NBER WORKING PAPER SERIES

GREENBACK RESUMPTION AND SILVER RISK: THE ECONOMICS AND POLITICS OF MONETARY REGIME CHANGE IN THE UNITED STATES, 1862-1900

Charles W. Calomiris

Working Paper No. 4166

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
September 1992

I thank Jeremy Atack, Michael Bordo, Karen Lewis, Larry Neal, Hugh Rockoff, and seminar participants at the Wharton School, the University of Illinois, and the NBER Summer Institute on the Development of the American Economy for helpful comments. This paper is part of NBER's research programs in Development of the American Economy and Monetary Economics. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

This paper begins by developing a framework for price and interest rate determination under suspension of convertibility during the national banking period. The model is applied to interpret unanticipated price level shocks and expected deflation during the period of greenback inconvertibility(1862-1879), and to explain forward discounts on the dollar during the 1890s, which saw substantial risk of a return to suspension of convertibility. Special features of dollar value risk during the 1890s, including an endogenous supply of government-licensed money (national bank notes), and a time-varying probability of a long-run switch to silver, require a different model of speculative attack from the standard approach which assumes a government-controlled supply of money.

The salient empirical findings of the paper are: (1) Ex ante real interest rates were higher than nominal interest rates during the 1870s, and lower than nominal interest rates during the silver-risk episodes of the mid-1890s. (2) Runs on the dollar in the 1890s mainly reflected concerns about short-run convertibility, and small depreciation of the dollar contingent on suspension, rather than a likely immediate switch from gold to a permanently depreciated silver standard. (3) Expected deflation in the 1870s accounts for the apparent weakness of the procyclicality of prices, using annual data for the national banking period. Once one takes account of shifting expectations of inflation, unanticipated movements in prices and output are much more closely related.

Charles W. Calomiris
Department of Finance
University of Illinois
Champaign, IL 61820
and NBER

I. INTRODUCTION

An enduring contribution of macroeconomic theory in the 1970s and 1980s was its emphasis on the role of expectations of future behavior in causing current movements in asset and commodity prices. While this approach had been applied to the valuation of stocks and bonds, the contribution of recent macroeconomics has been to translate the asset-pricing approach to the problems of understanding movements in exchange rates and price levels by taking explicit account of policy processes and agents' expectations (Muth, 1961, Sargent, 1973, Dornbusch, 1976, Krugman, 1979, Sargent and Wallace, 1981, Flood and Garber, 1983, 1984, Obstfeld and Rogoff, 1983, Obstfeld, 1986, Grilli, 1986, 1990). In particular, these models showed that a complete analysis of the price and exchange rate processes requires an explicit description of the money-supply process, and explicit modeling of anticipations of possible switches in monetary regimes. In a fixed-exchange-rate regime, promises of convertibility will only be convincing if government reserve holdings and long-run fiscal policy make those promises credible.

Uncertainty regarding future monetary regimes was a central feature of American political and economic life in the second half of the nineteenth century. From 1862 to 1879 the U.S. operated on a greenback standard with no convertibility maintained between the greenback and gold. Following a decade of bitter political struggle over resumption of convertibility, the greenback became convertible into gold in January 1879. But after resumption of convertibility, a new threat to the dollar emerged in the form of the "free-silver" movement. The goal of this movement was to re-establish a bimetallic standard, which would have led to a de facto switch to a depreciated silver dollar standard. These struggles were the defining characteristics of party platforms and national political campaigns. The soft- and hard-money wings of the Democratic party were described in terms of their positions on Greenback resumption in the 1870s and free coining of silver during the years of silver controversy from 1876 to 1896. President Grant's most controversial actions included his resistance to greenback supply increases, and his veto of inflationist legislation in 1874 (Unger, 1964). William J. Bryan's

famous speech at the Democratic convention in 1896 decried the "cross of gold" that threatened the crucifixion of America. Massive outflows of gold from the Treasury in the mid-1890s threatened to exhaust Treasury gold holdings and led President Cleveland to call Congress back into session to deal with the problem.

Economists and historians have emphasized the potential depressive effects of currency risk through its effects on interest rates and international capital flows during the 1890s. Friedman and Schwartz (1963, 1982) and Garber (1986) argue that silver risk increased ex post costs of borrowing, because anticipated possible increases in the price level (reflected in high nominal interest rates ex ante) were not realized (that is, the United States stayed on the gold standard). Conversely, other research has stressed how the credibility of the maintenance of, or likely return to, the gold standard at other times has been beneficial in lowering the costs of private and public finance (Bordo and Kydland, 1989, Calomiris, 1988a, 1988b, 1991).

Despite the importance of greenback and silver regime risks for American financial history, there have been only a few attempts to quantify the importance of the political events of this period using the tools of the recent rational-expectations literature. In this article, I will analyse the role that anticipations of possible regime switches played in determining nominal variables during the greenback suspension of convertibility and the silver crisis; use financial data to provide evidence of regime-specific inflation expectations; and argue that accounting for monetary regime expectations and risk are important for measuring ex ante real interest rates and for understanding some apparent departures from the normal procyclicality of the price level during this period.

With respect to the era of greenback suspension, in section II, I argue that anticipations of future resumption set current prices and exchange rates, and that nominal money was endogenous to these expectations. Moreover, institutional constraints on the money-supply process imposed important dynamic restrictions on the price process. While the supply of greenbacks was restricted,

national bank notes were the marginal component of the supply of paper currency. The real supply of national bank notes was an increasing function of expected inflation. In equilibrium, the zero profit condition for national bank currency issues required expected deflation. Thus current prices reflected not only long-run expectations of the price level, but also expected deflation.

In section III, I analyse the struggle over silver during the last decades of the nineteenth century. Silver risk ultimately concerned the maintenance of the token status of silver currency, which was threatened by the (unlikely) possibility of a return to "free silver" after 1878. Building on the model developed in section II, I argue that the run on the dollar in 1893 reflected a relatively high probability of a return to a suspension of convertibility. This, rather than the possibility of immediate conversion to a silver standard, was the main risk underlying forward premia and depletions of the Treasury gold reserve. I provide evidence that the probability of a switch to silver was never substantial in the 1890s, even though it caused large increases in nominal interest rates and ex post real interest rates.

The analysis in sections II and III suggests possible pitfalls for econometric studies of the nineteenth century U.S. economy that fail to take account of regime changes and regime risk, which are explored in section IV. The nineteenth-century U.S. experience included episodes of substantial expected deflation and inflation. These expectations were sometimes realized, and sometimes not. Average expected inflation varied importantly over time, as did the relationship between money and price, and the autocorrelations of either series. Nominal interest rates provide an underestimate of ex ante real rates of return during the greenback suspension, and an overestimate of ex ante real rates of return for some episodes in the early 1890s. At the same time, ex post real interest rates were higher than ex ante rates during the early 1890s because of unrealized expected inflation. Ironically, debtors, who had led the free-silver movement, suffered most from the uncertainty and high costs of credit it created.

Macroeconometric models that assume unchanging money and price processes over the nineteenth century are misspecified. Financial returns data from sections II and III can be useful to distinguish between periods of expected and unexpected price change. To illustrate the potential importance of taking account of regime change, I show that controlling for expected deflation during the 1870s helps to explain the weak procyclicality of prices during the late nineteenth century. Once one adjusts for shifts in expectations of price level change, prices and output exhibit much stronger comovement.

II. GREENBACK ISSUES AND THEIR VALUATION UNDER SUSPENSION

The laws authorizing the creation of legal-tender notes (or "greenbacks") beginning April 1862 were novel in three important respects. First, prior to this date no treasury securities had been given private legal-tender status, although treasury notes were sometimes receivable in payment of government dues. Second, unlike previous federal currency issues (the treasury notes of 1814 and the "demand notes" of 1861), the legal-tender notes were neither convertible into gold upon demand, nor useful for extinguishing gold-denominated liabilities like tariffs. Third, in contrast to earlier treasury issues, vast amounts of greenbacks were issued, and the Treasury had authority (and later would be required) to reissue any greenbacks it received. This made greenbacks an important permanent component of the money supply. The 1862 legislation thus marked three important precedents of lasting importance for U.S. monetary history: government encroachment in determining the numeraire for private debts; a departure from specie-based government note issues; and a permanent government role in providing a medium of exchange.[1]

During the greenback suspension domestic transactions were performed almost exclusively in paper currency and paper-denominated deposits, and gold was driven from domestic circulation. The exceptions to this rule were the Pacific states, where specific provisions were made to remain on a

gold standard (Lester, 1939). Until January 1875, there was no legislation establishing a timetable for returning to convertibility into gold on demand. Convertibility was achieved, as promised, on January 1, 1879, at which point specie and paper currencies once again circulated side by side.

Price and Exchange Rate Determination

The value of greenbacks relative to gold (or other commodities) varied greatly from 1862 until the resumption of convertibility in January 1879. At their nadir, in July 1864, greenbacks were valued in the New York gold market at less than 37 percent of their face value. Calomiris (1988b) reviews the literature on the valuation of greenbacks. The primary controversy in this literature has been whether the current supply of greenbacks, or news relevant for future government policy in support of greenbacks, was the most important determinant of their value. I argue that the latter view (espoused by Mitchell, 1903, 1908) seems to conform better to economic theory and available empirical evidence.

There are three central components in my model of the price process under greenback suspension. The first is expectation formation about the long-run future greenback value of gold (and price level). The second is the institutional arrangement whereby the government licensed national banks to provide money, along with related regulations relevant for the money-supply process. The third is a money-demand equation.

The U.S. was on an inconvertible paper-money (greenback) standard from 1862 through the end of 1878. Throughout that period the government promised eventual resumption of convertibility at the gold-parity exchange rate, but it was not until 1875 that the Resumption Act made the timing of that commitment explicit. That is not to say that expectations of resumption were constant prior to, or after, the Resumption Act. Throughout the period other actions by the government influenced the perceived probability of resumption. In particular, the greater the government's reliance on

greenback-denominated (as opposed to specie-denominated) debt, the less credible its commitment to resumption was perceived to be (as shown in Calomiris, 1988b). And after the Resumption Act, markets reacted during the 1876 election to the risk of a reversal of the commitment to resume on January 1, 1879.

Resumption was a policy that would not have happened suddenly. Thus resumption expectations concerned the price level at a distant point in the future. The relationship between resumption expectations and the future price level can be summarized by the following expression (which assumes, for convenience, an equivalence between the greenback price of gold and the price level):[2]

$$(2.1) \qquad E_t P_{t+u} = a_t(1) + (1-a)_t (P') ,$$

where a is the probability of resumption having occurred by time t+u, and P' > 1 is the expected price level at t+u contingent on resumption not having occurred. For simplicity, I will think of P' as predetermined.

The second ingredient in the model is the money-supply process, which was set, in part, by government regulation. I assume that demand fixed the ratios of deposits and gold holdings relative to paper currency. Gold was used primarily for foreign trade and for domestic transactions on the West Coast (Lester, 1939). With regard to deposits, there were no legal restrictions or greenback reserve requirements, and the assumption of a fixed ratio of paper money to deposits is defensible empirically for this period.[3] Under these assumptions it is sufficient to model the demand and supply for paper currency to determine the equilibrium timepath of prices.

Paper currency consisted of two components, which were perfect substitutes: greenbacks and national bank notes.[4] The supply of greenbacks was exogenously set by policy, and was

unresponsive to changes in prices (see Calomiris, 1988b, for a detailed discussion). National bank notes were issued by national banks, but were fully backed and guaranteed by the federal government. National banks, in essence, were licensed to issue government paper money under strict regulations. National banks held greenbacks and government bonds as required reserves against notes issued. National bank notes were the marginal (endogenous) component of the paper money supply, and were issued according to their profitability for national banks.[5] In essence, national bank note issues were a separable activity from the rest of banking. On the margin banks equated the profit from diverting capital toward the creation of notes, or toward commercial lending (and deposit creation).

The costs of issuing notes consisted of the opportunity cost from diverting capital to (possibly) lower-interest required government bond investments and zero-interest required greenback reserves,[6] and a one-percent tax on notes issued. Calomiris (1988b, pp. 218-19) shows that, for a given real marginal profit rate on alternative use of bank capital (s), we can write the zero-profit condition of national bank note supply as:

$$(2.2) \qquad s = L\{i_b - [(0.9q)i_l - 0.009]\} - \pi^e ,$$

where $L > 1$ is Cagan's (1965) leverage ratio on the use of bank capital for the creation of national bank notes, i_b and i_l are the nominal interest rates on government bonds and loans (for the marginal bank), q is the marginal bank's greenback reserve ratio (which varied by location), 0.009 reflects the simple tax on bank note issues, and π^e is expected inflation.

Under risk-neutrality and fully integrated capital markets, s and the real rates of return on government bonds and all banks' loans are equal, and expected inflation (deflation) is determined by rearranging the terms in equation (2.2). This solution for expected inflation implies constant expected deflation in equilibrium. Intuitively, the potential profitability of issuing national bank notes limits the

equilibrium rate of seigniorage (or inflation tax) and hence requires a negative rate of expected inflation.

More generally, bank loan interest rates can vary across regions due to limitations on capital mobility, and there is much evidence to suggest that such variation was important in the U.S. unit banking system (for reviews see Binder and Brown, 1991, Calomiris, 1992). James (1976) argued that regional composition of national bank note issues reflected such differences in bank lending opportunity costs. Under the assumption of different given real lending rates across banks, the supply of notes will be an increasing function of the rate of inflation, and the equilibrium rate of inflation will be determined jointly by (2.2) and the demand function for currency,

$$(2.3) \qquad (B/P)_t = b(Y, r + \pi^e), \; b_1 > 0, \; b_2 < 0,$$

where B is nominal paper currency (greenbacks plus national bank notes during the suspension), P is the price level, b is the money-demand function, Y is real output, and r is the real rate of interest on alternative assets.[7] For simplicity, I follow the classical assumptions of predetermined real output and real interest rates. The note-supply function is determined by summing across all banks. Banks with high loan interest rate opportunities will be the last to devote capital to note issuing.

Conditions (2.2) and (2.3) solve for the equilbrium values of the rate of inflation (deflation), the real stock of currency, and its components. We derive the time path of the expected price process by beginning with $E_t P_{t+s}$ from (2.1), and solving recursively for the previous periods' prices using the equilibrium rate of inflation (deflation). Given solutions for expected inflation (deflation), real currency, and the price level over time, the money-demand equation implies the equilibrium nominal amount of paper money holdings of the public, which consists of a predetermined amount of greenbacks and an endogenous supply of national bank notes.

Figure 1 depicts the equilbrium in the currency market under two alternative specifications of national bank note supply. Under integrated capital markets, all rates of return are equal and the supply schedule is flat at the equilibrium rate of deflation. Under imperfectly integrated capital markets, $i_b < i_l$ and $i_b < s+n^e$, and the supply schedule will be upward sloping in expected inflation. The kinks in the supply functions reflect the real value of predetermined greenback balances. If the supply schedule is sufficiently steep, it is possible for the equilibrium to entail expected inflation rather than deflation. Positive equilibrium expected inflation requires sufficiently large rates of return on bank stock and loans relative to government bonds for the marginal bank, and is unlikely if there are substantial additional costs associated with note issue (in addition to the 1 percent tax), as argued by Champ, Wallace, and Weber (1992). For this reason, and because of empirical evidence for expected deflation discussed below, it seems reasonable to characterize equilibrium price expectations as deflationary during the suspension.

We can also use this model to understand the determination of the equilibrium amount of real national bank notes issued under the post-1879 specie standard. In this case, either the supply of government-issued currency in the hands of the public or gold will be the marginal component of currency supply. In practice after 1879, gold coin and certificates were the marginal component, as the supply of greenbacks remained fixed by law. Under the gold standard, the rate of inflation mainly was determined exogenously by world markets for gold and other commodities, and the expected rate of inflation under the gold standard was essentially zero (Klein, 1975, Shiller and Siegel, 1975, Rockoff, 1984, Barsky, 1987). Now the zero-profit condition (2.2) alone will determine the amount of national bank notes issued, such that the marginal issuer earns zero profits when the expected inflation rate is zero. Thus the amount of national bank note issues should rise, ceteris paribus, when moving from a regime with expected deflation to a regime with a zero expected inflation rate.

Our model of money and prices under the greenback suspension has some interesting testable implications. The price of gold (and price level) processes should have followed a random walk with negative drift; individuals should have expected predictable deflation; news about the probability and timing of resumption should have been an important determinant of innovations in the price of gold and price level; and (contrary to Friedman and Schwartz, 1963) the supply of greenbacks -- an infra-marginal component of the money supply -- should have been relatively unimportant for price movements.[8]

Calomiris (1988b) provides evidence supporting each of these implications of the model, including evidence of deflationary expectations, of the importance of fiscal-policy news, and of the differential pricing of greenbacks and demand notes[9], which is consistent with the asset-pricing approach. On the causal role of greenbacks in determining other variables I presented results from a vector autoregression among monetary aggregates, commodity prices, the price of gold, output, fiscal-news proxies and the interest rate which supported the statistical irrelevance of greenbacks for gold and commodity price determination. News regarding the government's choice of numeraire for its debt, however, was an important determinant of gold price movements -- presumably because it contained information about future government resumption policy.

For present purposes I wish to stress the empirical findings in favor of expected deflation, and the measures of anticipated movements in prices. For mid-1869 through 1878 data are available on gold- and greenback-denominated securities from which one can extract precise measures of expected deflation only if one knows each period's default risk premium on railroad bonds. Column 4 of Table 1 compares the actual annual rate of greenback appreciation at each point in time to the implied forecast of the rate of appreciation assuming no variation in the risk premium. At each date shown in the table I compare the actual rate of appreciation of greenbacks from that date to 1881 with the

forecasted rate of appreciation implied by the yield differential between greenback- and gold-denominated bonds with that maturity.

There is clearly positive serial correlation in the measured forecast errors, which may reflect either time-variation in the risk premium, or coincidentally serially correlated news. Positive measured forecast errors suggest a time-varying risk premium, since it is not reasonable to suppose that people expected resumption at greater than the parity level. The measured forecast errors are consistent with the view that agents had been sanguine of timely resumption in the early 1870s. The positive values of the forecast errors for the period prior to 1873 probably reflect a rising default premium on railroad bonds after the Panic of 1873.[10] Column 5 provides an alternative rough measure of the appreciation forecast error under the assumption that the risk premium doubled (rose from 1.1 to 2.2) after the Panic of 1873.

The estimated forecast errors in column 5 indicate that there were changes in expectations regarding timely resumption. Times of relative pessimism include 1871, 1873-early 1874, and early 1876. In all three cases qualitative historical accounts support the view that these were times when resumption policy was questioned. 1871 saw a change in Treasury policy which was perceived as a signal of a possible significant increase in the supply of greenbacks and was regarded as a threat to timely resumption. This policy was promptly reversed to restore confidence (see Dewey, 1903, pp. 360-361). The controversy wore on until Grant's veto of April 1874, which Dewey (1903, p. 361) describes as "a turning point in the agitation for an increased volume of treasury legal tender notes." The estimates in column 5 support the view that resumption expectations rose after the veto.

The brief pessimism regarding resumption in early 1876 coincided with the political struggle over resumption prior to the election of 1876. The Democrats were divided between "hard"- and "soft"- money advocates. The desire to maintain unity and to attract soft-money independents led to a tolerance of the soft-money minority in the Democrat-controlled Congress, and the possibility of a

swing toward repeal of the Resumption Act. Repeated attempts by soft-money Democrats to force consideration of the repeal of the Act prior to the election were thwarted by procedural rules and then finally by the nomination of the hard-money candidate, Tilden, in July. The repeal movement failed to force the issue prior to the election in an attempt to extract a price for party unity. Tilden's empty promises to postpone resumption and a party platform pledging the same were not viewed as credible commitments. The nomination of Tilden in July had effectively put to rest any true threat of a postponement of resumption. Even the House bill calling for postponement which passed August 5, 1876 was nothing more than a political ploy; it was kept vague deliberately and passed with a vote of 106 to 86, with 93 abstentions.

In summary, Table 1 indicates that much of the deflation of the 1870s was anticipated. Furthermore, changes in estimated resumption expectations coincide with some political events that historians have pointed to as turning points in resumption expectations, particularly the election of 1876.

III. MODELING SILVER-STANDARD RISK AND EXPECTED INFLATION

Legislation demonetizing silver (the "Crime of '73") occurred in the midst of the controversy over resumption of greenback convertibility. In response to fears of a decline in the value of silver due to new silver discoveries, Congress discontinued the free coining of silver, and thereby prevented a de facto inflation in the dollar numeraire (i.e., a change from a gold standard to a silver standard).

The "Crime" was first identified by the Greenbackers during the election of 1876 as evidence of a creditor conspiracy to lower prices. The demise of the greenback inflationist movement after 1876 ushered in the free-silver movement as a substitute means for inflationist debtors (especially farmers) to achieve an increase in the price level. Until that time, complaints about the end of free coining of silver in 1873 were absent, and there was no political movement to speak of favoring the

free coining of silver (see Laughlin, 1896, pp. 209-14, and Russell, 1898, pp. 150-91). According to Russell (1898), worried Congressmen during the election of 1876 even claimed (disingenuously) to be unaware of the abrogation in 1873 of free silver coining. From that point on, gold-standard conservatives and inflationist pro-silver advocates struggled intermittently for 20 years over the possible conversion from a gold standard to a silver standard.

The only pro-silver legislation to pass Congress during this period were two compromise measures, the Bland-Allison Act of 1878 and the Sherman Purchase Act of 1890. Both provided for the limited issue (not free coining) of silver coins or silver-related paper currency (i.e., currency issued for government purchase of silver bullion). These acts were viewed as temporary measures by silver advocates. The central goal of the pro-silver lobby remained the return to free silver. To mitigate the inflationary consequences of a return to free silver (and thus make it more politically attractive to hard-money advocates) Congress sponsored several international conferences from 1878 to 1892 (see Russell, 1898, for detailed discussion of each), which were designed to pursuade all countries to adopt a uniform bimetallic standard. It was argued that if this could be achieved, then the value of silver would be increased, and the return to free coining of silver could be accomplished with little effect on prices. All of these conferences were unsuccessful, owing in part to the lack of agreement over the form of the new bimetallic standard (limited or unlimited coining of silver) and which silver-gold ratio should be adopted (Russell, 1898).

Beginning in the spring and summer of 1893, there was growing apprehension that the continuing minting of silver in compliance with the Sherman Act, along with continuing net outflows of resources from the Treasury owing to the decline in tariff revenues relative to expenditures, might lead to a cessation of gold convertibility at the Treasury. These fears produced additional strain on the Treasury through a dramatic increase in demands for conversion of paper currency (as shown in Table 2). The continuing decline in the Treasury's reserves led to the repeal of the Sherman Act in

November 1893, which halted the increase in paper currency supply and helped the Treasury shore up its stock of gold.

Free-silver advocates continued to call for a repeal of the Crime of '73. William Jennings Bryan's Presidential campaign in 1896 saw a resurgence of a movement to permit the free coining of silver, but Bryan's defeat marked the end of the pro-silver movement. The Gold Standard Act of 1900, and the gold price inflation of the late 1890s (which reduced debt burdens of pro-silver farmers) ensured that the pro-silver platform would never return.[11]

The risk of a return to free silver associated with Bryan's election campaign is easy to understand, but the potenital risk to the gold standard in the aftermath of the Sherman Act, and the emergence of a perceived increase in numeraire risk in 1893 can only be understood within the context of the specific political struggle that gave rise to the minting of silver coins and the issuing of silver certificates from 1878 to 1893, and the economic constraints that affected the value of these token currencies.

Legislative History

Several pieces of silver-coining legislation were proposed and struck down in Congress. The Act of 1878 was a compromise between the inflationist forces who advocated free coining of silver, and those who fought any potential threat to the gold standard. According to the provisions of the Act, the Treasury would purchase between $2 million and $4 million worth of silver (in market value) on the open market. Thus as the gold price of silver declined, more silver dollars would be coined for any given value of silver purchased. The silver would be coined and placed into circulation by the Treasury through government purchases. Silver coin would be returned to the Treasury in one of two ways: either in payment of any dues to the government, for which the coins would be received at their face (not intrinsic) value; or through exchanges of coins for silver certificates, which would be

backed 100 percent by the silver so deposited with the Treasury. In addition to new issues of coins and certificates, coins and silver certificates previously returned to the government in payment of taxes, tariffs, or other dues could be returned to circulation through the regular course of government purchases.

Under the Bland-Allison Act, silver coins were not convertible directly into gold. Yet silver currency issued under the Bland-Allison Act always traded at its face value. As Laughlin (1896) recognized, and as discussed in detail below, tax payment parity can be as good as a convertibility option for maintaining a token's value if tax payments are large enough relative to token currency.[12]

The Sherman Act of 1890 essentially was a continuation of the Bland-Allison Act, but required larger monthly purchases of silver -- $4.5 million (in coin produced). The Sherman Act differed from the Bland-Allison Act in three other respects. First, the amount purchased each month was not a fixed amount of silver in dollar units of bullion purchased, but a fixed amount of silver in face value of currency produced. Thus the amount minted did not fluctuate with the gold value of silver, as before. Second, rather than issue silver coin which was convertible into silver certificates, the Treasury would use newly authorized Treasury notes to buy the silver bullion. Third, the policy of the Secretary of the Treasury was to redeem these notes on demand in gold.[13] The only substantive differences between the Sherman Act and the Bland-Allison Act were the amount of token currency issued, and the Treasury's voluntary commitment to redeem Treasury notes in gold on demand. The other differences were neutral with respect to their effect on the currency issued and the potential threat to the gold standard.

Modeling the Potential Collapse of the Gold Standard

The possible collapse of the gold standard did not occur in the 1890s, although I will show that the discussion of contemporaries and evidence from market indicators are consistent with

significant moments of concern regarding short-run convertibility, and a small implied probability of a long-run switch to silver. Modeling the risk of dollar depreciation entails imagining a possible, but unrealized (counterfactual) world. The goal is to construct a coherent model of the possible suspension or collapse of the gold standard for the 1890s which is consistent with a variety of observed data, and with the fears voiced by sophisticated financial observers of the time.

Perhaps surprisingly, despite the importance of the silver crisis years of the 1890s for American financial history, there has been only one attempt to construct a formal model of the potential threat to the gold standard posed by silver, namely Grilli (1990). Grilli (1990) proposes a "speculative-attack" model in which the amount of gold currently in the treasury is positively related, and the amount of outstanding paper currency negatively related, to the probability of maintaining the gold standard. Short-run reductions in the gold reserve, or increases in the currency supply, increase the risk of a collapse of the gold standard because, by assumption, the long-run money-supply growth process is assumed to be an extrapolation of the short-run process. Not surprisingly, the period of recession and low tariff revenues (partly due to the revised schedule of duties under the McKinley Tariff) was one of high deficits, short-run decumulation of gold in the Treasury, and -- under the provisions of the Sherman Act -- increase in outstanding silver-related currency. These facts, combined with Grilli's method for estimating the long-run money supply, explain the run on the dollar in 1893 as a rational expectation of an inconsistency between the pledge to maintain the gold standard and the long-run expected money supply.

Despite some attractive features of this model, the treatment of the money-supply and deficit processes is an important weakness. As Grilli's framework recognizes, what matters most for fixed-exchange rate credibility is the long-run viability of the gold standard. One necessary condition for maintenance of the gold standard is the "transversality condition" for the government's ability to maintain gold convertibility in the future, which he argues depends on the long-run factors governing

deficits and the supply of currency. But government credibility, and post-suspension dollar prices, do not always depend exclusively on predetermined changes in the government supply of money, or on government deficits.

Consider what would have happened to the price level if during the 1890s current gold convertibility had been suspended, but it remained a certainty that the government would eventually control deficit-driven expansion of money and return to gold convertibility. The post-suspension price level would be determined using the model developed in section II above. Dollar depreciation at the time of suspension would be a function of the expected duration of the suspension and the equilibrium expected deflation implied by the zero-profit condition governing the marginal supply of money (national bank notes), as in equation 2.2. As in section II, the money supply would be endogenous to the price level. Suspensions anticipated to be short-lived would have little effect on the price level.

If the government's ultimate commitment to gold were uncertain, and if the only other possibility were the adoption of a silver standard (by act of Congress), then the price level at the time of the suspension of convertibility would be determined by the expected duration of suspension and the equilibrium rate of deflation, and by the probability-weighted future price levels under either the gold or silver standard (as in equation 2.1 above).

Grilli's model of the 1890s differs from mine in three important respects. First, he envisions a range of long-run outcomes for the value of the dollar other than the two alternative specie standards (silver or gold) that were at the focal point of the debates in the 1890s. Second, he views the money-supply process as the driving force of long-run price determination. In contrast, my model stresses the endogeneity of money supply through national bank note issues, and stresses long-run expectations of government support for gold. Third, Grilli argues that short-run increases in deficits in the 1890s threatened the long-run viability of the gold standard. I am convinced by Bohn's (1991) evidence that short-run deficits never constituted a long-run threat to gold during this period.

Bohn's (1991) study of deficit processes in the U.S. from 1792 to 1988 argues that increases in deficits elicited reductions in expenditures and increases in taxes that prevented deficits from threatening the money-supply process. Bohn employs an error-correction framework to show that the government responded to deficits as if it were preventing the violation of its intertemporal budget constraint. Deficits eventually hit "reflecting barriers" and triggered government policies to prevent continuing deficits and monetization of debt. Thus the high deficits of the 1890s (see Table 4) likely were not expected to persist, and thus they would not be expected to influence long-run money-supply growth.

Grilli's model also equates a change in government currency with a change in total currency outstanding, ignoring the important role of national bank notes as the marginal component of currency supply under suspension of convertibility. As noted above, the presence of national bank notes has important implications for the determination of the price process. Consider, for example, what would happen if the government credibly announced a future switch to a silver standard and an immediate suspension of greenback convertibility, but constrained the growth of greenbacks to zero and refused to mint silver freely in the interim. The money supply would adjust immediately to the new policy through an increase in national bank notes, and the dollar would depreciate immediately to a level consistent with long-run establishment of free silver minting and interim expected deflation. This example illustrates the pitfalls of viewing the money supply as predetermined, and the importance of incorporating long-run expectations of silver conversion and the supply function for national bank notes into a model of price determination and speculative attack during the period of silver risk.

Token Silver Issues and the Maintenance of the Gold Standard

If, as Bohn (1991) argues, the short-run deficits of the 1890s posed no significant threat to the long-run maintenance of the gold standard, what about the token currency acts themselves? Did the

Bland-Allison or Sherman Acts, per se, threaten the gold standard through their effects on the money supply, or in some other way? An investigation of the possible role of the silver acts requires a detailed analysis of the various components of currency and the factors governing their supply during the 1890s.

By the 1890s the supply of currency in the United States consisted of full-valued gold coins and gold certificates, paper currency in the form of greenbacks and national bank notes (direct and indirect obligations of the government to redeem in either gold or silver on demand, depending on which served as the specie numeraire for the monetary system), and silver token currency (silver coins, silver certificates, and Treasury notes of 1890).

Assume for simplicity that all forms of token and full-valued currency trading at par are perfect substitutes in a physical sense for transactions and storage purposes, and that there is an exogenous (growing) real demand for currency, M_t (expressed in gold units). Furthermore, consistent with the provisions in both silver acts, assume silver currency is receivable in payment of taxes at par with gold.

The silver-token-currency supply process implied by the two Acts can be summarized by:

$$(3.1) \qquad S_t = xt - \sum_{w=0}^{t} (T_w - G_w)_w ,$$

where S_t is the stock of silver token currency in circulation at time t, x is the constant amount of new token currency issued per year (roughly \$2 million per month under the Bland-Allison Act and \$4.5 million per month under the Sherman Act), T_w are the annual tax payments made in silver, and G_w are

the government purchases made with token currency previously received in taxes.[14] The S_t process is bounded from above by xt because, by definition, the sum of the G_t terms must be less than or equal to the sum of the T_t terms.

An attack on the currency could have occurred as a result of token currency issues if either of two conditions regarding expectations of the long run were violated. First, if people believed that the supply of government-issued token currency in the hands of the public (silver tokens plus greenbacks) expected to prevail in the future would eventually overtake the total real demand for currency, then gold would disappear and token currency would cease to be an inframarginal component of the money supply. In this case, the tax transversality condition would be violated. The prices of gold and commodities eventually would be determined by the intrinsic value of the silver dollar. Given the real demand for money and the exogenous-supply component of money (greenbacks, a limited supply of token silver and Treasury notes), national bank notes would increase endogenously to equalize total supply and demand of currency at a depreciated value of the dollar. Expected deflation would characterize the transition to the long-run establishment of free coining in silver.

A second possible violation of the tax transversality condition might occur even if the total stock of token money were not expected to overtake the total real demand for money. If the ratio of the stock of token currency to the flow of tax payments were expected to become sufficiently high permanently, then individuals eventually would be able to avoid using gold for tax payments forever. In this case, the tax transversality condition would again be violated, and tax receivability would not ensure current parity of the two currencies.[15] If this were expected to occur and the government were not expected to act to support the currency through maintenance of convertibility into gold on demand, then there would be an immediate collapse of the gold standard.

In both these scenarios, the collapse of the gold standard is immediate. An expectation of a future violation of a transversality condition leads to an immediate run because there can be no

forecastable excessive capital losses on token currency in equilibrium, and because the supply of national bank notes is endogenous (thus nominal government currency does not determine the current value of the dollar).

These theoretical possibilities of a collapse of the gold standard through expectations of the increasing supply of the exogenous component of token currency, however, do not appear to be relevant empirically. One cannot reasonably argue that a permanent continuation of the Sherman Act, and other government policies in place in the 1890s, would have led to token currency overtaking total currency demand, either in terms of money stock holdings or tax payment flows. Under existing law, the supply of greenbacks was fixed at $346.7 million.[16] Thus any indefinite continued expansion of token currency under existing law would have had to come from the silver acts themselves. Money-demand and taxes are both tied to the real economy, would be reasonably expected to grow at some rate over time, and could never be permanently overtaken by a linear function like xt. That is, in comparing the long-run growth of money demand and token currency,

$$(3.2) \qquad \lim_{t \to \infty} (M_0 e^{gt})/(xt + N) = \infty$$

where g is the rate of increase of money demand, and N is the constant ceiling on other paper currency supplied.

Empirical evidence suggests that the exogenous component of nominal token currency would never have exceeded the total demand for currency in gold units, and thus there was no real risk of token currency displacing gold. The total amount of currency in circulation (currency outside the Treasury) grew at roughly 4 percent from 1878 to 1898, from $729 million to $1,840. These were not extraodinary years with respect to the business cycle, and therefore serve as useful benchmarks

for long-run money-demand growth. From 1878 to 1890 $351 million in silver currency was created under the Bland-Allison Act, while total money demand increased by $702 million. Gold in circulation rose substantially (by $350 million), while national bank notes fell $129 million, as Table 3 shows.[17] Clearly, an indefinite continuation of the Bland-Allison Act could not have displaced full-valued currency at any time.

By mid-1890 total currency in circulation was $1,431 million. The Sherman Act implied an annual issue of $54 million in Treasury notes. An expected four percent annual growth rate for money demand, however, implies that total money demand would be expected to increase each year by upwards of $56 million. In fact, from 1890 to 1893 gold in circulation actually increased $33 million, while total currency holdings increased $165 million (consistent with a roughly 4 percent growth rate).[18] Thus even the larger increases in silver currency due to the Sherman Act never threatened to displace gold by overtaking total money demand (see the related discussion in Friedman and Schwartz, 1963, pp. 128-34).

In summary, I have argued that absent some other change in policy affecting the long-run credibility of the gold standard, the currency emissions from the Sherman Act of 1890 could not have threatened the gold standard.

Free-Silver Risk and the Run on the Dollar

Notwithstanding the above arguments regarding the irrelevance of deficits and token currency supply for long-run maintenance of the gold standard and the token status of silver and paper currency, clearly there was substantial concern in 1893 and thereafter regarding the maintenance of the gold standard, which is visible in the financial press, the actions of Congress and President Cleveland, and the data on redemptions of paper currency at the Treasury (see Table 2).

Moreover, the focus of much of this concern was the Treasury's gold holdings, and the threat deficits and silver currency issues posed for the short-term maintenance of the reserve.[19] How can this evidence be reconciled with the above arguments regarding the irrelevance of token currency growth and deficits for the long-run viability of the gold standard?

Irrelevance of token currency and deficits for the long-run viability of the gold standard does not imply their irrelevance for short-run convertibility. In the model presented in section II, even departures from convertibility that are known to be temporary may still result in depreciation of the dollar (and expected appreciation during the suspension, which returns the currency to par). Moreover, return to gold after suspension would not have been certain since there remained a strong constituency for free silver until Bryan's defeat in 1896. Even though suspending itself would have no obvious effect on the probability of victory for free silver,[20] suspension of convertibility implied that current and subsequent perceptions of free-silver risk would be reflected in varying rates of discount of the currency during suspension rather than a contraction of its supply (which, under convertibility, would have maintained parity).

An additional necessary condition for suspension to result in depreciation is that tax receivability would not provide an alternative form of short-run backing for the currency. Imagine, contingent on suspension, that the public were able to return all paper currency to the government (say, at the beginning of each month) in partial payment of tax obligations. That is, each period the public pays in paper currency and gold, and the government immediately spends the currency it receives. In this case, there would be virtually no depreciation in the currency, since it would effectively be "redeemed" each period at par in gold. This is only true, however, if the public must pay some taxes each period in gold as well as in paper. If it were feasible to pay all taxes in token currency, then taxes would not provide short-run support to the currency. Figure 2 plots the proportion of tax payments made in gold (or gold certificates). These data indicate that at several

times from 1878 to 1896, and practically for the entire interval from 1892 to 1897, taxes were paid almost exclusively in token currency. It seems reasonable to suppose that if suspension had occurred -- increasing the incentive to pay taxes in tokens -- people would have been able in the short run to avoid paying taxes in gold, and therefore, tax receivability would not have provided an alternative means of short-run support for the currency.

To sum up, it seems that the main threat to the gold standard in the 1890s was a temporary suspension of convertibility that would have allowed the dollar to fall to a small discount. This discount would have reflected three separate influences: the probability of the passage of free-silver legislation during the period of expected suspension, the relative value of silver and gold in the market, and the duration of the expected suspension. The higher the risk of free silver, the lower the value of silver, and the higher the duration of suspension, the greater the potential post-suspension depreciation of the currency.

The discount would not be influenced by the (inframarginal) supply of greenbacks and Treasury notes. Unlike models of speculative attack in fiat-money regimes (e.g., Grilli, 1990), the money supply would not be the exogenous forcing process determining the dollar's value in a post-collapse state. As during the greenback suspension, national bank notes would have become the marginal component of currency supply, and the total nominal supply of money would have been endogenous along with the price level. While the probability of an attack would be influenced by short-run paper (and other token) currency outstanding relative to reserves, the post-collapse value of the dollar would be determined by the combined influence of the risk of free-silver victory, the relative value of silver, the equilibrium rate of inflation/deflation, and the expected duration of the suspension.

The following informal model captures the essence of the problem. Consider a holder of government paper currency. Assuming a shoe-leather cost to redeeming currency in gold

(alternatively, a convenience service to paper as opposed to gold currency) the currency holder will "run" the Treasury only if the expected capital loss of not doing so is sufficiently large. Depreciation will only occur if reserves at the Treasury are exhausted (i.e., if there is a successful "attack"). The holder of greenbacks contemplating whether to run the Treasury must determine: (1) whether his information sources indicate that the depreciation contingent on an attack is large enough to provide an incentive for running the Treasury; (2) whether suspension is likely -- that is whether other holders of government currency are likely to agree with his assessment of the possibility of a run on the Treasury; and (3) whether his decision to run the Treasury today, rather than postpone his decision until tomorrow, will result in a change in the chance of his receiving gold if he does run (i.e., whether he will he is likely to be one of the first in line today but not tomorrow). Given that individuals may disagree on the fundamental risks affecting the long-run value of the currency, they will try to infer each other's decisions by observing the depletion in the government's reserve. Furthermore, they will have incentive to act quickly as that depletion accelerates in order to avoid being last in line. Thus as reserves fall, the possibility of a run increases for any given amount of expected post-attack depreciation. Furthermore, for given levels of currency outstanding and reserves in the Treasury, increases in expected post-attack depreciation will prompt action by increasing numbers of currency holders (with diverse views regarding fundamental risk and possibly diverse shoe-leather costs).[21]

One can write the probability of an attack as:

$$A_t = v(R_t, N+S_t, P'_t, a_t, u), \quad v_1 < 0, v_2, v_3, v_4, v_5 > 0, \tag{3.3}$$

where R is the level of reserves, N+S is the supply of outstanding paper (and other token) currency, P' is the silver price of gold, a is the probability of victory for free-silver at time t+u, and u is the

expected duration of the suspension (and delay in legislative decision-making regarding free silver conditional on suspension). For simplicity, assume that suspension is expected to last for a fixed duration, and let P' follow a random walk (thus at any time the value of P' is expected to remain constant).[22]

If suspension did occur, then the price level would be determined by:

(3.4) $$e_t = z(n^e, Q_t, a_t, u), \quad z_1, z_2, z_3, z_4 > 0.$$

As in section II, n^e would be determined by equations (2.2) and (2.3). The expected future price level at t+u is determined by P' and a (as in condition 2.1), and the current price level is determined by the expected future price level and the rate of expected deflation.

The unconditional expectation of the one-period ahead future price of gold at any time prior to the occurrence of suspension is given by:

(3.5) $$E_{t-1}\, e_t = (1 - A_{t-1})1 + A_{t-1}\, z(n^e, P'_{t-1}, a_{t-1}).$$

Each period agents construct estimates of a, observe R, P', and N+S, and decide whether to expend resources to demand redemption of their paper currency from the government. If enough agents demand redemption, suspension of convertibility will occur.

Once suspension has occurred, agents know that suspension will end u periods after it begins. At that time, either the government will successfully return to par convertibility in gold, or it will announce a policy of "free silver" coining, implying that the dollar price of gold will be equal to P'. a is the probability of the success of free silver. At the time of suspension, the price level expected

for u periods later is (1-a)1 + aP'. The current price level is derived from the price level at t+u and the expected rate of dollar appreciation, which is given by equations (2.2) and (2.3).

Each period agents form expectations of the probability a suspension will occur, based in part on their expectation of the "shadow exchange rate" -- the price of gold that would prevail immediately after a suspension. The shadow exchange rate is an increasing function of P' and a, and A is an increasing function of the shadow exchange rate.

The discounts on the demand notes of 1861 after the suspension of convertibility in December 1861 provide an example of the counterfactual small depreciation that could have occurred in the 1890s if the Treasury had suspended convertibility. As already noted, the demand notes were useful for extinguishing tax liabilities denominated in gold. From December 1861 to March 1863 the demand notes circulated at a discount relative to gold, and a premium relative to greenbacks. By March 1863 they had disappeared from circulation, having been "redeemed" in the interim through tariff payments. The average discount rate on demand notes was roughly 4 percent during this period, and discounts ranged from 0.5 percent (in late February 1863) to 9.2 percent (in late July 1862). By late February 1863 the comparable discount rate on greenbacks had risen to greater than 40 percent. Clearly, the difference between the gold value of greenbacks and demand notes reflected the duration of their effective suspension periods, and the different risks associated with their long-run convertibility. For demand notes, the risk was that tariff receivability would be discontinued prior to the paying in of all demand notes. For greenbacks, the risk was that the promised long-run return to gold would not occur.

Evidence on Depreciation Expectations Due to Silver Risk

How can one verify that silver risk during the 1890s involved expectations of a small depreciation, rather than the possibility of an immediate move to a silver standard? Abstracting from

risk premia, the interest rate differential between otherwise identical dollar- and gold-denominated securities provides an estimate of the expected rate of currency depreciation. Short-term interest rate data for choice two-name commercial paper in New York provide a short-run nominal interest rate series for a default-risk-free instrument. Greef (1938, p. 56) claims that one New York bank's losses on commercial paper during the troubled years 1891-1895 amounted to a trivial 0.05 percent. A riskless gold-denominated interest rate for New York can be derived from prices of bills of exchange (of New York banks) on London banks under the assumption that the pound faced no exchange rate risk during this period. There were no references in the Economist to imminent collapse of the pound or British exchange rate risk during this period, despite British promotion of the international conferences on bimetallism. Indeed, British investors repatriated their capital investments in America in response to silver risk, especially in 1893.[25]

Data from the National Monetary Commission (1910) on 60-day and "sight" bills of exchange prices can be used to construct a measure of the gold-denonominated interest rate in New York as follows. Assuming "sight" bills were redeemable in 10 days (i.e., that it took 10 days to travel to London from New York), then the ratio of the price of sight and 60-day bills traded in New York today implies an interest rate in gold units over the 50-day period beginning 10 days hence. This can be converted into a rough measure of the 60-day rate by multiplying by 6/5.

Table 5 reports 60-day nominal and real interest rates for the last week and day, respectively, of each month from 1893 through 1896, and calculates expected depreciation (n^e_{60}) as the difference between the two rates. These data indicate that at no point during the period did markets anticipate any significant risk of a change from a gold to a silver standard in the near term, which is consistent with the political history of the silver movement's uphill battle. Moreover, even a successful campaign in Congress to switch to a silver standard would have taken much longer than sixty days to complete. Rather than view the 2 percent sixty-day expected depreciation of the dollar in June 1893

as a 2.7 percent chance of an imminent conversion to the silver standard (using P' as the post-attack price level, given in Table 5), one should view expected depreciation as the product of the probabilities of a temporary suspension of convertibility and the expected immediate depreciation contingent on suspension. For example, a 2 percent expected depreciation is consistent with a 20 percent chance of suspension and a 10 percent post-attack expected depreciation. Of course, there is a wide range of probabilities whose product equals 2 percent, so it is not possible to estimate separately the probability of suspension or the expected depreciation of the currency contingent on suspension. If, as argued before, the depreciation of the demand notes in 1862 and 1863 is an indication of the likely post-attack depreciation of the dollar in the 1890s, then the range of reasonable estimates of the probability of suspension in June 1893 can be narrowed to, say, 10 to 30 percent.

The estimates of expected depreciation reported in Table 5 should be viewed as upper bounds on true expected depreciation for two reasons. First, I assume a zero depreciation risk premium; second, I use the highest rate quoted for choice commercial paper as the definition of the nominal interest rate.[24]

The timing of the run on the dollar in 1893, evident both in the high interest rate differentials observed for March through September and the redemptions of greenbacks and Treasury notes during the same period, can be understood within the context of the model developed above. Two important events increased currency risk during late 1892 and early 1893: the election of Cleveland and the failure of the international conference on bimetallism. While Cleveland's hard-money views figured prominently in his inaugural speech in March 1893, his plan for supporting the gold standard and issuing debt remained unclear, and there was fear that he would wait too long to raise the necessary resources (see the Economist, March 4, 1893, pp. 265-66, and March 11, pp. 289-90), making suspension more likely. There was also concern that, as a Democrat, Cleveland might be more prone to compromise with the soft-money wing of his party.

The increasing pessimism over the adoption of an international bimetallic currency policy during 1892, and the indefinite recess of the international monetary conference in December 1892 -- which would never reconvene -- led to a fall in the value of silver relative to gold, as people became pessimistic of any future monetary role for silver as an international currency (see the Economist, December 10, p. 1544, December 17, p. 1577, and December 24, p. 1615). From January 1892 to July 1893 the gold value of silver (1/Q) fell some 30 percent (Laughlin, 1896, p. 294). The collapse of the convention also led to renewed pressure from the pro-silver lobby in Washington, as there was no more reason to postpone unilateral action by the United States in anticipation of a joint international bimetallic policy. While Grilli (1990) is correct to point to increased pressure on the gold standard from increased currency supply and declining reserves, prior political news may have precipitated much of the subsequent decline in the reserve position through its effect on expecations and silver's value (i.e., an increase in a and P').

Cleveland's vigorous opposition to the Sherman Act, his success in convincing commercial banks to help shore up the Treasury's reserve, and increasing Congressional support for his views -- culminating in the repeal of the Sherman Act on October 30 -- signalled Cleveland's commitment to maintain parity and his skill in protecting the gold standard. Furthermore, the repeal of the Sherman Act removed a major source of short-term pressure on the reserve.

One interesting feature of the data in Table 5 is the absence of any significant short-term depreciation risk from November 1893 until late 1895. In particular, the data provide little support for Garber and Grilli's (1986) and Grilli's (1990) view that the Belmont-Morgan syndicate (of February 1895) saved the gold standard. Instead they indicate that Bryan's candidacy was the only substantial threat to the gold standard after the crisis of 1893. Weekly data on interest rates reported in National Monetary Commission (1910, pp. 123-24) do not alter this conclusion. Indeed, from November 1894 through February 1895 interest rates on top-quality two-name paper in New York

never exceeded 4 percent and did not vary much from week to week. There is no evidence from interest rate differentials of any significant expected depreciation in the dollar during this period.

Garber and Grilli (1986) and Grilli (1990) echoed earlier historians of the Belmont-Morgan syndicate (Burke, 1899) in arguing that there was substantial concern over the Treasury gold reserve in 1894 and 1895. The Resumption Act of 1875 gave the Treasury the power to raise funds through any of the bonds authorized in the Refunding Act of 1870 so long as the bonds were sold at a price greater than or equal to par.[25] Effectively, this meant that bonds could be sold at yields less than or equal to 5 percent. The Secretary of the Treasury used this power in January and November 1894.[26] But, as shown in Table 2, the depletion of the gold reserve accelerated in late 1894 and early 1895. Garber and Grilli (1986) describe this as a run on the dollar, and argue that the Belmont-Morgan syndicate of February 1895 ended the run.

The agreement with the syndicate gave the government an option to buy gold with bonds in the future on demand, and required that at least half of the gold would be shipped from Europe. The reason for this latter provision was that preceding bond issues were not deemed entirely successful in shoring up the government's reserve, in part because domestic bondholders (who were required to purchase bonds with gold) obtained much of their gold by redeeming paper currency at the Treasury (Burke, 1899, p. 27). Alternatively, bond purchasers who used their own gold holdings to buy bonds replenished their gold holdings by converting domestic currency into gold after buying the bonds. Banks continued to provide gold to the Treasury in exchange for paper currency in 1894, but could not compensate for the large private withdrawals by bond purchasers (Burke, 1899, pp. 27-9).

While the gold-purchase option clearly was of use to the government in 1895, it is not clear that it was crucial to maintaining convertibility. On the one hand, it does seem that the very rapid daily withdrawals of gold from the Treasury in late January (averaging more than $3 million per day for the last seven days of the month) represented a lack of confidence in the gold standard.

Furthermore, this was reversed after the deal with the syndicate was announced in February. On the other hand, however, the withdrawals in January seemed to reflect concern over the Administration's willingness to continue to use its powers of bond issue. Burke (1899, p. 28) writes of the period prior to the government's resort to the banking syndicate:

> The first indications of a general withdrawal of gold for hoarding seems to have been noticed on January 17. Eight days after the movement culminated in the total withdrawal of over seven million in a single day. Three days later the President sent his special message to Congress and as nothing was done to allay public fears, withdrawals continued to be heavy. Negotiations [with Congress] for a new bond issue [in a form other than that allowed by the Act of 1870, which the Administration viewed as desirable] were begun on January 30th and withdrawals at once fell off and reached a minimum of $63,374 on February 4th. Delay and rumors over some difficulty in negotiations caused the withdrawals to increase to $390,302 on February 5th and to $729,479 on the next day. Denial of the rumor again caused a falling off in the withdrawals.

Once these plans failed, withdrawals began anew, and the government was forced to resort to the syndicate as a backup measure. Thus absent the collapse of the earlier negotiations, and the fears that Congress or the Administration might not act swiftly enough to issue bonds to protect the gold standard, the syndicate may have been entirely unnecessary.

How can one reconcile the large withdrawals from the Treasury in December through February of 1895 and the concern over the Treasury's reserve with the small interest rate differential in Table 5? One possible explanation is that the procrastination of the Administration in issuing bonds in early 1895 raised the possibility of a very brief suspension of convertibility, which would have been expected to prompt immediate large issues of government bonds to replenish the reserve (bonds could have been placed in foreign markets to avoid reserve depletion by domestic bondholders).[27] One can imagine that importers and exporters anticipating the possibility of a brief suspension may have feared a postponement of immediate access to gold for international transactions.

This would explain the hoarding of gold from December 1894 through February 1895 without implying a significant expectation of currency depreciation.

IV. INFLATION EXPECTATIONS AND THE PROCYCLICALITY OF PRICES

The preceding sections indicate that the 1870s and the 1890s saw periods of unusual regime-specific inflation expectations, due in the first case to expectations of resumption, and in the second instance, to the perceived possibility of the collapse of the gold standard. One important iinplication of these findings is that "Phillips-Curve" modeling of the nineteenth and twentieth centuries as a single epoch, which implicitly assumes unchanging expected and actual price processes, may introduce error into the measured relationship between output and price movements.

Since the seminal work of Friedman (1968), Phelps (1968), Phelps et al. (1970), and Lucas (1972, 1973), researchers have emphasized the importance of expectations in modeling the relationship between price and output co-movements. Interpretations of the price-output relationship can be usefully grouped into three categories: models of wage and price rigidity (as in Blanchard, 1987, Fischer, 1977, Gordon, 1980, 1982, and 1990, Lucas, 1990, and Taylor, 1980), models of imperfect information about monetary disturbances (Lucas 1972, 1973), or models of the allocative effects of unanticipated price changes under nominal financial contracting (Bernanke, 1983, Bernanke and Gertler, 1990, Calomiris, Hubbard, and Stock, 1986, Calomiris and Hubbard, 1989a, 1990, and Fisher, 1933). Despite important differences, these three modeling strategies agree that anticipated and unanticipated changes in prices will be associated differently with output movements. In particular, anticipated inflationary (or deflationary) disturbances will not be as strongly associated with output growth (or decline) as unanticipated inflationary (or deflationary) disturbances.

The evidence for expected deflation in the 1870s and expected inflation in the 1890s, leads one to expect weak or perverse association between output and price movements during these periods.

The predictions are clearer for the 1870s. During the 1870s expected deflation should not have been associated with decline in output.

The effect of silver risk on the relationship between price and output in 1893 and 1896 is harder to predict. On the one hand, the realized flat time path of prices was deflationary compared to the expected price level (which incorporated the possibility of a switch to silver), and thus little deflation could be consistent with large output declines. On the other hand, devaluation expectations led to a flight to gold, which was deflationary (given some domestic autonomy in price determination). For example, mid-1893 witnessed large declines in prices (see Calomiris and Hubbard, 1989a). Furthermore, because expectations of devaluation were not uniform within 1893 or 1896, annual data on GNP and the GNP deflator (used below) may mask important short-run effects.

Any discussion of the pattern of association between price and output must acknowledge the disagreement that currently exists over the proper measures of these variables for the mid-to-late nineteenth century. Three commonly used annual series now exist: the Gallman-Kendrick series (Gallman, 1966), the Balke-Gordon (1989) series, and the Romer (1989) series. Table 6 provides annual data for real output and the price level from the two most recent sources.

Visual inspection of Table 6 shows that during the 1870s and 1890s the normal procyclical pattern of association between growth in real output and growth in the price level is not immediately visible. Nor does it seem to be consistent across sub-periods.[28] The distinction between expected and unexpected price change seems to be relevant for the pattern of association between output and price. During the 1870s substantial deflation was associated with positive growth, particularly from 1875 to 1879. From 1892 to 1896 prices were essentially flat (in annual data), while output growth was exceptionally slow. The output-price correlation (in log differences) increases substantially when the 1870s are excluded from the sample. Using Romer's data the correlation rises from 0.056 to 0.387. Using Balke and Gordon's data the correlation rises from 0.103 to 0.231.

Table 7 provides a rough means for quantifying the importance of expected price changes in modeling the association between output and price. I regress price growth on output growth, with and without separate dummies for the 1870s and 1893/1896.[29] These dummies should be thought of as price-expectations-shift variables. The R-squared in the regressions rises markedly when the dummies are included (from 0.011 and 0.003 to 0.327 and 0.239, respectively for the Balke-Gordon and Romer datasets). The size of the coefficient linking price and output movements increases by a factor of two using Balke and Gordon's data, and a factor of three using Romer's data. Consistent with Klein (1975) and Barsky (1987), the constant term is essentially zero in all the regressions.

The dummy variable for the 1870s is of the predicted sign and large in both regressions, and is statistically significant. It is also interesting to note that the Durbin-Watson statistic improves in both cases in the presence of the dummy variables. As I have argued, the 1870s were unusual in that there was persistent predictable deflation. This accounts for the reduction in serial correlation of inflation disturbances once the mean rate of deflation in the 1870s is controlled for.

The sign of the dummy for 1893/1896 is different in the two regressions, its size is small, and it is statistically insignificant. As noted above, the marginal effects of anticipated inflation on prices in the 1890s are difficult to predict, and difficult to measure in annual data.

This evidence suggests that future work on cyclical patterns in price change for other times and places in which monetary regime changes occurred, or might have occurred, could benefit by using financial returns data to distinguish between anticipated and unanticipated changes in the price level. The importance of taking account of regime switching in analysing the procyclicality of prices is supportive of Lucas' (1976) exhortation that econometricians take account of changes in individuals' decision rules that follow from changes in policy regimes.[30]

V. CONCLUSION

This paper has argued that modeling the money-supply process and the effects of expectations of monetary regime changes yields important insights for macroeconomic historians. During the expected deflation of the 1870s, nominal rates were lower than real rates, and substantial expected deflation was accompanied by modest economic growth. During episodes of suspension risk during the silver controversy of the mid-1890s, nominal rates were much greater than real rates. At their maximum, in June 1893, annualized nominal rates were more than 12 percentage points above real rates. The effect of silver risk on dollar depreciation expectations and nominal interest rates was due in large part to the effect of long-term silver risk and short-term silver currency issues on the depletion of the gold reserve of the Treasury, which increased the possibility of an attack on the dollar and a suspension of convertibility.

In addition to the implications of our results for measuring ex ante and ex post real costs of borrowing, and for the debate over the Phillips Curve and the procyclicality of prices, these results have implications for the international integration of capital markets and the operation of the "Atlantic economy." In particular, real rates of interest between London and New York were much closer than nominal interest rate differentials would suggest. Comparisons of long-term government bond yields in Calomiris (1991) -- possible only after the elimination of numeraire risk on U.S. specie bonds in 1869 -- and comparisons of short-term real interest rates (Calomiris and Hubbard, 1989b) show that real interest rate differentials between London and New York were small. Interest rate differentials typically were less than 2 percent, and remained within a bandwidth of 3 percent.

NOTES

1. The perceived need for an inconvertible paper currency in early 1862 must be understood within the context of policies and events of 1861. The first government currency issue of the Civil War was the demand notes of 1861. These were convertible into gold upon demand, and useful for extinguishing government tariff liabilities at par with gold. Like the treasury notes issued during the War of 1812, these notes retained nearly their entire par value by virtue of their receivability for duties even when, at the end of 1861, they were made inconvertible into gold on demand. The government suspension of convertibility followed the suspension of the banking system in the face of adverse news about government finances in December 1861 (the surprisingly bleak annual report of the Secretary of the Treasury, and the threat of war with Britain over the Trent Affair).

Banks held large amounts of government securities in December 1861, and were unusually at risk of a deterioration in government credit. When government credibility declined, banks were threatened with insolvency, and were forced to suspend. Indeed, Hammond (1970) argues that private legal-tender authority for a depreciated paper currency in 1862 was a disguised means for bailing out troubled banks, which had suffered from the decline in the value of government securities. By linking all bank liabilities as well as assets to the government-currency numeraire, the government insulated banks from the declining value of their holdings of government debt.

2. Calomiris (1988b) shows that, in fact, the price level and exchange rate were closely related at short and long frequencies during the years of greenback suspension.

3. See Calomiris (1988b), Table 1 and footnote 2.

4. National bank notes were backed 111 percent by government bonds deposited at the Treasury, and redundantly, by the full faith and credit of the federal government.

5. All national banks had an incentive to issue some national bank notes, because they were required to hold a minimum amount of government bonds, which were used as collateral for the notes (Hetherington, 1990). On the margin, however, national banks chose whether to buy bonds in order to supply notes. Changes in the real supply of national bank notes reflected changes in bank opportunity costs and changes in the price of government bonds, and were limited by a variety of possible ceilings. See Calomiris (1988b, footnotes 3, 5, and 9), Friedman and Schwartz (1963, p. 23), Cagan (1965), James (1976), and Laughlin (1896, p. 249).

6. For simplicity, I assume risk-neutrality, so there is no partially offsetting benefit to holding government bonds, and in equilbrium real rates of return on bonds and loans are equal.

7. I assume that the demands for currency and bank deposits are in fixed proportions, and hence bank deposits can be excluded from the model. Calomiris (1988b) argues that, empirically, the demand for currency is quite stable as a function of interest rates and income. Bordo (1989, p. 51) correctly points out that there is much evidence for money-multiplier stability (and hence stability of the currency-to-deposit ratio), but he incorrectly criticizes my model for assuming that the money multiplier was unstable.

8. The predetermined supply of greenbacks might still matter for prices for two reasons: first, as a signal of government resumption intentions, and second, if the supply function for bank notes is upward sloping, through its effect on the location of the kink in Figure 1. A higher predetermined supply of greenbacks will lower equilibrium expected inflation and increase the price level at each date prior to expected resumption. Such an effect only would be significant economically if the supply schedule were implausibly steep.

9. Demand notes were redeemable at par in payment of duties, but not convertible on demand into gold. Expected continuing parity in tax payments kept demand notes trading nearly at par relative to gold, until all demand notes were replaced by greenbacks. See Mitchell (1903) for a detailed discussion.

10. In footnote 18 of Calomiris (1988b) I incorrectly argued against Fels' (1959) conjecture that railroad risk had risen after 1873. I miscalculated that a rise in railroad risk implied an increase over time in the numbers in column 4. In fact, the opposite is true, and the data provide some support for Fels' position.

11. For a discussion of the link between agrarian unrest and financial distress during this period see Stock (1984).

12. Laughlin later ignored the potential importance of gross tax backing in his discussion of the threat to silver (pp. 272-3), and focused instead on the level of gold reserves, arguing "to mean anything, redemption must redeem on any and all occasions. Anything short of that is a sham" (p. 277). While this statement is not correct as a general proposition, my subsequent discussion will be in agreement with Laughlin's emphasis on the gold reserve during this period, given that taxes provide little means of immediate redemption for token currency after 1890.

13. The notes were redeemable in either gold or silver, at the discretion of the Treasury. But the Treasury was charged in the Act with maintaining the various currencies on a parity with each other in accordance with their legally defined ratio.

14. In this analysis, I treat the silver acts of 1878 and 1890 as expected to be permanent changes. This is not to say there was no possibility of repeal. Clearly, from the beginning there was a possibility of repeal, especially if the acts would be found to threaten the gold standard. Ultimately, repeal occurred in 1893 in response to just such a threat. Nevertheless, for purposes of argument, it is useful to ask whether a permanent continuation of the acts by themselves could have threatened the gold standard.

15. This "tax transversality condition" was well understood by contemporaries as an important source of support for token (or paper) currencies, and was employed to explain different relative prices between token currencies with different tax backing. For example, Laughlin (1896, pp. 238, 253-8) emphasized the role that tax arbitrage played in maintaining the currency issued under the 1878 Act at par:

> This [tax receivability] is a species of daily redemption of the silver dollar; for as gold has hitherto been required...in payment of customs, now that silver dollars are receivable equally with gold for that purpose, they must remain at par with gold until there is forced upon the circulation more than is necessary for such uses...In brief we have unconsciously created a

system of quasi-redemption of silver in gold by accepting silver at the customs when otherwise gold would be demanded. (p. 253)

Laughlin also noted that the silver trade dollar, created by the Act of 1873, which was not receivable in payment of taxes after its value fell in 1876, circulated at its intrinsic value and below the value of the silver dollars created under the 1878 Act. The trade dollar continued to trade at a discount until legislation in 1887 provided for its redemption at par in order to remove it from circulation.

Mitchell (1903) had referred to the tax parity constraint to explain the relative price of greenbacks and the old demand notes of 1861. Demand notes were receivable at par with gold for customs, while greenbacks were not. Otherwise they were equivalent -- neither was redeemable on demand in gold, and the two were physically similar. Demand notes maintained nearly their entire face value while greenbacks fell to two-thirds of their face value. By early 1863 all demand notes had disappeared from circulation, having been used in the interim almost exclusively to pay for customs duties (Mitchell, 1903, p. 196). During 1862 and early 1863 demand notes received a higher valuation because of their expected usefulness for redeeming tariff obligations in future months.

16. The Act of May 31, 1878 forbade further retirement of greenbacks; thus all greenbacks redeemed at the currency had to be reissued to maintain a fixed amount in circulation. National bank notes were demand-determined under the gold standard. Unlike the pre-1879 period, expected long-run inflation was near zero (see Barsky, 1987).

17. Data are from National Monetary Commission (1910), pp. 157-8.

18. Ibid.

19. For examples, see Ford (1895), Warner (1895), Burke (1899), and the following entries in the Economist: December 10, 1892, p. 1544; March 4, 1893, pp. 265-66; March 11, 1893, pp. 289-90; April 15, 1893, pp. 441-42; June 3, 1893, p. 656; June 10, 1893, pp. 690-91; July 22, 1893, p. 873; September 9, 1893, pp. 1081-82; October 14, 1893, pp. 1225-26; October 28, 1893, pp. 1281-82.

20. Some observers argued that President Cleveland deliberately postponed shoring up the gold reserve in 1893 to create an atmosphere of crisis to galvanize anti-silver support (the Economist, June 3, 1893, p. 656). Similarly, one can argue that allowing suspension might have worked against the passage of free-silver legislation.

21. This model shares common features with information-based models of bank runs (Jacklin and Bhattacharya, 1988, Chari and Jagannathan, 1988, Calomiris and Kahn, 1991, Calomiris, Kahn, and Krasa, 1992).

22. See Roll (1972) and Calomiris (1988b) for supporting evidence during the greenback suspension.

23. Evidence for this view that capital was scarce during the early-mid 1890s comes from Wilkins (1989, pp. 151-52, 580-81) and from contemporary chroniclers. The Economist of London provided weekly analysis of U.S. capital markets, which often took the form of lengthy discussions of problems of capital flight, which it linked to the risk of the switch to silver. See especially the columns of March 4, 1893 (p. 265), March 11, 1893 (p. 289-90), April 15, 1893 (p. 442), and June 3, 1893 (p. 656). In the March 11 issue, for example, the foreign correspondent writes: "...it would

appear, therefore, that for some time longer doubts as to the ability of the Treasury to maintain the parity of silver and gold will continue to act as a drag upon business in the States, to depreciate the value of American securities, and to cause a certain uneasiness and want of stability in the European money market" (p. 290).

24. In modern data for fiat-currency regimes the observed risk premium may be large, and the forward rate may not be closely linked to the expected future spot rate. In the 1890s, however, the risk premium was likely a much smaller part of the forward premium. If potential depreciation over short intervals was bounded by, say, 10 percent, then exchange rate risk would be relatively small compared to the exchange rate risk in a fiat-money regime where money follows a random walk. My model of potential depreciation, and the data in Table 5, imply small depreciation conditional on a collapse of fixed parity.

25. The January and November issues of 5 percent coupon bonds were sold at substantial premia, with respective yields to maturity of 3 and 2.88 percent (Burke, 1899, p. 32).

26. In February 1893 the Secretary had received assistance from New York banks. Six banks voluntarily exchanged $8.25 million in gold for legal tender notes to support the gold reserve.

27. According to the Economist (March 11, 1893, p. 290): "Some doubts have been expressed as to the possibility of placing any large amount of such bonds here, because of the possible disturbance to the money market which would result from the shipment of gold to the States in payment for them. No consideration of that kind, however, would deter investors from subscribing if reasonable terms were offered. If they thought about the money market at all, they would leave it to take care of itself, and a Government of the high credit of that of the United States is about as independent of the goodwill of intermediaries as is our own. The ability of the States to borrow here, and, as a consequence, to draw gold hence, need not, therefore, be questioned."

28. Of course, the formulation of the price-output relation varies, and need not take the form of a consistent contemporaneous association between output and price growth. For example, Gordon (1990) associates price and wage change with deviations of output from its potential level, which is calculated using peak-to-peak benchmarks. It is beyond my current scope to join the ongoing debate over the form of the Phillips Curve, or to provide new estimates of the Phillips Curve. Instead, I am interested in pointing out the relevance of expectations for simple correlations between output and price growth.

29. There is no good reason to treat prices an endogenous to output changes, as these regressions (and most similar regressions in the Phillips Curve literature) assume. Indeed, Calomiris and Hubbard (1989a, 1989b) show that, in monthly data, price growth predicts output growth in Granger causality tests and not vice versa. Furthermore, chroniclers of business cycle conditions tended to view prices as leading indicators and economic causes of boom or decline, which is consistent with the debt-deflation view of the procyclicality of prices.

30. In a related vein, in a recent study of wage adjustment in the U.S. and the U.K., Alogoskoufis and Smith (1991) find important differences in Phillips Curves (the response of wages to cyclical changes in employment and inflation) between the post-World War II and the pre-World War I periods, and relate these to the different exchange rate regimes (price processes) governing these eras.

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Table 1
Bond Yield Differentials and Long-Run Appreciation

	(1) Average Differential Between Gold and Greenbacks Yield*	(2) Expected Appreciation (Current Differential Less Differential for July-December 1878)	(3) Average Actual Rate of Greenbacks Appreciation to 1881[a]	(4) Appreciation Forecast Error (2)-(3)	(5) Appreciation Forecast Error Allowing Time-Varying Risk Premium[b]
January-June 1869	1.33	3.53	2.00	1.53	0.43
July-December 1869	0.49	2.69	1.85	0.84	-0.26
January-June 1870	-0.52	1.68	0.93	0.75	-0.35
July-December 1870	-0.42	1.78	0.93	0.85	-0.15
January-June 1871	-1.01	1.19	1.09	0.10	-1.00
July-December 1871	-0.95	1.25	1.10	0.15	-0.95
January-June 1872	-0.02	2.18	1.26	0.92	-0.18
July-December 1872	0.01	2.21	1.40	0.81	-0.29
January-June 1873	-0.09	2.11	1.90	0.21	-0.89
July-December 1873	-0.26	1.94	1.39	0.55	-0.55
January-June 1874	-0.65	1.55	1.60	-0.05	-0.05
July-December 1874	-0.45	1.75	1.50	0.25	0.25
January-June 1875	0.07	2.27	2.36	-0.09	-0.09
July-December 1875	0.09	2.29	2.30	-0.01	-0.01
January-June 1876	-1.19	1.01	2.50	-1.49	-1.49
July-December 1876	-1.07	1.13	1.76	-0.63	-0.63
January-June 1877	-1.22	0.98	1.36	-0.38	-0.38
July-December 1877	-1.21	0.99	0.84	0.15	0.15
January-June 1878	-1.32	0.88	0.40	0.48	0.48
July-December 1878	-2.20	0.00	0.10	0.10	0.10

* $\frac{1}{6}\sum_{j=1}^{6}[i_{sp}(j) - i_{gr}(j)] = d.$

[a]The average of monthly exchange rate closings for the period was used to measure the current gold price of greenbacks. The 6s of 1881 were redeemable June 1, 1881.

[b]This calculation sets the risk premium equal to 1.10 for 1869-1873, and 2.20 for 1874-1878.

Source: Calomiris (1988b).

Table 2

Gold Redemptions and the Gold Reserve
(Thousands)

	Redemptions in Gold during Each Month			Net Gold in Treasury, Coin and Bullion
	United States Notes	Treasury Notes of 1890	Total	
January, 1892	$152	$160	$312	$119,575
February	206	270	476	122,122
March	476	256	733	125,815
April	438	259	697	119,910
May	335	287	622	114,232
June	568	1,854	2,423	114,342
July	4,086	5,149	9,235	110,444
August	1,049	5,091	6,141	114,156
September	2,264	1,824	4,088	119,396
October	283	316	599	124,006
November	406	292	698	124,410
December	5,700	4,538	10,238	121,267
	$15,964	$20,297	$36,261	
January, 1893	$6,359	$5,137	$11,497	$108,182
February	5,811	8,017	13,829	103,284
March	1,642	3,285	4,926	106,892
April	12,569	7,483	20,052	97,011
May	12,077	4,471	16,548	95,049
June	3,073	1,178	4,251	95,485
July	772	264	1,036	99,203
August	1,190	1,158	2,348	96,009
September	144	197	341	93,582
October	263	433	695	84,385
November	299	217	516	82,959
December	296	222	517	80,892
	$44,494	$32,063	$76,556	
January, 1894	$119	$238	$356	$65,650
February	10,983	8,211	19,193	106,527
March	2,266	1,195	3,461	106,149
April	6,072	1,594	7,666	100,202
May	25,131	1,410	26,541	78,693
June	20,708	1,461	22,170	64,873
July	13,368	556	13,923	54,976
August	4,210	532	4,741	55,217
September	636	300	937	58,875
October	2,543	505	3,048	61,362
November	7,085	715	7,800	105,425
December	30,820	1,088	31,907	86,244
	$123,941	$17,803	$141,744	
January, 1895	$43,415	$1,702	$45,118	$44,706
February	4,785	776	5,561	87,086
March	809	280	1,089	90,643
April	734	284	1,018	91,247
May	735	432	1,166	99,151
June	645	402	1,046	107,512
July	3,123	704	3,827	107,236
August	16,219	345	16,564	100,330
September	17,120	258	17,377	92,912
October	1,849	318	2,167	92,943
November	15,616	418	16,035	79,334
December	19,788	425	20,213	63,262
	$124,837	$6,344	$131,181	
January, 1896	$15,686	$762	$16,449	$49,846
February	21,081	656	21,737	123,963
March	6,381	475	6,857	128,646
April	6,755	376	7,131	125,394
May	21,727	313	22,040	108,345
June	7,964	297	8,261	101,700
July	16,275	1,010	17,285	110,719
August	11,389	981	12,370	100,958
September	3,437	1,225	4,661	124,035
October	9,907	2,167	12,074	117,127
November	3,137	925	4,062	131,510
December	858	273	1,132	137,317
	$124,597	$9,461	$134,058	
January, 1897	$594	$352	$946	$144,800
February	521	403	924	148,661
March	679	570	1,249	151,786
April	6,935	567	7,502	153,341
May	8,045	838	8,883	144,320
June	6,595	519	7,113	140,791
July	5,072	203	5,275	140,818
August	2,876	241	3,116	144,216
September	2,598	144	2,742	147,663
October	2,505	191	2,696	153,573
November	1,787	324	2,110	157,364
December	1,816	204	2,019	160,912
	$40,023	$4,554	$44,577	

Source: Burke (1899), p. 24.

Table 3
Currency in Circulation, 1876-1900[a]
($ million)

	Gold	Silver dollars	Silver certif.	Treasury notes of 1890	U.S. notes (Greenbacks)	National Bank notes	Other[b]	Total
1876	25.0	NA	0	0	331.4	316.1	55.1	727.6
1877	25.0	NA	0	0	337.9	301.3	58.1	722.3
1878	25.0	NA	0	0	320.9	311.7	71.5	729.1
1879	110.5	NA	0.4	0	301.6	321.4	84.7	818.6
1880	220.6	18.9	6.0	0	315.8	336.2	75.9	973.4
1881	312.6	28.4	38.8	0	319.8	346.4	79.8	1,115.8
1882	355.9	32.2	57.2	0	314.7	352.5	69.8	1,182.3
1883	347.1	36.0	71.7	0	313.2	349.8	24.1	1,241.9
1884	340.7	40.4	97.4	0	307.9	333.5	116.5	1,236.4
1885	342.8	39.3	105.1	0	296.3	309.1	198.6	1,291.2
1886	360.4	52.9	89.2	0	306.4	306.9	140.3	1,256.1
1887	377.8	55.4	139.1	0	315.9	278.4	148.6	1,315.2
1888	396.4	56.5	196.6	0	300.5	249.1	172.3	1,371.4
1889	377.0	54.8	255.5	0	302.7	210.8	196.7	1,397.5
1890	375.2	56.5	294.7	0	326.9	183.3	194.6	1,431.2
1891	406.7	59.9	310.5	38.1	327.3	164.0	197.8	1,504.3
1892	408.9	57.1	327.3	87.1	318.5	167.4	253.7	1,620.0
1893	407.9	58.1	322.1	132.5	319.0	171.9	184.7	1,596.2
1894	496.8	52.0	330.0	140.1	270.6	199.7	186.5	1,675.7
1895	483.8	52.8	321.6	118.0	266.9	206.6	156.5	1,606.2
1896	455.9	52.7	336.3	98.1	225.6	215.3	137.7	1,521.6
1897	520.2	53.0	362.8	86.6	248.8	224.8	163.5	1,659.7
1898	649.6	57.6	391.2	100.2	290.2	224.6	126.5	1,839.9
1899	724.3	63.4	401.3	93.1	311.1	238.1	124.2	1,955.5
1900	618.6	67.6	408.5	78.6	322.8	294.1	284.5	2,074.7

[a]Dates are for June.

[b]Includes gold certificates, subsidiary silver and currency certificates of 1872.

Source: National Monetary Commission (1910), pp. 158-163.

Table 4
Government Receipts and Outstanding Debt, 1876-1900

	Ordinary Receipts		Public Debt Less Cash in Treasury	
	Total ($ million)	Per Capita ($)	Total ($ million)	Per Capita ($)
1876	281	6.2	2,061	45.7
1877	279	6.0	2,019	43.6
1878	262	5.5	1,999	42.0
1879	292	6.0	1,996	40.9
1880	357	7.1	1,919	38.3
1881	382	7.5	1,820	35.5
1882	409	7.8	1,675	31.9
1883	370	6.9	1,539	28.7
1884	334	6.1	1,439	26.2
1885	337	6.0	1,375	24.5
1886	351	6.1	1,282	22.3
1887	383	6.5	1,175	20.0
1888	378	6.3	1,063	17.7
1889	391	6.4	976	15.9
1890	420	6.7	891	14.2
1891	356	5.6	852	13.3
1892	374	5.7	842	12.9
1893	343	5.2	839	12.6
1894	306	4.5	899	13.3
1895	322	4.7	902	13.1
1896	315	4.5	955	13.6
1897	399	5.6	987	13.8
1898	442	6.1	1,027	14.1
1899	555	7.5	1,155	15.6
1900	574	7.5	1,108	14.5

Source: National Monetary Commission (1910), pp. 253-255.

Table 5

Expectations of Depreciation

		Nominal 60-Day Rate, Two-Name Choice 60-Day Commercial Paper in New York	Gold 60-Day Rate, Derived from Exchange Markets in New York on London	π^{e}_{60}	P'
1893	1	0.75	0.49	0.26	1.54
	2	0.92	0.49	0.43	1.54
	3	1.33	0.49	0.84	1.55
	4	1.00	0.74	0.26	1.54
	5	1.33	0.86	0.47	1.55
	6	2.50	0.49	2.01	1.70
	7	2.50	0.62	1.88	1.76
	8	2.50	1.12	1.38	1.74
	9	1.33	0.49	0.84	1.72
	10	0.92	0.74	0.18	1.79
	11	0.80	0.62	0.18	1.84
	12	0.63	0.62	0.01	1.89
1894	1	0.58	0.62	−0.04	2.02
	2	0.58	0.49	0.09	2.15
	3	0.50	0.37	0.13	2.01
	4	0.50	0.37	0.13	2.05
	5	0.50	0.37	0.13	2.05
	6	0.50	0.37	0.13	2.04
	7	0.50	0.25	0.25	1.99
	8	0.54	0.37	0.17	1.98
	9	0.58	0.37	0.21	2.01
	10	0.46	0.25	0.21	2.04
	11	0.50	0.37	0.13	2.12
	12	0.50	0.25	0.25	2.15
1895	1	0.50	0.25	0.25	2.14
	2	0.67	0.37	0.30	2.05
	3	0.67	0.37	0.30	1.94
	4	0.63	0.37	0.26	1.93
	5	0.46	0.25	0.19	1.94
	6	0.46	0.25	0.19	1.94
	7	0.50	0.25	0.25	1.94
	8	0.63	0.25	0.38	1.93
	9	0.83	0.25	0.58	1.90
	10	0.83	0.25	0.58	1.91
	11	0.67	0.37	0.30	1.94
	12	1.00	0.37	0.63	1.91
1896	1	1.00	0.25	0.75	1.93
	2	0.83	0.25	0.58	1.96
	3	0.92	0.25	0.67	1.94
	4	0.83	0.25	0.58	1.94
	5	0.75	0.25	0.50	1.94
	6	0.75	0.25	0.50	1.96
	7	1.00	0.25	0.75	1.96
	8	1.67	0.50	1.17	1.94
	9	1.17	0.62	0.55	1.91
	10	1.67	0.75	0.92	1.87
	11	0.92	0.81	0.11	1.86
	12	0.67	0.62	0.05	1.86

Two-name, choice commercial paper is the highest rate reported for the last week of each month, as given in National Monetary Commission (1910), pp. 122–25. The gold rate is constructed from 60-day and sight bills of exchange traded on the last day of each month, from National Monetary Commission (1910), pp. 192–95. P', the silver price of gold, is from Laughlin (1896), Appendix II, Tables F and G, and for 1896, the continuation of the same series in the *Economist*.

Table 6
Real GNP and the GNP Deflator, 1869-1913

Year	Romer (1989) Estimates: GNP (Billions of 1982 Dollars)	Romer (1989) Estimates: Implicit Price Deflator (1982 = 100)	Balke and Gordon (1989) Estimates: Real GNP (Billions of 1982 Dollars)	Balke and Gordon (1989) Estimates: Implicit GNP Deflator (1982 = 100)
1869	75.609	10.244	78.2	10.49
1870	75.464	9.661	84.2	9.98
1871	76.952	9.769	88.1	9.86
1872	89.605	9.423	91.7	9.60
1873	94.863	9.329	96.3	9.51
1874	96.205	9.169	95.7	9.25
1875	97.684	8.945	100.7	8.85
1876	104.628	8.539	101.9	8.51
1877	110.797	8.207	105.2	8.38
1878	118.906	7.627	109.6	7.87
1879	127.675	7.378	123.1	7.64
1880	139.990	8.166	137.6	8.03
1881	143.580	7.998	142.5	7.99
1882	149.307	8.267	151.6	8.16
1883	152.097	8.141	155.3	7.88
1884	155.684	7.730	158.1	7.53
1885	157.789	7.260	159.3	7.35
1886	164.375	7.173	164.1	7.35
1887	169.453	7.240	171.5	7.35
1888	168.940	7.352	170.7	7.47
1889	175.030	7.402	181.3	7.48
1890	182.964	7.256	183.9	7.30
1891	191.757	7.166	189.9	7.30
1892	204.279	6.893	198.8	7.21
1893	202.616	7.036	198.7	7.23
1894	200.819	6.603	192.9	6.85
1895	215.668	6.513	215.5	6.74
1896	221.438	6.342	210.6	6.76
1897	233.655	6.383	227.8	6.66
1898	241.459	6.572	233.2	6.75
1899	254.728	6.799	260.3	6.86
1900	264.540	7.136	265.4	7.00
1901	284.908	7.086	297.9	7.04
1902	291.572	7.335	303.0	7.14
1903	306.239	7.420	311.7	7.33
1904	307.127	7.502	323.5	7.39
1905	323.162	7.676	353.2	7.40
1906	351.499	7.873	367.7	7.64
1907	361.920	8.206	362.0	7.98
1908	346.800	8.145	342.2	7.81
1909	368.872	8.422	382.1	7.82
1910	383.888	8.645	383.8	8.14
1911	391.858	8.603	396.0	8.12
1912	407.112	8.944	418.9	8.32
1913	424.492	9.009	435.4	8.40

Table 7
Price Change Regressions, 1869-1913

Dependent Variable	Data Source	Constant[a]	Coefficient d ln (real GNP)[a]	1870s dummy[a]	1893/96 dummy[a]	R^2	Durbin-Watson
d ln (GNP deflator)	Balke and Gordon (1989)	-0.0077 (0.0056)	0.0671 (0.1002)	--	--	0.011	1.33
d ln (GNP deflator)	Balke and Gordon (1989)	-0.0016 (0.0053)	0.1069 (0.0883)	-0.0349 (0.0082)	0.0063 (0.0171)	0.327	1.70
d ln (GNP deflator)	Romer (1989)	-0.0053 (0.0086)	0.0611 (0.1693)	--	--	0.003	1.54
d ln (GNP deflator)	Romer (1989)	-0.0001 (0.0082)	0.1777 (0.1581)	-0.0420 (0.0119)	-0.0045 (0.0239)	0.239	1.85

[a]Standard errors in parentheses.

Equilibrium in the Currency Market

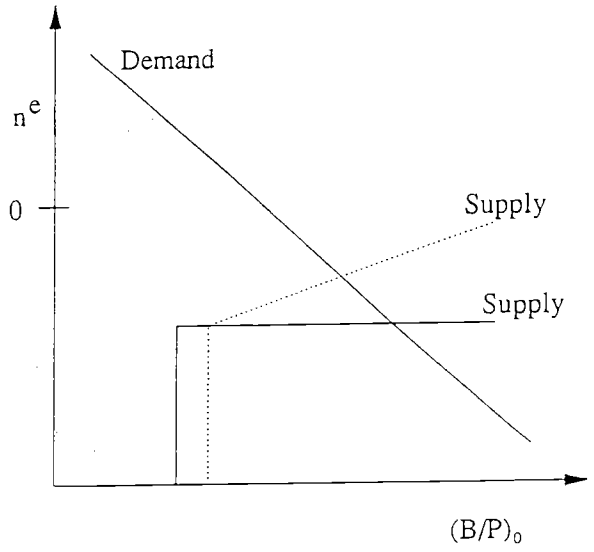

Figure 1

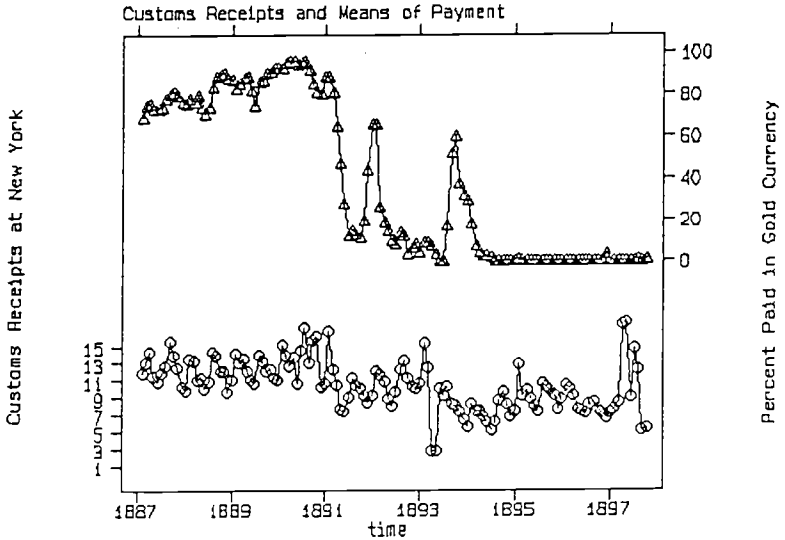

Figure 2