See Kindahl (1961) or Friedman and Schwartz (1963).

for the whole period. The weights are fixed within each year and look reasonably stable across time.

Banker's bill rate in London was also known as the open market rate of discount. Data starting June, 1857, was obtained by NBER by averaging weekly rates on three-month bills.

Rates on the first class 3–6 month bankable paper in Boston are not available in the form of monthly averages. Martin (1898) did not arrange the data in a convenient tabular form. I tried to accurately extract information on the prevalent rate on best and good loans.[7]

IV. Insatiable Investors: Methodology and Results

Notation

The notation used in this Section is as follows.

$\{g_t\}_{t\geq t_0}$ is the price process of 1 gold dollar in New York City. Before the suspension and after the resumption g_t is set to \$1.

The nominal gross return processes are:

$\left\{1+i^1_{t,t'}\right\}_{t\geq t_0}$: the call loan index process in New York City,

$\left\{1+i^2_{t,t'}\right\}_{t\geq t_0}$: the commercial paper index process in New York City,

$\left\{1+i^3_{t,t'}\right\}_{t\geq t_0}$: the first-class bankable paper index process in Boston,

[7] Throughout the "Greenback Era" years (and even more so after 1863 when the national banking system was established) New York was the dominant financial center of the U.S. In this paper, Boston series is used only as a supplementary source of data.

$\left\{1 + i^{£}_{t,t'}\right\}_{t \geq t_0}$: the banker's bills index process in London.

$\{S_t\}_{t \geq t_0}$ is the process of the railroad stock price index. S_t is quoted in legal tender dollars at t.

t indexes discrete calendar time (monthly). t_0 is the time period when quotes become available (January 1857). Time to maturity, $t' - t$, is equal to 3 months. This choice allows to obtain realizations of the return processes with minimal interpolation.

Theory

I suppose that the money market investors were insatiable. An insatiable individual strictly prefers more wealth to less. This assumption is a standard one in modern finance theory.

An arbitrage opportunity is an investment strategy that (1) has zero cost, (2) will never result in a loss, and (3) has strictly positive expected benefit.

Arrange gross returns on the call loan index, commercial paper index, Boston bankable paper index, and effective gross return in legal tender dollars on the London banker's bills index[8] in one vector:

$$\mathbf{x}_{t,t'} = \left(1 + i^{1}_{t,t'}, 1 + i^{2}_{t,t'}, 1 + i^{3}_{t,t'}, \frac{g_{t'}}{g_t}\left(1 + i^{£}_{t,t'}\right)\right)'.$$

If the investors were insatiable, they rationally "hunted for" arbitrage opportunities and exploited them completely. By a well known result in finance theory, the money market admits no arbitrage if and only if there exists a strictly positive *scalar*

[8] As discussed in Section III, $\frac{g_{t'}}{g_t}$ is the ratio of the exchange rate between the legal tender dollar and pound sterling at t' to the corresponding exchange rate at t.

random variable $\mathcal{M}_{t,t'}$ such that:

$$E_0 \left[\mathcal{M}_{t,t'} \cdot \mathbf{x}_{t,t'} \right] = \mathbf{1}, \text{ for every } t, \tag{1}$$

where E_0 is the unconditional expectation.

In finance literature, $\mathcal{M}_{t,t'}$ is known as the stochastic discount factor (SDF) and equation (1) is a corollary to the first fundamental theorem of financial economics.

If the money market admitted no arbitrage opportunities, realizations of *some* SDF must be *positive*. A convenient representation of SDF is due to Hansen and Jagannathan (1991, pp. 232–234):

$$\mathcal{M}_{t,t'} = E_0 \mathcal{M}_{t,t'} + \left[\mathbf{1} - E_0 \mathbf{x}_{t,t'} E_0 \mathcal{M}_{t,t'} \right]' \mathbf{\Sigma}^{-1} \left(\mathbf{x}_{t,t'} - E_0 \mathbf{x}_{t,t'} \right), \tag{2}$$

where $\mathbf{\Sigma}$ is the covariance matrix of gross returns.

A reasonable task is then to verify whether realizations of SDF (2) were positive in the period of interest.

Empirically this test is rather weak. One way of evaluating the goodness of an estimate of the SDF series realization, $\left\{ \hat{\mathcal{M}}_{t,t'} \right\}_{t \geq t_0}$, is to see how well some other asset, for instance, the railroad stock index, is "priced", that is, whether:

$$E_0 \left[\mathcal{M}_{t,t'} \frac{S_{t'}}{S_t} - 1 \right] = 0, \text{ for every } t. \tag{3}$$

Equation (3) implies that sample average, $\frac{1}{T} \sum_t \left[\hat{\mathcal{M}}_{t,t'} \frac{S_{t'}}{S_t} - 1 \right]$, must be insignificantly different from zero (T is sample size). If it is found to be significantly different from zero, then, obtained $\left\{ \hat{\mathcal{M}}_{t,t'} \right\}_{t \geq t_0}$ cannot be a valid SDF series.

Application

The data provide a time series of $\mathbf{x}_{t,t'}$ realizations. From these, it would be straightforward to obtain a series of SDF realizations (2), if $E_0\mathcal{M}_{t,t'}$, $E_0\mathbf{x}_{t,t'}$, and $\mathbf{\Sigma}$ were known.

Matrix $\mathbf{\Sigma}$ and vector $E_0\mathbf{x}_{t,t'}$ can be estimated. However, the joint distribution of $\mathbf{x}_{t,t'}$ may be changing with t. To make the results more robust, I consider two methods.[9]

Method 1. $E_0\mathbf{x}_{t,t'}$ and $\mathbf{\Sigma}$ are estimated on the basis of the full sample data and *held fixed* for each t.

Method 2. $E_0\mathbf{x}_{t,t'}$ and $\mathbf{\Sigma}$ are estimated on the basis of the sample data *prior to* period t only.

$E_0\mathcal{M}_{t,t'}$ cannot be estimated from available data. However, it is known from finance theory that if the risk-free security were traded, $E_0\mathcal{M}_{t,t'}$ would be equal to the inverse of the gross risk-free return.

In the mid-nineteenth century, hardly any security in the U.S. provided the risk-free return. Therefore, I consider a range of values from 3 to 6 percent. Note that the return on U.K. consols, which was, probably, the safest financial asset at that time, fluctuated about 3.23 percent in a tight range from 3.10 to 3.48 percent.[10] The traditional lending rate was 6 percent. There are reasons to believe that the net risk-free rate would have been within the bounds and, most likely, close to $4 - 5$ percent.

[9] Under certain parametric assumptions, it is straightforward to obtain $E_0\mathbf{x}_{t,t'}$ and $\mathbf{\Sigma}$ by Kalman smoothing (nested within a maximum likelihood procedure). Since the results are qualitatively and quantitatively similar to the ones reported below, I do not discuss this alternative method to save space.

[10] Data series is available from the NBER dataset.

In each of the two methods and for every hypothetical risk-free rate above, I calculate realizations of SDF and check whether the numbers are positive.

Then, I statistically test at 95 percent significance level whether the railroad stock index is "priced". The null hypothesis (referred to as the "pricing hypothesis" below) is that $\frac{1}{T}\sum_t \left[\hat{\mathcal{M}}_{t,t'}\frac{S_{t'}}{S_t} - 1\right]$ is insignificantly different from zero. I estimate the standard error which is robust to heteroskedasticity and autocorrelation up to 2 lags with a scalar version of the Newey–West formula.

Since it is not feasible to reproduce on paper tables with 204 rows (17 years, monthly), I provide a qualitative summary of the results.[11]

I find that under both estimation methods, the "no arbitrage" condition is likely to have been violated in the following months: November, 1872, October and November, 1873. In addition, under method 2, I find violations in March – May, and October, 1864, October, 1869, and October, 1872. This result seems to suggest that, at worst, violations occurred in less than 5 percent of all months of the "Greenback Era".

The pricing hypothesis is not rejected for any choice of the risk-free rate in the range from 3 to 6 percent.

It appears that the "no arbitrage" condition was violated unsystematically and violations did not persist for a long time. The few probable violations correspond to periods of major market disturbances, such as the gold market crises in 1864 and 1869, as well as the financial market instability in the fall of 1872 and the debacle of 1873.

[11] Datasets, computer programs, and output are available on request.

V. Conclusion

The pattern of the money market returns during the "Greenback Era" is a difficult puzzle. The course of interest rates seems to contradict common sense and basic economic theory.

Previous research attempted to solve the conundrum by suggesting that people failed to foresee dramatic price swings. An alternative story is that foreign capital flows created a mitigating supply effect.

Unlike the existing literature on the issue, this paper directly asks whether the observed return series can be "rationalized". There is anecdotal evidence of "non-economic" trading in the Civil War government bond market, as well as factual evidence of the gold point violations around the turn of the 20th century. Therefore, the possibility of arbitrage opportunities in the money market of 1862 – 1878 did not a priori look implausible.

I thoroughly "scan" the data and cannot detect systematic violations of the "no arbitrage" condition. Unsurprisingly, the few probable deviations correspond to periods of major market crises. Overall, the money market trading appears to satisfy the minimal consistency requirements implied by non-satiable preferences. This is an important result, since it shows that the puzzle cannot be attributed to systematic failures of the investors to exploit profitable opportunities. It is, probably, the case that the essence of the puzzle is in the nature of expectations held by the money market investors, and this should be the focus of future research.[12]

[12] In an extension to this paper, I try to back up the expected gold price series from the money market and gold market data. My findings suggest that the investors, on average, may have held zero inflationary expectations, which is in line with the original guess of Mitchell. However, to obtain the result I had to impose the assumption of risk-neutrality. Future research work may relax the risk-neutrality.

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Table 1: Data Summary Statistics

	Warren–Pearson Index	Greenbacks per Gold $100	Call Loan Rate	Comm. Paper Rate	Boston Paper Rate	London Bills Rate	Stock Index
mean	126.77	127.47	6.15	6.85	6.43	3.62	30.82
st. dev.	32.04	27.42	4.63	2.31	2.57	1.84	9.39
max	225.00	280.50	61.23	24.00	30.00	9.75	45.20
min	83.00	100.00	1.70	3.60	3.00	0.91	12.83
median	124.00	115.44	5.50	6.49	6.00	3.10	32.68

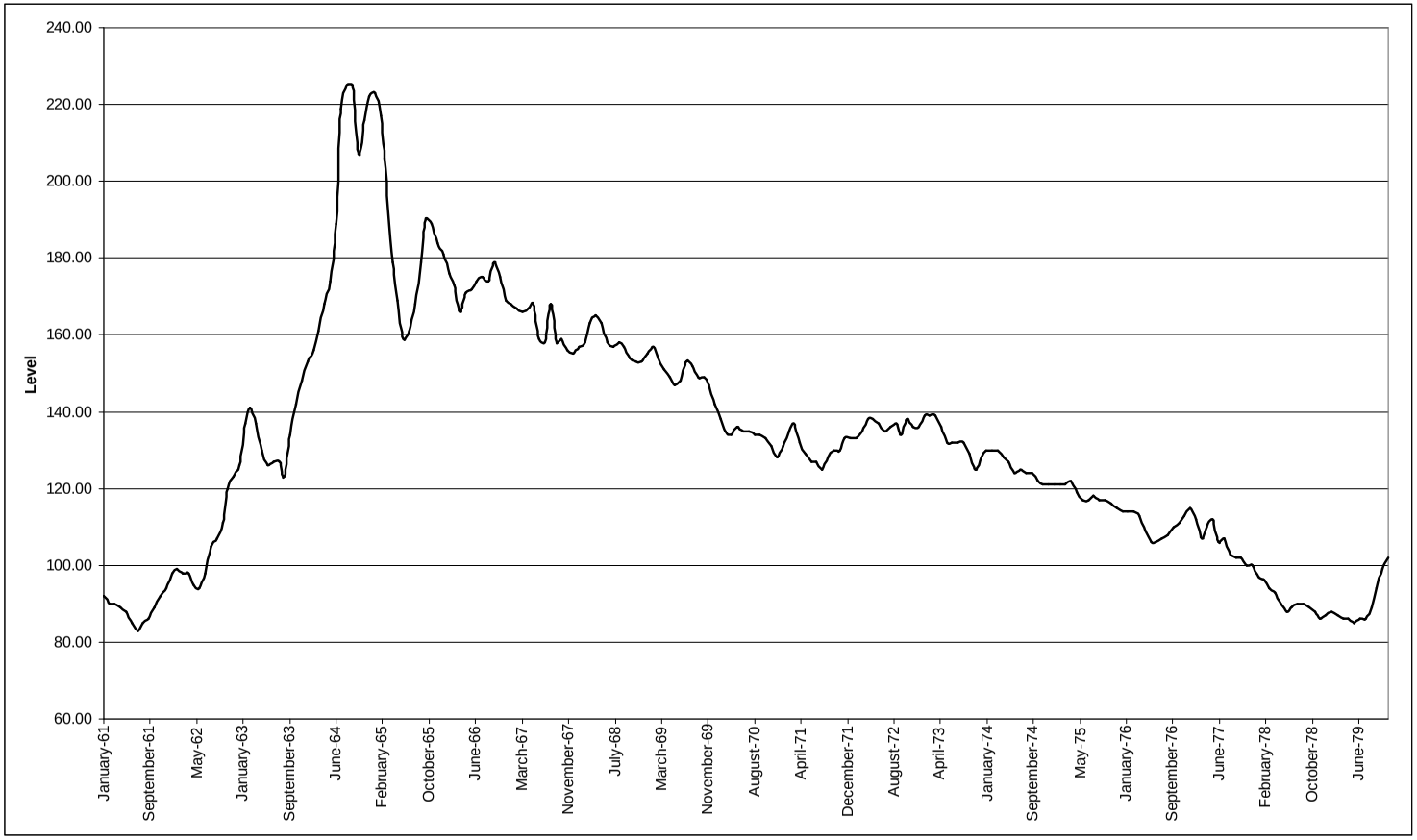

Figure 1: Warren–Pearson Index of Wholesale Prices, Monthly (1910–1914 = 100)

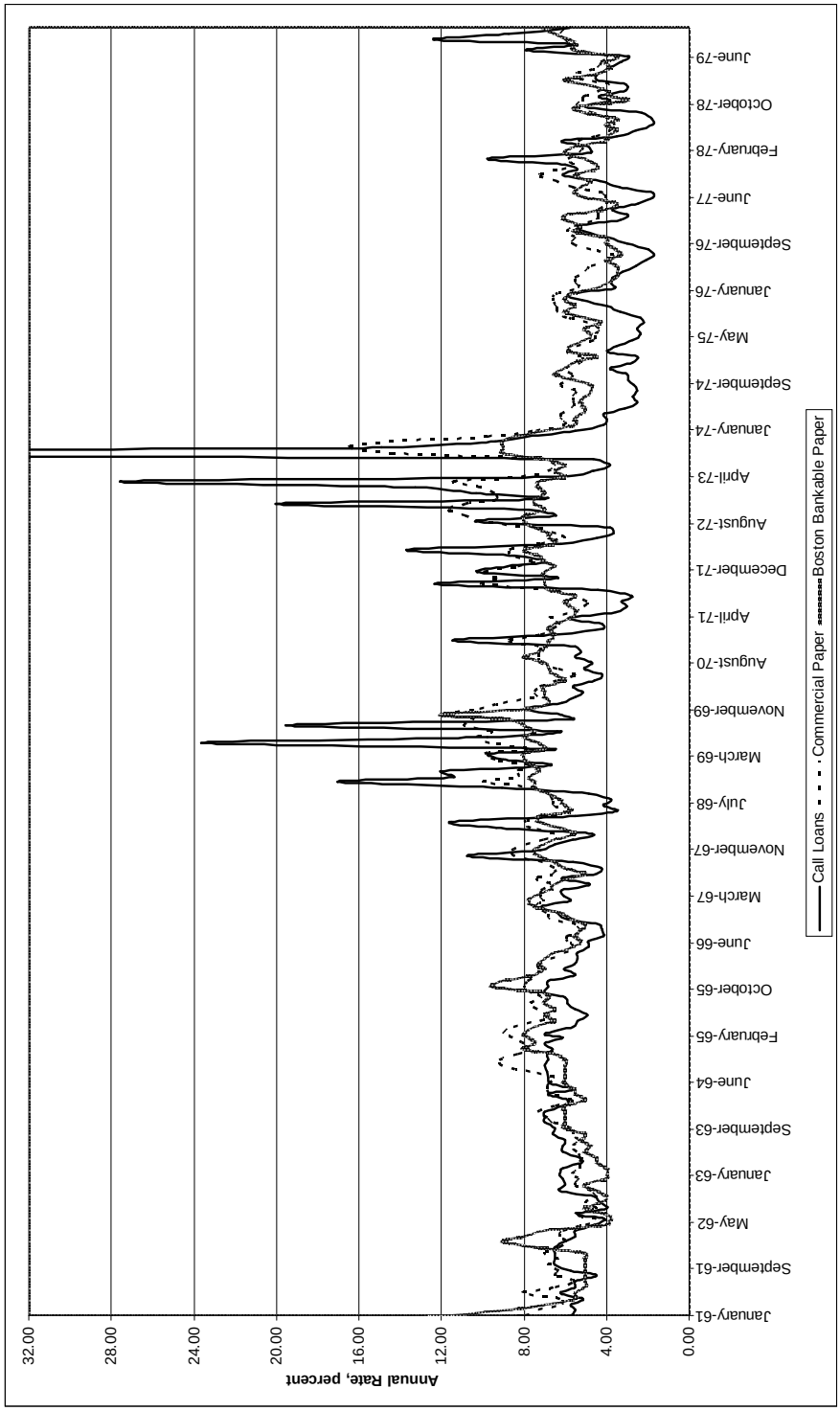

Figure 2: Money-Market Rates, Monthly Averages