THE CRIME OF 1873

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Abstract

The U.S. Coinage Act of 1873 eliminated provision for the free coinage of silver. That Act cast the die for a gold standard. The conventional view is that "the Act of 1873 was a piece of good fortune." This paper indicates that it was the opposite–a mistake that had highly adverse consequences. This is a judgment about 1873, not 1896. By 1896 it was almost surely too late to undo the damage; Bryan was trying to close the barn door after the horse had been stolen.

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> I am persuaded history will write [the Act of 1873] down as the greatest legislative crime and the most stupendous conspiracy against the welfare of the people of the United States and of Europe which this or any other age has witnessed.
>
> Senator William Stewart of Nevada (1889)

> In 1873 we find a simple legal recognition of that [the demonetization of silver] which had been the immediate result of the act of 1853.
>
> James Laurence Laughlin (1895)

> You shall not press down upon the brow of labor this crown of thorns. You shall not crucify mankind upon a cross of gold.
>
> William Jennings Bryan (1896)

> The Act of 1873 was a piece of good fortune, which saved our financial credit and protected the honor of the State. It is a work of legislation for which we can not now be too thankful.
>
> James Laurence Laughlin (1895)

The Coinage Act of 1873, to which these quotations refer, was passed by a vote of 110 to 13 in the House and 36 to 14 in the Senate after lengthy, though superficial, committee hearings and floor debate. It attracted little attention at the time even from members of Congress (including Senator Stewart) who voted for it yet who later attacked it in vitriolic terms as a "grave wrong," a "conspiracy" perpetrated by "corrupt bargains," a "blunder which ... is worse than a crime," a "great legislative fraud" and, finally, "the crime of 1873."[1]

How did this apparently innocuous legislative measure evoke such strong and contrasting reactions from leading scholars, businessmen, and politicians over so long a period? How did it become a central issue in a Presidential campaign conducted more than two decades after its passage?

Was it a crime, in any sense of the term? What were its actual consequences? To answer these questions requires some background in monetary history and theory.

1. The Background

The United States Constitution gives Congress the power "to coin money, regulate the value thereof, and of foreign coin," and prohibited the States from making "anything but gold and silver coin a tender in payment of debts." In initially exercising this power, the Congress, following the recommendation of Alexander Hamilton, passed the coinage act of April 2, 1792. That act defined the basic monetary unit of the U.S. as the dollar, and defined subsidiary coinage on a decimal basis [the cent, "half-disme" (later, the nickel), the "disme" (later, the dime), quarter, etc.]. It further defined the dollar as equal to 371.25 grains of pure silver and the 10 dollar eagle as equal to 24.70 grains of pure gold, authorized free coinage of both silver and gold at the specified ratio of 15 to 1, and specified the fraction of alloy to be combined with pure metal in striking the coins.[2]

I have italicized two terms that are critical to understanding the Crime of 1873. "Free coinage" is critical because it gave practical content to a specie standard by providing that the government mint would convert specie that individuals chose to bring to the mint into legal tender currency denominated in "dollars" (initially solely in the form of coins, later paper certificates as well) at the stated metallic equivalent. "Both" is critical because it effectively established the U.S. on a bimetallic standard, i.e., a monetary standard that authorized free coinage, and hence the use as money of either of two metals, silver or gold. These two provisions were equivalent to saying that the government would buy all silver

or gold offered to it at prices of $1.2929... per troy ounce of pure silver, and $19.3939... per troy ounce of fine gold, i.e., 15 times as much for an ounce of gold as for an ounce of silver, whence the "ratio of 15 to 1."[3]

Though either silver or gold could legally be used as money, in practice only silver was so used until 1834. The reason was simple. There was and is a market for silver and gold outside the U.S. Mint — for jewelry, industrial use, coinage by other countries, etc. In 1792, the ratio of the market price of gold to the price of silver was almost exactly 15 to 1, the ratio Hamilton recommended. But shortly thereafter, the world price ratio went above 15 to 1 and stayed there.[4] As a result, anyone who had gold and wanted to convert it to money would do better by exchanging the gold for silver at the market ratio and taking the silver to the mint than by taking the gold directly to the mint.

To put the matter in another way, if the mint were a two-way street at a 15 to 1 ratio, an obvious get-rich scheme would be to bring 15 ounces of silver to the mint, get one ounce of gold, sell the one ounce of gold on the market and with the proceeds buy more than 15 ounces of silver, pocket the profit and keep going. Clearly the mint would soon be overflowing with silver and out of gold. That is why the mint's commitment under a bimetallic standard is solely to buy silver or gold (i.e., coin freely), though it may, at its discretion, also sell (redeem) one or the other or both metals. The end result was that the U.S. was effectively on a silver standard from 1792 to 1834. Gold was not used for money. It was too valuable for that purpose. Gresham's law was in full operation: cheap money drove out dear money.[5]

In 1834, new coinage legislation was introduced in recognition of the changed world market gold-silver price ratio, which by then was about

15.625:1. This ratio was repeatedly recommended by the Select Committee on Coins of the House of Representatives from 1832 to 1834, supposedly in the desire "to do something for gold," which had not long before been discovered in Virginia, North Carolina, South Carolina, and Georgia, and "had become of genuine importance to the four southern states."[6] However, rather suddenly, the Select Committee changed its recommendation to a ratio of 16 to 1, not to do something for gold -- though it certainly did -- but to do something against Nicholas Biddle's Bank of the United States.[7] This was at the height of the famous "bank war" between President Andrew Jackson and Nicholas Biddle that finally resulted in the failure of the Bank to obtain a new charter when its original federal charter expired in 1836. As Paul M. O'Leary put it, the ratio of 16 to 1 was "a golden club ... used by Jackson and his supporters to belabor their hated enemy," The Bank.[8] The unsatisfactory state of the currency -- a mixture of U.S. and foreign silver coins, plus paper money issued by state banks, some of doubtful quality -- had made the notes issued by the Bank a favored medium of exchange. The Act of 1834 was expected to weaken the Bank by making gold coins an effective substitute for its notes.

Two points are noteworthy about this episode. First, in 1834, "16 to 1" was a golden club; in the 1890s, "16 to 1" was a silver club. Second, in both cases it was wielded by much the same political constituency against much the same political constituency -- the largely rural, small business, lower-class Southern and Western supporters of Andrew Jackson in 1834 and of William Jennings Bryan in 1896 against the bankers, financiers, big business and urban upper classes of the East and Northeast.

In any event, the adoption of the 16 to 1 ratio -- i.e., of an official price of $20.671835... (= 480/23.22) per fine ounce of gold -- spelled

the end of the reign of silver. From then to the Civil War, little silver was coined. Even subsidiary silver coins became scarce until 1853, when Congress voted to reduce the silver content of subsidiary silver coinage, so that it no longer became worthwhile to melt them down (at least until the Civil War greenback inflation). From 1834 on, gold coins circulated and gold was the effective standard. Despite the increased demand for gold for monetary use, the gold-silver price ratio fell after the California and Australian gold discoveries of the 1840s and 1850s so that its status as "cheap money" seemed secure.

The Civil War temporarily ended the reign of gold. The exigencies of war finance led to the introduction of paper money -- greenbacks -- issued without gold or silver backing and without any promise to redeem them in either metal. Paper, as it were, became the cheap money. Gold, however, continued to circulate, particularly on the West Coast, but of course not on a one-to-one ratio with greenbacks. There was a free market in which the "greenback price of gold" rose above the official legal price -- indeed, at the extreme, to more than double the official price. The government required customs duties and some other obligations to be paid in gold; banks provided separate "gold" and "greenback" deposits for their clients. In short, gold and greenbacks circulated side by side at a floating exchange rate determined in the market.

At long last, we return to 1873. Movement was afoot to end the greenback episode and "resume" a specie standard. It was time to start tidying up the coinage legislation. The resulting Coinage Act of 1873 listed the coins to be minted. The list included gold coins and subsidiary silver coins but omitted the historical standard silver dollar of 371.25 troy grains of pure silver. Further tidying up occurred in 1874.[9] That was

followed by the Resumption Act of 1875, and successful resumption on the basis of gold on January 1, 1879.[10]

The events culminating in resumption in 1879 precisely parallel a corresponding sequence in Britain more than six decades earlier -- a bimetallic standard before 1797 followed by the adoption of an inconvertible paper standard, the demonetization of silver in 1816, and resumption in 1819 on a gold basis, whereas, without the 1816 legislation, resumption would have been on silver. The parallelism is not accidental. The initial step, ending convertibility and adopting a paper standard, was a reaction in both countries to the financial pressures of war.[11] As in the U.S., Britain's decision to return to a specie standard reflected the outrage of the financial community, holders of government bonds, and some economists at the inflation produced by the departure from a specie standard, and the desire to have a "sound money." In Britain, it was something of an accident that gold was chosen instead of silver for this purpose.[12]

If resumption in the U.S. had occurred under the coinage legislation before it was amended by the Coinage Act of 1873, silver would have become the "cheap metal" whenever the gold-silver ratio rose appreciably above 16 to 1, as happened by 1875, and producers of silver would have found it advantageous to bring their silver to the mint rather than to sell it on the market. Similarly, owners of gold coins would have found it advantageous to melt their coins down and sell the gold on the market rather than use them as money at their nominal face value.[13]

In practice, neither the conversion of specie into currency at the mint, nor the melting down of gold or silver coins, is costless. Commonly, a small seignorage charge is made to cover the expenses of the mint, and melting involves similar costs. In addition, interest is lost because of

the delays involved in minting, and trading involves costs in selling gold or silver, and conversely. As a result, the tendency to regard the legal ratio as a precise number so that only one metal can circulate at a time is a fallacy. Just as "gold points" permit exchange rates of two gold standard currencies to fluctuate within a range without producing gold shipments, under a bimetallic standard "gold-price ratio points" permit the ratio to fluctuate within a range without producing the complete replacement of one metal by the other.[14]

The omission of any mention of the standard silver dollar in the Coinage Act of 1873 ended the legal status of bimetallism in the United States. Had that fateful line not been omitted from the Act of 1873, resumption in 1879 would almost surely have been on the basis of silver, not gold. Hence, "the crime of 1873" in the eyes of the proponents of silver.

Those events raise two questions: the less important but easier to answer, "Was there a 'crime,' in any meaningful sense?" The far more important but far harder to answer, "What would have been the consequences of including the fateful line?"

2. Was There a "Crime"?

In 1877, "an editorial in The Nation ... read in part as follows: 'Mr. Ernest Seyd, a designing bullionest and secret agent of foreign bondholders, came to this country from London in 1873, and by corrupt bargains with leading members of Congress and officers of the Government brought about the demonetization of silver.' It was said that he brought with him $500,000 to bribe certain members of Congress and the Comptroller of the Currency."[15] If that had been true, there would indeed have been a crime in every sense of the term. But no evidence has ever been offered to indicate that it was true. No allegation of bribery has ever been made -- let alone

documented -- against any individual member of Congress or government official in connection with the passage of the Coinage Act of 1873. The act was discussed at great length both in committee and on the floor of Congress and openly voted for by large majorities -- though later critics claim that the key provision to which they objected was barely mentioned and not further discussed on the floor.[16] Moreover, the government official chiefly responsible for drafting the act and, in particular, for the omission of the fateful line was not the Comptroller of the Currency but the Director of the Mint. In the literal dictionary sense of crime -- "an act punishable by law, as being forbidden by statute or injurious to the public welfare" -- there was no crime.

On the other hand, in what the dictionary calls a "more general" use of the term -- "an evil or injurious act; an offence, a sin"[17] -- the existence of a crime is a question of opinion. What is not open to question is that the standard silver dollar was omitted from the list of coins to be minted intentionally, in full knowledge of the likely consequences, and in the belief that those consequences were desirable. That is made clear by Mr. H. R. Linderman, the Director of the Mint at the time of the passage of the act, in a book published not long thereafter.[18] In a Report to the Secretary of the Treasury in November 1872, when the Coinage Act was pending in Congress, he wrote: "The fluctuations in the relative value of gold and silver during the last hundred years have not been very great, but several causes are now at work, all tending to an excess of supply over demand for silver, and its consequent depreciation" (p. 48).

On the consequences of the act, he wrote: "The declaration in the Coinage Act of 1873, that the gold dollar was to be thereafter the unit of value, and the omission of the silver dollar from the coins to be struck

under the provisions of the Act, placed the United States upon the single gold standard.... [T]he weight of opinion in Europe and America was against the practicability of maintaining a double standard on any basis which might be selected, and in favor of a single gold standard" (p. 44).

In a later chapter, he wrote: "The advocates of the restoration of the old silver dollar ... appear to think that an error, if not a wrong, was committed in discontinuing its coinage; and they desire to correct the same without reference to the question, whether it would be possible to maintain concurrent circulation of gold and silver coins after resumption in 1879" (pp. 100-101).

As Paul O'Leary summarized the evidence: "[I]t seems only reasonable to conclude that the failure to include provision for the standard silver dollar in the Coinage Act of 1873 was based not upon recognition of the existing economic facts but rather upon calculated hostility to silver as a part of the monetary standard. The Act anticipated the future. It was purposive and deliberate in the mind of the man who largely framed the legislation and saw it through Congress. In this sense, the silver people are correct in holding that it was the result of 'malice aforethought.' It was expected to accomplish and did accomplish a result going far beyond a mere 'tidying up of our coinage laws and procedures.'"

O'Leary went on to say, "For the next twenty-seven years the silver question bedeviled the politics and the finances of the United States. Silver never won back the place it would have enjoyed had the Act of 1873 not failed to include provision for the coinage of the standard silver dollar. The consequences of not striking down the free and unlimited coinage of the silver dollar could have been vast for subsequent American financial, economic, and political life. That is, however, another story."[19, 20]

To which we now turn.

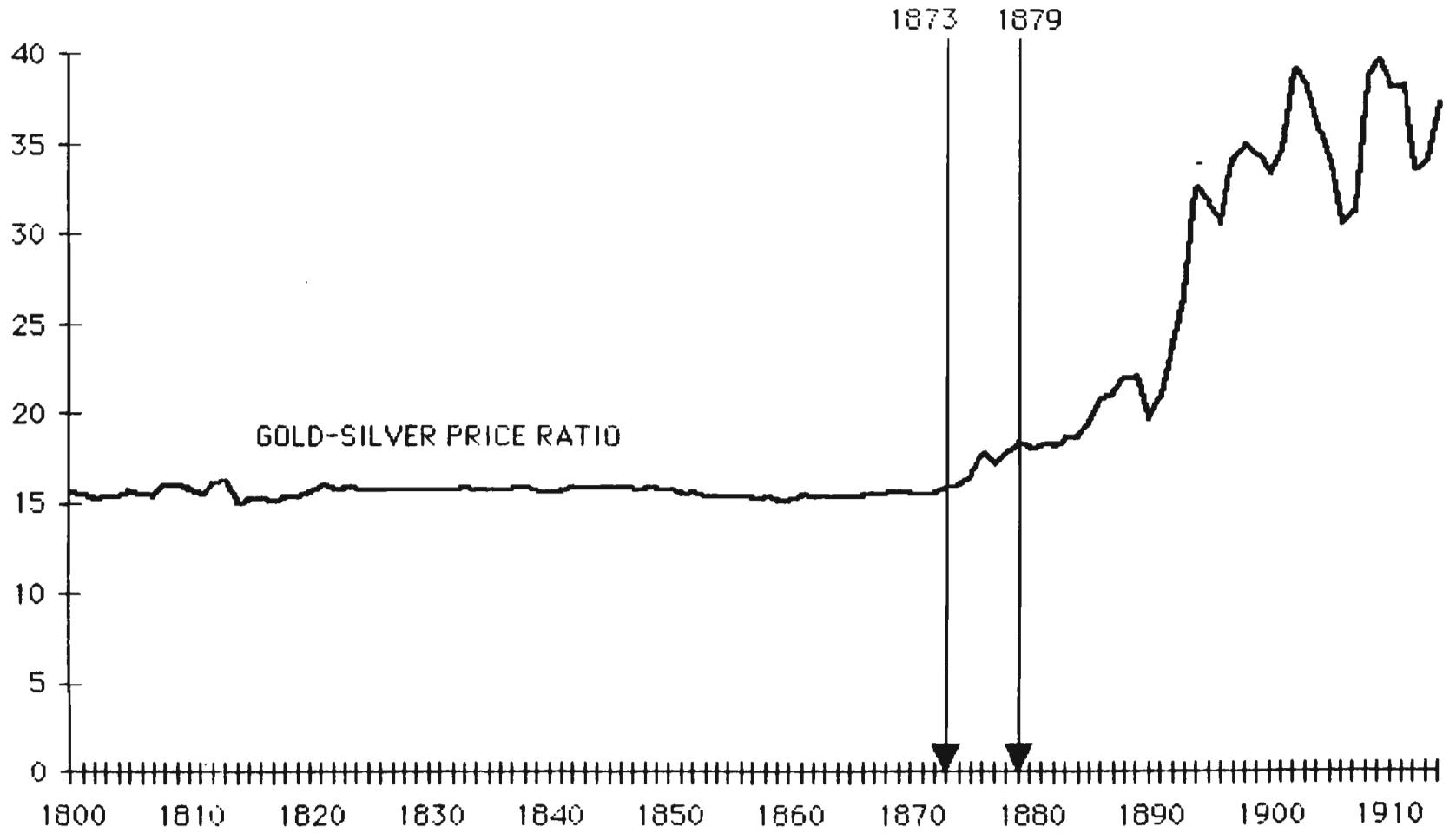
3. The Consequences of the Coinage Act of 1873

Eliminating the free coinage of silver had major consequences because of one central fact cited by Mr. Linderman: the likely decline in the world price of silver relative to that of gold. Had there been no decline in the silver-gold price ratio -- or, as it is more usually expressed, rise in the gold-silver price ratio -- it would have been irrelevant whether the fateful line was included in the Act of 1873 or omitted. In either event, the pre-Civil War situation of an effective gold standard would have continued when and if the U.S. resumed specie payments.

As it was, however, a rise in the gold-silver price ratio started well before the U.S. passed the Act of 1873, and was in full swing when the U.S. resumed specie payments in 1879. Resumption by the U.S. on the basis of gold was the final nail in the coffin of silver. The gold-silver price ratio, plotted in Figure 1, fluctuated around 15.5 (the mint ratio in France) for decades before the gold discoveries in California in 1848 and in Australia in 1851. It then fell to a low of nearly 15 by 1859, when it started an irregular but more or less steady rise.[21] The rise speeded up rapidly after 1870, as one European country after another shifted from a silver or bimetallic standard to a single gold standard -- a tribute to the leadership of Britain, by then the recognized dominant economic power. Germany shifted in 1871-73, after it defeated France and imposed a large war indemnity payable in funds convertible into gold. France, which had maintained a bimetallic standard since 1803, despite first major silver and then major gold discoveries, demonetized silver along with the other members of the Latin Monetary Union (Italy, Belgium, and Switzerland) in 1873-74. The Scandinavian Union (Denmark, Norway, and Sweden), the Netherlands, and Prus-

FIGURE 1

RATIO OF PRICE OF GOLD TO PRICE OF SILVER, ANNUALLY, 1800-1914



sia followed suit in 1875-76; and Austria in 1879. By the late 1870s, India and China were the only major countries on an effective silver standard. The resulting increased demand for gold, and increased supply of silver for nonmonetary purposes, produced a dramatic rise in the gold-silver price ratio. From 15.4 in 1870, it jumped to 16.4 by 1873, 18.4 by 1879, and 30 by 1896, when 16 to 1 was the Bryan battle cry.

By joining the movement to gold, the U.S. added to the upward pressure on the gold-silver price ratio, both by absorbing gold that would otherwise have been available for monetary use by the rest of the world and by failing to absorb silver. The effects were far from trivial. In preparation for resumption, the U.S. Treasury had accumulated gold so that by 1879, the stock of monetary gold in the U.S., both in the Treasury and in private hands, already amounted to nearly 7 percent of the world's stock. By 1889, the U.S. share had risen to nearly 20 percent. Even more dramatically, the increase from 1879 to 1889 in the U.S. stock of monetary gold exceeded that in the world's stock. The monetary gold holdings of the rest of the world declined from 1879 to 1883, then rose but did not surpass its earlier level until 1890.

For silver, the failure to absorb silver via free coinage was offset to some extent by repeated special legislation for the benefit of silver interests requiring the federal government to buy silver at market prices. The first such measure preceded resumption, the Bland-Allison Act of 1878 which authorized the Treasury to buy between $2 and $4 million of silver each month at the market price, and which led to continued purchases from 1878 to 1890. Then silver purchases were stepped up drastically under the Sherman Silver Purchase Act, until the silver purchase clause was repealed in 1893.

Interestingly enough, the number of ounces of silver purchased under these acts was almost equal to 16 times the number of ounces of fine gold added to the country's monetary gold stock. On first blush, it looks as if political measures absorbed as much silver as free coinage would have. However, that is not the case. As will become apparent in what follows, had the U.S. been on silver, the stock of money would have risen faster than it did and hence the ounces of silver brought to the Mint would have substantially exceeded 16 times the ounces of gold actually acquired.[22]

The most obvious, but by no means the most important, consequence of the U.S.'s return to gold rather than to a bimetallic standard was the sharp rise in the gold-silver price ratio. A far more important consequence was the effect on the nominal prices of goods and services in general. The increased world demand for gold for monetary purposes coincided with a slowing in the rate of increase of the world's stock of gold and a rising output of goods and services. These forces put downward pressure on the price level. Stated differently, with gold scarcer relative to output in general, the price of gold in terms of goods went up, which means that the nominal price level (under a gold standard, the price level in terms of gold) went down. The downward pressure was relieved somewhat by a rapid expansion of the banking system which increased the amount of money that could be pyramided on each ounce of gold. On the other hand, rising real income, plus the spreading monetization of economic activities, plus the declining price level itself increased the downward pressure on prices by leading the public to hold larger cash balances relative to their income (i.e., velocity declined).

The outcome was deflation from 1875 to 1896 at a rate of roughly 1.7 percent per year in the United States, 0.8 percent per year in the United

Kingdom, which means in the gold standard world.[23] In the United States, the deflation from 1875 to 1896 followed the even sharper deflation after the Civil War. That sharper deflation was an essential requisite for successful resumption on gold at the prewar parity between the U.S. dollar and the British pound. It also produced wide unrest and dissatisfaction particularly in rural areas. The unrest led to the formation in 1876 of the Greenback party to continue earlier agitation to issue more greenbacks to replace deflation by inflation. The political agitation ended the retirement of greenbacks, which had started after the Civil War, and led to the adoption in 1878 of the Bland-Allison bill authorizing the Treasury to purchase a limited amount of silver at market prices.

Though the silver was purchased at market prices, it was valued for monetary purposes at the higher legal price, the difference being treated as "seignorage." The silver was mostly coined into standard silver dollars. However, most of the coins were stockpiled in the Treasury as "reserves" for pieces of paper called Silver Certificates or, after 1890, Treasury Notes of 1890. These were nominally convertible into silver, but they were also "legal tender" effectively convertible into gold. Hence, it was cheaper to get silver by using the paper money to buy it on the market than by converting the paper money into silver at the fictional legal price. In effect, the silver certificates were fiat money differing from greenbacks only because the historic role of silver as money made it more acceptable to increase the money supply by buying silver rather than by openly issuing fiat money. It also had the political effect of harnessing silver interests to the populist cause of inflation. The stock of silver in the Treasury was the counterpart to the stock of wheat currently held by the U.S. government as a result of its attempt to prop up the price of wheat.

A 1.7 percent per year decline in prices may seem too mild to generate the kind of agitation that bedeviled the two decades from resumption to the end of the century. But several considerations argue otherwise. First, the 1.7 percent is for a price index that covers all goods and services (the implicit price deflator). The wholesale prices of agricultural and other basic commodities doubtless fell at a greater rate (3.0 percent a year by one index). At least as important, we all want the prices of the things we sell to go up, not down, so that sellers of goods and services are almost invariably inflationists. True, we want the prices of the things we buy to go down. But, as consumers, we buy many things, whose prices are moving in different directions, so we are far less acutely aware of what is happening to the price level than of what is happening to the specific prices of the things we sell. And that was far truer in the nineteenth century, when data on the economy as a whole were few and far between, than it is now. Moreover, at all times, sellers tend to be relatively few in numbers, and to be organized, so that they have more political clout than the dispersed consumers who benefit from declining prices. That was particularly true of producers of silver who clearly had much to gain by the adoption of a silver standard. Though few, they were politically influential because the sparsely populated silver states had the same representation in the Senate as the densely populated urban states.

An additional factor was that farmers are generally net monetary debtors, and as such are harmed by a fall in prices, which raises the real value of their debt, and benefited by a rise in prices, which reduces the real value of their debt. As debtors, they were particularly susceptible to propaganda representing the "crime of 1873" as the evil machinations of a cabal of Eastern and foreign capitalists: Wall Street versus Main Street.[24]

One paradoxical result of the agitation for inflation via silver was that it explains why deflation was more severe in the U.S. than in the rest of the gold standard world (1.6 percent versus 0.6 percent). As Anna Schwartz and I concluded, "This entire silver episode is a fascinating example of how important what people think about money can sometimes be. The fear that silver would produce an inflation sufficient to force the United States off the gold standard made it necessary to have a severe deflation in order to stay on the gold standard. In retrospect, it seems clear that either acceptance of a silver standard at an early stage or an early commitment to gold would have been preferable to the uneasy compromise that was maintained, with the uncertainty about the ultimate outcome and the consequent wide fluctuations to which the currency was subjected."[25]

4. Which Would Have Been Better? Silver or Gold?

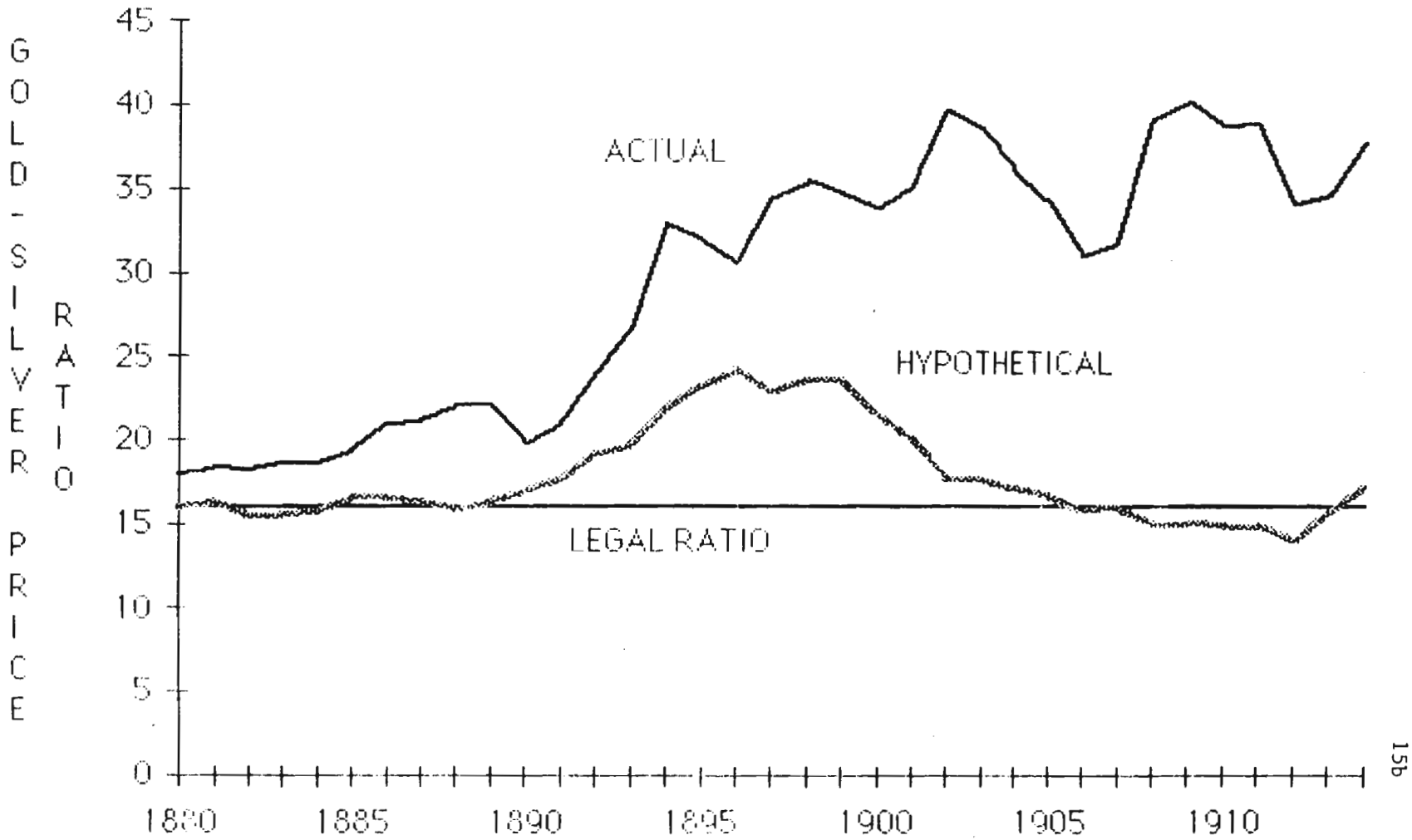
Given that either extreme would have been preferable to the uneasy compromise, which extreme would have been better: the early adoption of silver as the single standard at the monetary value of $1.2929... an ounce; or, the early commitment to gold as the single standard? Or, seemingly different from either extreme, the continuation of nominal bimetallism? An answer requires a thorough examination of the quantitative consequences of the three choices.

As it happens, that examination, presented in the Appendix, makes it clear that resumption under a continuation of the bimetallic standard would have been to silver not gold, and would have occurred in 1876, a year after the passage of the Resumption Act. As a result, the gold-silver price ratio would have behaved very differently than it did.

Figure 2 plots the legal gold-silver price ratio, the actual price ratio, and an estimate of the price ratio that would have prevailed if legal

FIGURE 2

GOLD-SILVER PRICE RATIO: LEGAL, ACTUAL, HYPOTHETICAL; 1880-1914



bimetallism had continued. The striking feature is that the estimated ratio departs widely from the legal ratio only from 1891 to 1904, and less widely from 1906 to 1913. Before 1891, it fluctuates narrowly around 16-1. From 1906 to 1913, it is below 16-1, reaching its lowest level in 1913. The years during which the ratio departs widely from 16-1 are no accident. The ratio rises well above 16-1 during the years of maximum political agitation about free silver surrounding the Bryan free silver campaign of 1896, and the subsequent unwinding of the effects of that agitation. If the critical line had been retained in the Coinage Act of 1873, that agitation would never have occurred. The hypothetical price ratio falls below 16-1 during the period when world gold production, which started rising rapidly in 1897, reached peak levels, which tended to depress the real price of gold.

These estimates allow as fully as I could for the alteration in economic circumstances that would have been produced by the continuation of legal bimetallism -- the higher world price level and lower real price of gold, the reduction in the amount of silver available for nonmonetary use, and so on. But I have not been able to allow for some predictable effects -- notably changes in real income and in the production of silver and gold -- let alone for the change in the political climate. No doubt, the political vacuum created by the disappearance of the free-silver issue would have been filled by other issues, but there is no way of conjecturing what they would have been, much less of what effect they would have had on the gold-silver ratio. Any attempt to do so would carry this exercise in history as it might have been into the realm of fantasy.

My conclusion is that the adoption of silver would in practice have produced ratios throughout the period that would have fluctuated around 16 to 1 and would have varied even less than the estimates for the period

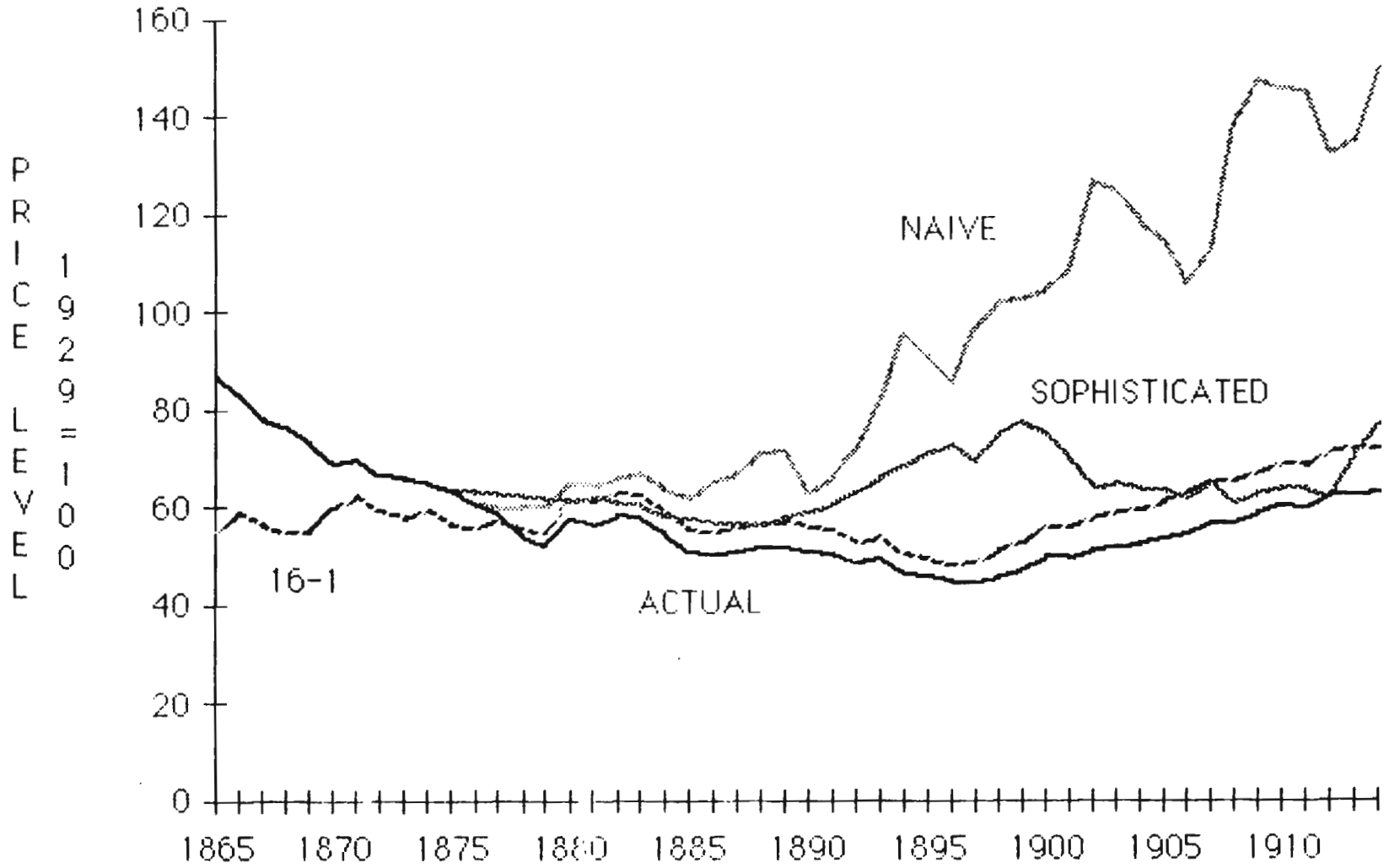
before 1891 and after 1904. In short, my conclusion is that the U.S. could have played the same role after 1873 in stabilizing the gold-silver price ratio that France did before 1873. If I am right, the fears of the opponents of bimetallism that a bimetallic standard would involve continual shifting between silver and gold would have proved false. With the U.S. effectively on silver and the U.K. and other major countries on gold, changes in the gold-silver ratio would have been directly reflected in the exchange rate between the dollar and other currencies. A rise in the ratio would have produced a dollar depreciation, a decline in the ratio, a dollar appreciation. Here again, a relatively steady gold-silver ratio would have meant relatively steady exchange rates -- varying for sterling around the same level, $4.86, as actually prevailed.

Figure 3 plots the actual price level and alternative hypothetical price levels corresponding to the gold-silver price ratio in Figure 1. The naive estimate simply assumes that the gold-silver price ratio would have been what it actually was, which clearly produces a great overestimate of the price rise that would have occurred. The 16-1 estimate goes to the other extreme; it underestimates the effect of the adoption of a silver standard on the price level by assuming that the actual ratio would have been precisely 16-1 throughout. However, it almost surely gives a more accurate picture of the likely year-to-year pattern than either of the other estimates. The other estimates are bedevilled by much purely statistical noise. In addition, U.S. bimetallism would have provided an incentive for worldwide stabilizing speculation in silver that would have eliminated erratic movements.

The actual U.S. price level fell from 1875 to 1896 at a rate of 1.7 percent a year, and rose from then to 1914 at a rate of 2.0 percent a year.

FIGURE 3

US PRICE LEVEL: ACTUAL, ALTERNATIVE ESTIMATES UNDER SILVER STANDARD, 1865-1914



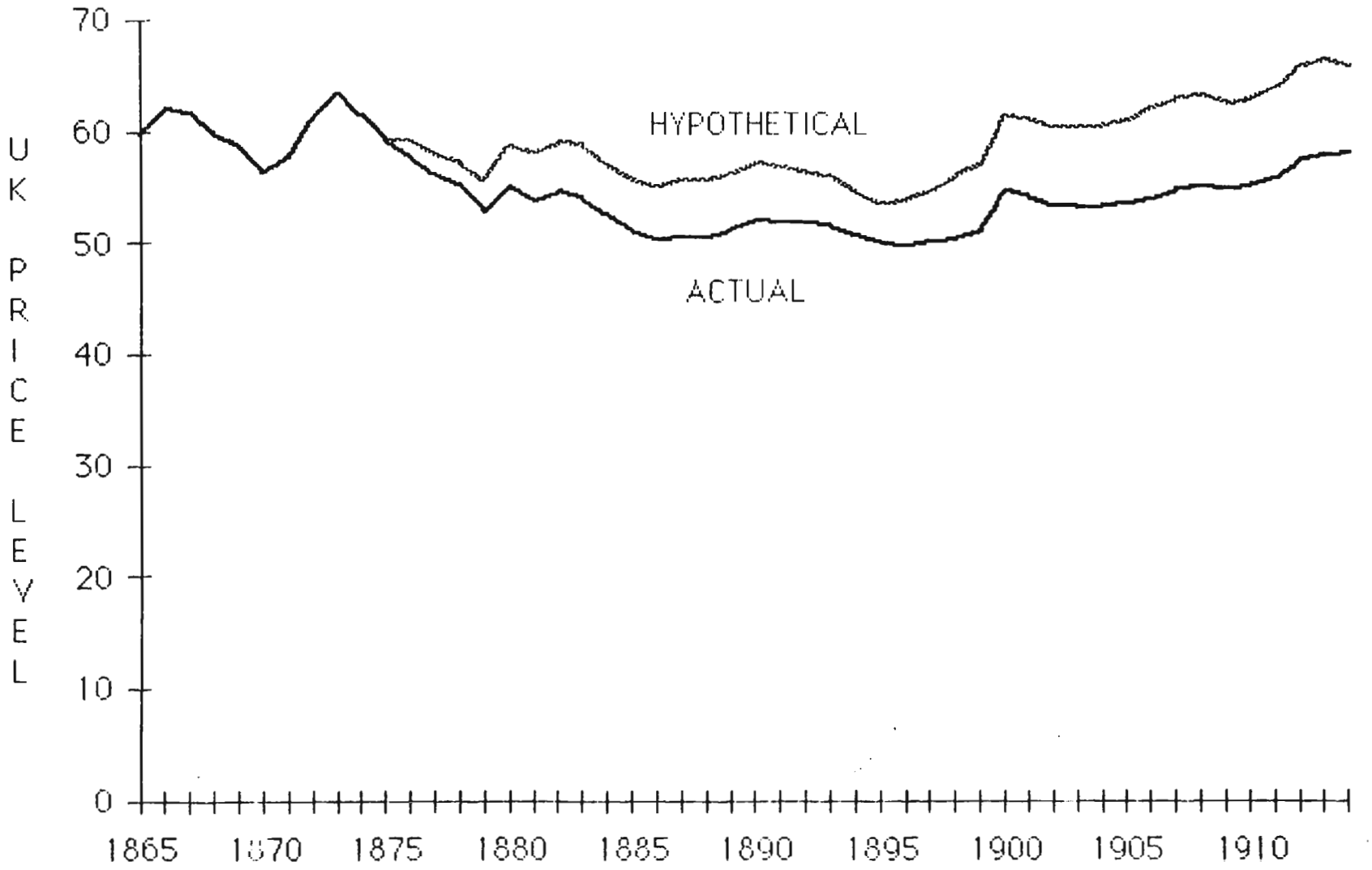
The 16-1 price level first falls at 0.7 percent, then rises at 2.3 percent a year. The sophisticated price level declines from 1875 to 1888 at a rate of 0.9 percent a year and then rises to 1914 at the rate of 1.2 percent a year. Either alternative implies roughly a halving of the initial rate of decline. The 16-1 alternative implies a slightly more rapid subsequent rise; the sophisticated alternative a much milder rise. If my estimates are anywhere near correct, a bimetallic standard would have produced a steadier price level than the gold standard that was adopted.

Perhaps even more important, it almost surely would have avoided what in our Monetary History, Anna Schwartz and I dubbed "the disturbed years from 1891 to 1897" (p. 104); encompassing the very sharp contraction of 1892 to 1894, a brief and mild recovery from 1894 to 1895, followed by another contraction from 1895 to 1896,[26] widespread bank failures plus a banking panic in 1893, and a run on U.S. gold reserves by foreigners fearful that silver agitation would force the U.S. off the gold standard. Confidence was restored and departure from gold prevented by a private syndicate headed by J. P. Morgan and August Belmont, under contract to the U.S. Treasury. "The allegedly onerous terms of the contract, arranged secretly through agents long identified in Populist literature as 'the conspiracy of international bankers,' became an issue in the campaign of 1896."[27]

The effects would not of course have been limited to the U.S. I have not been able to make anything like as thorough an empirical study for the rest of the world as for the U.S., but in the course of preparing the estimates for the U.S., it was necessary to estimate the effect on the price level in the gold-standard world, for which I used the U.K. as a proxy. Figure 4 gives the actual and hypothetical level of prices in the U.K. The estimated effect, though smaller than in the U.S., is clearly substantial.

FIGURE 4

UK PRICE LEVEL(1929=100):ACTUAL AND HYPOTHETICAL UNDER U.S. SILVER STANDARD,1865-1914



The price level would have been consistently higher for the rest of the world. The 0.8 percent per year decline in the actual price level from 1875 to 1895 would have been cut to 0.5 percent; the .09 percent per year subsequent rise would have been increased to 1.1 percent. Here too, however, there clearly would have been effects other than those encompassed in our simple calculation. The changes in the U.S. would doubtless have produced echoes elsewhere. Presumably, a healthier U.S. economy would have meant a healthier world economy. In addition, the consistently lower real price of gold would have reduced the incentive to produce gold. That might have delayed the introduction of the cyanide process for extracting low-grade ore which was responsible for the flood of gold that produced worldwide inflation after 1896. I have not allowed for any such effect.

Whether or not a verdict of "guilty" would have been appropriate in a court of law for "the crime of 1873," it is appropriate in the court of history. The omission of the fateful line had momentous consequences for the subsequent monetary history of the United States, and indeed, to some extent, of the world. The rhetoric was overheated; but the importance of the issue was not overstated. The real issue was the monetary standard: gold and silver bimetallism, which in practice in the U.S. had meant alternating silver and gold standards, a single silver standard, or a single gold standard. The Act of 1873 cast the die for a gold standard — which explains its significance. Moreover, while the conventional view is Laughlin's, that "The Act of 1873 was a piece of good fortune," my own view is that it was the opposite -- a mistake that had highly adverse consequences. I hasten to add that this is a judgment about 1873, not 1896. By 1896 it was almost surely too late to undo the damage; Bryan was trying to close the barn door after the horse had been stolen.

NOTES

*I am indebted for helpful comments on earlier drafts to Michael D. Bordo, Conrad Braun, Phillip Cagan, Joe Cobb, Harold Hough, David Laidler, Hugh Rockoff, and, as always and especially, to Anna J. Schwartz. In addition, David D. Friedman made a number of helpful suggestions and Rose D. Friedman critically reviewed and helped revise the penultimate draft.

1. See Paul S. Barnett, "The Crime of 1873 Re-examined," Agricultural History 38 (July 1964):178-81. According to Paul M. O'Leary, "The Scene of the Crime of 1873 Revisited: A Note," Journal of Political Economy 68 (August 1960): 390, "The first person to use the word 'crime' was George M. Weston, the secretary of the U.S. Monetary Commission of 1876 ... [i]n his special report, attached to the full report of the commission" published in 1877. Barnett (p. 180) attributes the first use of the full phrase "The Crime of 1873" to Senator Henry M. Teller of Colorado on July 10, 1890.

2. The Act of 1792 stated that "bullion so brought [to be coined at the legal rates] shall be assayed and coined as speedily as may be after the receipt thereof, and that free of expense to the person or persons by whom the same shall have been brought." Roy W. Jastram, Silver: The Restless Metal (New York: John Wiley, 1981), p. 63. Hence, coinage was "free" in a dual sense — open to all in unlimited amount, and without charge.

The provision that no charge should be made for coinage is exceptional. Typically, a small charge, called "seignorage," is made for the cost of coining. However, the so-called "seignorage" charge has sometimes been manipulated and used for purposes other than repaying the cost of

coinage; e.g., by ancient "seignors" (= lords) for revenue, by Franklin Delano Roosevelt as a device for pegging the price of silver.

3. The continuing decimals (.2929..., .3939...) arise because an ounce troy equals 480 grains. Given that a dollar was defined as equivalent to 371.25 grains of pure silver or 24.75 grains of fine gold, one ounce of silver was worth 480 divided by 371.25 or $1.2929..., and one ounce of gold, 480 divided by 24.75 or $19.3939...

4. See Jastram, Silver, pp. 63-69.

5. For precision, the "law" should be expanded by adding, "in a regime in which there is a fixed price ratio between them."

6. Paul M. O'Leary, "The Coinage Legislation of 1834," Journal of Political Economy 45 (February 1937): 80-94, quotation from p. 83.

7. Though the ratio is described as "16 to 1," that is an approximation. In the 1834 act, the weight of the gold dollar was set at 23.2 grains of pure gold, which gave a gold-silver ratio trivially higher than 16 to 1. The act was amended in 1837 to make the weight equal to 23.22, which gives a ratio trivially below 16 to 1. The reason for the change was to make the percentage of alloy in the minted coin equal to precisely 10 percent. A good source for the early coinage laws of the United States is National Executive Silver Committee, Silver in the Fifty-first Congress (Washington, 1890). See also, Commission on the Role of Gold in the Domestic and International Monetary Systems, Report to the Congress (March 1982), vol. 1, chap. 2.

8. O'Leary, "The Coinage Legislation of 1834," p. 84.

9. The 1873 Act included provision for coining a heavier silver Trade Dollar to be used in trade with Mexico and the Far East, which were on the silver standard. The trade dollar had legal tender status, which was

removed in June of 1874, when Congress passed the Revised Statutes which provided that no silver coin was to be legal tender beyond the amount of $5 and that foreign coin was prohibited from being a tender. See Barnett, "The Crime of 1873 Re-examined," p. 178.

10. For a detailed discussion of the Greenback period and resumption, see Milton Friedman and Anna J. Schwartz, A Monetary History of the United States, 1867-1960 (Princeton: Princeton University Press, for the National Bureau of Economic Research, 1963), chap. 2.

11. It was not the only possible reaction, despite the tendency of many historians to regard what happened as if it had to happen. France was under even greater financial pressure than Britain, yet, "through twenty years of war, at times against half Europe, [Napoleon] never once allowed a resort to ... inconvertible paper money." Francis A. Walker, International Bimetallism (New York: Henry Holt & Co., 1896), p. 87.

12. David Ricardo, one of the most influential proponents of resumption, initially favored silver though not bimetallism. See David Ricardo, Proposals for an Economical and Secure Currency (1816), in The Works and Correspondence of David Ricardo, ed. by Piero Sraffa, vol. 4: Pamphlets and Papers, 1815-1823 (Cambridge: University Press, for the Royal Economic Society, 1951), p. 63. In subsequent testimony of 1819 before a committee of Parliament, Ricardo shifted to gold because, "I have understood that machinery is particularly apposite to the silver mines and may therefore very much conduce to an increased quantity of that metal and an alteration of its value, whilst the same cause is not likely to operate upon the value of gold" — a judgment that like so many judgments based on the opinion of technical "experts" proved to be very wide of the mark. The Works and Correspondence of David Ricardo, ed. by Piero Sraffa, vol. 5: Speeches and

Evidence (Cambridge: University Press, for the Royal Economic Society, 1952), pp. 390-91; see also p. 427.

13. Currently, it pays to bring neither gold nor silver to the mint because both have been replaced by a cheaper money, paper. There still are, however, official prices on the books (1.2929 for silver, $35 for gold). The gold holdings of the U.S. government are still valued on the books at the official price. Yet no one would dream of using a silver coin stamped $1 or a gold coin stamped $20 as money at these nominal values. They are numismatic items valued at above $8 and $475, respectively. I am indebted to Conrad J. Braun for the rough estimates of the current market values of the silver and gold coins.

14. That was the situation in France from 1803 to 1873, during the whole of which time both gold and silver circulated despite market ratios that departed from the French legal ratio of 15.5 to 1, though at times, silver was tending to displace gold; at other times, gold was tending to replace silver. Walker, International Bimetallism, chaps. 4 and 5, esp. p. 121. Irving Fisher, Purchasing Power of Money (New York: Macmillan, 1911), chap. 7, has a rigorous analysis of the theory of a bimetallic standard as well as an illuminating discussion of the experience of France.

15. Barnett, "The Crime of 1873 Re-examined," p. 178.

16. They even cite their opponent in support: "As Professor Laughlin states ...: 'The Senate occupied its time chiefly on questions of seignorage and abrasion and the House on a question of the salaries of the officials.'" National Executive Silver Committee, Silver in the Fifty-first Congress, p. 22.

17. Definitions from Oxford English Dictionary.

18. Money and Legal Tender in the United States (New York: G. P. Putnam's Sons, 1877), chap. 9.

19. O'Leary, "The Scene of the Crime of 1873 Revisited," p. 392.

20. In a fascinating unpublished paper, Hugh Rockoff persuasively argues that Frank Baum's The Wonderful Wizard of Oz "is not only a child's tale but also a sophisticated commentary on the political and economic debates of the Populist Era," i.e., on the silver agitation generated by the so-called "Crime of '73." "The land of Oz," according to Rockoff, "is the East,... where the gold standard reigns supreme and where an Ounce (Oz) of gold has almost mystical significance." Rockoff goes on to identify the Wicked Witch of the East with Grover Cleveland, the gold Democrat who, as president, "led the successful repeal of the Sherman Silver Purchase Act of 1893."

Similarly, Rockoff is able to identify many of the other places and characters, and much of the action, with places, people, and events that played a significant role in the final years of the free silver movement. Hugh Rockoff, "The Wizard of Oz as a Monetary Allegory," Preliminary Version (July 1988), quotations from pp. 1, 12, 13.

21. Though France doubtless adopted the ratio of 15.5 to 1 because that was roughly the market ratio in 1803, France's successful maintenance of bimetallism undoubtedly helped to stabilize the ratio. See Walker, International Bimetallism, p. 87; Fisher, Purchasing Power of Money, p. 136.

22. According to the estimates discussed in section 4 below, 25 times as many ounces of monetary silver would have been accumulated as the ounces of gold actually acquired.

23. I use 1880 instead of 1879, because 1879 was an aberrant year in

which prices were abnormally low relative both to prior and subsequent years.

24. I owe this comment to Hugh Rockoff.

25. Friedman and Schwartz, Monetary History of the United States, pp. 133-134.

26. These are the annual reference dates we used in our Monetary Trends in the United States and the United Kingdom (Chicago: University of Chicago Press, 1982).

27. Monetary History, p. 112n.

Appendix to "The Crime of 1873"

ESTIMATING THE EFFECT OF CONTINUING BIMETALLISM AFTER 1873[1]

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1. **Objective.** To estimate what the price level and gold-silver price ratio would have been if the so-called "Crime of '73" had never occurred, i.e., if the Coinage Act of 1873 had contained provision for free coinage of the standard silver dollar of 371.25 troy grains of pure silver, so that the legal market price of silver was 1.2929....

2. **Naive Estimate.** Assume that the real price of silver would have been the same as it actually was (PS/P). Since the nominal price of silver would have been $1.2929..., and the real price is simply the nominal price divided by the price level, it would have been 1.2929/PHN. Equating the two and solving for the naive hypothetical price level gives

$$(1) \qquad PHN = 1.2929... \cdot \frac{P}{PS} ,$$

where P is the actual price level, PHN is the naive estimate of the hypothetical price level under the silver standard, and PS, the actual nominal price of silver. (For subsequent definitions of notation, see appended Record of Notation.) The hypothetical price calculated in this way is less than the actual price from 1865 to 1876. In 1876, the two are equal, hence, if the fateful line had not been omitted from the Coinage Act of 1873, resumption on the basis of silver would have occurred in 1876, a year after the passage of the Resumption Act. Figure A1 plots the subsequent naive estimate of the price level; Table A1 gives the numerical values.

Defects of naive estimate: 1. The U.S. probably would have added to its silver stock under a silver standard even more than it did in response to the silver interests under a gold standard. That would have tended to raise the real price of silver. 2. The U.S. would also have released gold and not accumulated additional gold, which would have added to the rest of the world's monetary and nonmonetary stocks of gold and have raised nominal prices in the gold standard world. That would have lowered the real price of gold. 3. On both scores, the gold-silver price ratio would have been lower than it actually was and might even have gone below 16 to 1.

3. **16-1 Estimate.** Assume that the adoption of a silver standard by the U.S. was effective in establishing 16 to 1 not only as the legal ratio but also as the actual ratio of the price of gold to the price of silver and that the U.S. stayed on a strict silver standard (i.e., the ratio was trivially above 16 to 1). As we shall see, this is not as farfetched as it seems. For much of the nineteenth century before 1873, the actual ratio seldom varied more than trivially from 15.5 to 1, the legal ratio in France. The lowest value reached was 15.19 in 1859, the highest 16.25 in 1813, and most of the time the range was much narrower (Warren and Pearson, table 25, p. 144).

To estimate the hypothetical U.S. price level under this assumption, we need an estimate of the hypothetical real price of gold. The Report of the U.S. Gold Commission gives estimates of the world's and the U.S.'s monetary stock of gold and the world's nonmonetary stock of gold. Assume that adoption of a silver standard led to the disposal of the whole of the U.S. monetary gold stock and that the gold released by the U.S. was divided between nonmonetary use (by the U.S. plus the rest of the world) and the monetary gold stock of the rest of the world in the proportion that actually

prevailed between these two components of the total gold stock.[2] Assume further that the world price level rose in proportion to the increased stock of gold. We then have

$$(2) \qquad RPGH = RPG \cdot \frac{EWMG + WNMG}{WMG + WNMG} .$$

Since the real price of silver is by assumption 1/16 the real price of gold, and by definition equal to the nominal price (= legal price) divided by the price level, we have

$$(3) \qquad PH16 = 1.2929... \cdot \frac{16}{RPGH} .$$

Since the actual U.S. monetary gold stock became a steadily increasing fraction of the world's monetary gold from 1879 on, the result of this calculation is that the hypothetical price roughly parallels the actual price, though the differential rises somewhat over the period. See Figure A1. In 1876, when resumption on silver would have taken place, the price level as estimated from equation (3) was a trifle below the actual price level. By 1877, it was a trifle above.

The hypothetical real price of gold is also all that is needed to estimate the effect on the price level of the gold standard world of the U.S. being on a silver standard throughout the period. If we take the U.K. price level as representative of the price level of the gold standard world, we have

$$(4) \qquad UKPH = UKP \cdot \frac{WMG + WNMG}{EWMG + WNMG} .$$

See Figure A2. The effect is clearly appreciable, starting in 1876, the year in which, according to the naive estimate, resumption would have occurred.

FIGURE A1

US PRICE LEVEL: ACTUAL, ALTERNATIVE ESTIMATES UNDER SILVER STANDARD, 1865-1914

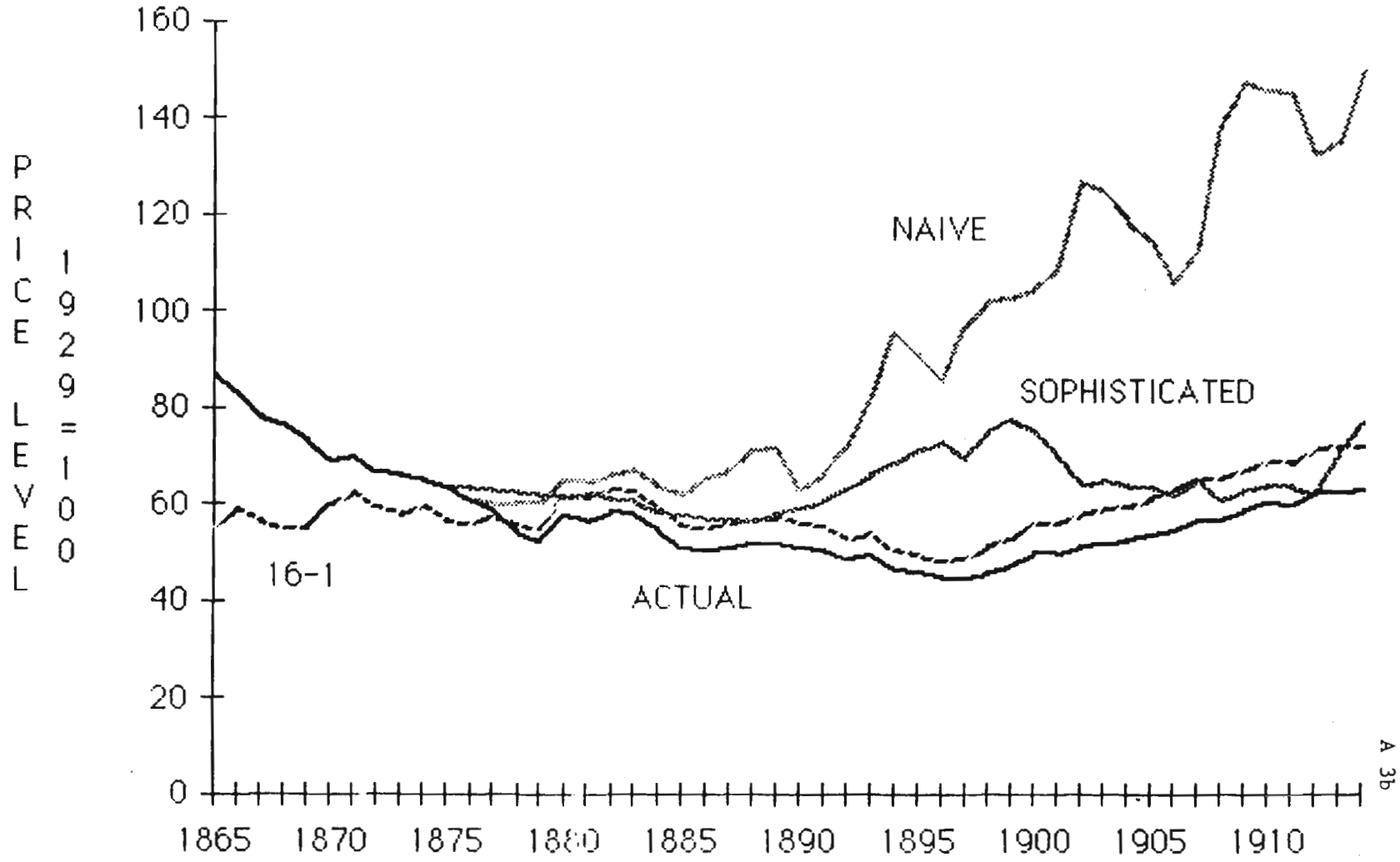
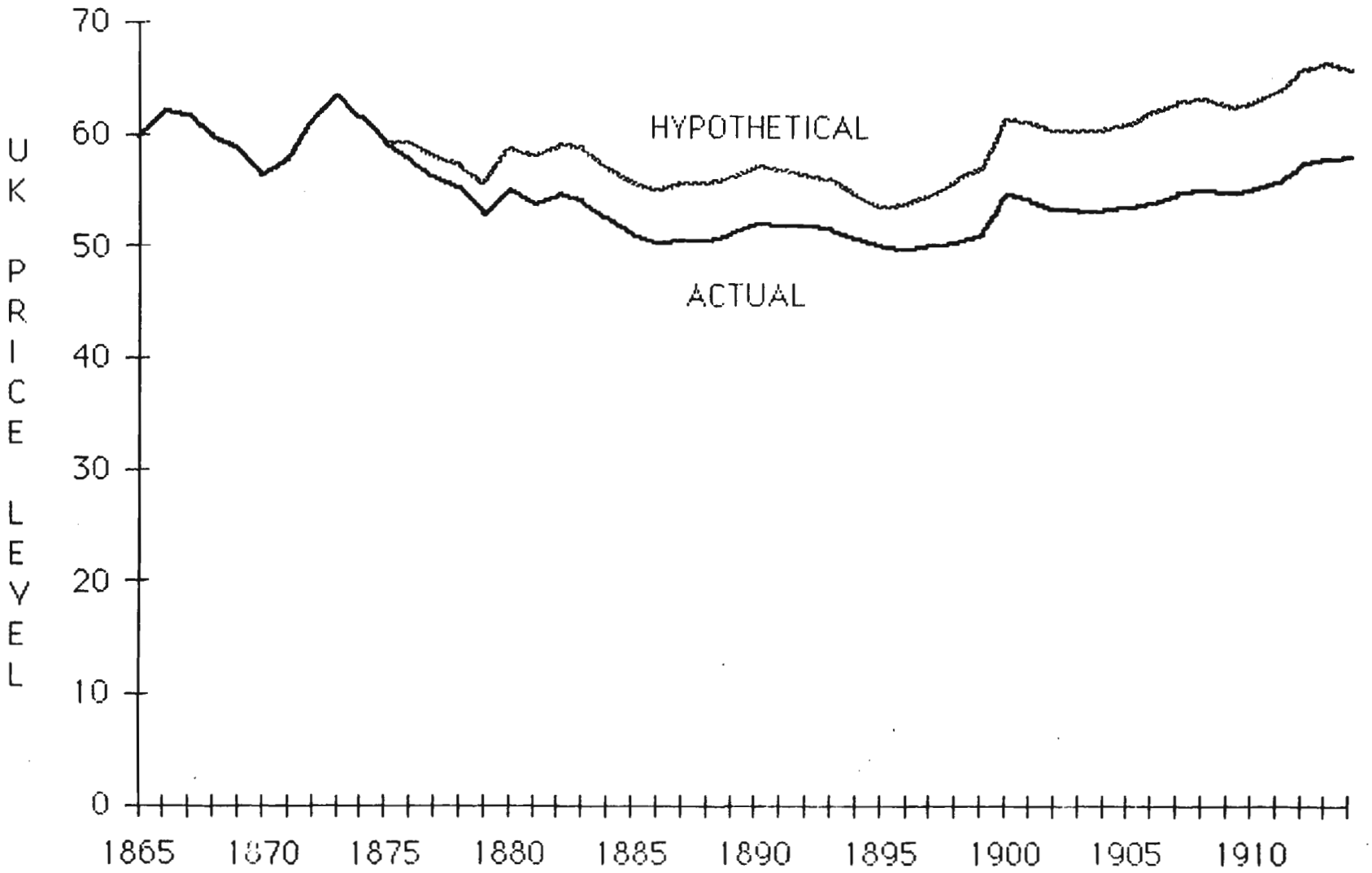


FIGURE A2

UK PRICE LEVEL(1929=100):ACTUAL AND HYPOTHETICAL UNDER U.S. SILVER STANDARD,1865-1914



4. **A More Sophisticated Estimate.** To go beyond these simple estimates requires a much more detailed analysis. The key is to find a way to estimate the real price of silver since, if we have such an estimate, we can use the counterpart of equation (3) to estimate the hypothetical price level.

The real price of silver is determined primarily by (a) the supply of and (b) the demand for silver for nonmonetary use in the world as a whole. There seems no reason to suppose that the adoption of a bimetallic or silver standard by the U.S. would have altered significantly the world demand function for silver for nonmonetary use. To estimate that demand function (section b below), we need data on the actual nonmonetary use of silver (a1). On the other hand, the adoption of a bimetallic or silver standard by the U.S. would clearly have affected significantly the monetary demand for silver and hence the supply of silver for nonmonetary use (a2). Constructing acceptable estimates for the period in question (1875-1914) proved by far my most troublesome problem.

a1. Actual Nonmonetary Use of Silver. The supply of silver for nonmonetary use is equal to (1) the production of silver minus (2) the demand for silver for monetary use by the rest of the world minus (3) the demand for silver for U.S. monetary use. Or,

$$\text{SNM} = \text{SPROD} - \text{EWMDS} - \text{UMDS}. \tag{5}$$

Estimates for item (1) on the right-hand side of equation (5), the annual production of silver, are readily available from a number of sources. Estimates for item (2), the increment in the monetary stock of silver by other countries, are given by Louis Drake for successive five-year periods based on Annual Reports of the Director of the Mint.[3] I simply assumed that

the accumulation for each five-year period was constant during the period and so got estimates on an annual basis. Since the numbers are small and do not vary drastically from one five-year period to the next, not much error can be introduced by this assumption. The major error is likely to be in the initial estimates, which I suspect are subject to a large margin of error.

For item (3), the increment in the U.S. monetary stock of silver, the dollar value of silver in circulation and in the Treasury is given in Monetary History for 1879-1914. However, the dollar value cannot be converted directly into the physical quantities we need simply by dividing by the legal price at which the silver was evaluated (as the corresponding figures for the monetary stock of gold can be). When the Treasury bought silver under the successive silver purchase laws (of February 12, 1873, January 14, 1875, February 28, 1878, and July 14, 1890), it paid for it at the market price, but valued it for monetary purposes at the higher legal price, treating the difference as seignorage. Estimates are, however, available from a report of the Treasury department of the total amount purchased under the earlier two laws, and of the amounts purchased under the final two laws by fiscal years (years ending June 30) from 1878 to 1894. I have assumed that the amounts purchased included amounts used for subsidiary silver.[4] For the years after 1894, when purchases were small, I have used the increments in the dollar value of the reported monetary stock, divided by the legal price and multiplied by the ratio of the market price to the legal price. Since items (1) and (2) were for calendar years, I have converted the fiscal year data to calendar year data by a two-year moving average.

a2. Hypothetical Supply of Silver for Nonmonetary Use. Equation (5) gives actual nonmonetary use. Add an H to the relevant symbols and it gives

hypothetical nonmonetary use under a silver standard. Item (1), silver production, clearly depends in principle on the real price of silver. However, during the period in question, the actual production of silver rose sharply, nearly tripling from 1880 to 1914, while at the same time the real price of silver fell to less than half its initial level. Clearly, supply was being driven by exogenous discoveries and innovations. Moreover, in general, much silver is a by-product of the mining of other metals and so is relatively inelastic in supply. Hence, I have assumed that silver production would have been what it actually was. This assumption introduces an error leading to an upward bias in the estimated real price of silver.

Re item (2), I have assumed that the adoption of silver as its standard by the U.S. would not have affected other countries either by causing them to adopt silver rather than gold or by changing the amount of silver accumulated to add to their monetary stocks. The implicit assumption that this would not have occurred seems eminently justified. The major move from silver to gold by Germany, France, etc., came before the U.S. would have moved to a silver standard, and indeed was part of the reason why the U.S. itself moved to a gold standard. Hence, I have simply used the actual monetary demand by other countries as the hypothetical.

Item (3), the hypothetical increment in the U.S. monetary stock of silver, is the most difficult. We can tautologically express the hypothetical U.S. monetary silver stock (in ounces) as the product of the ratio maintained between specie and money (SPR) times the quantity of money divided by the legal price of silver or, expressing the quantity of money by the ratio of nominal income to velocity, and nominal income as the product of real income and the price level, as follows:

$$(6) \qquad UMSH = SPR \cdot \frac{Y}{V} \cdot \frac{P}{LP} = SPR \cdot \frac{Y}{V} \cdot \frac{1}{RPSH} = k_1 \cdot \frac{1}{RPSH} \cdot$$

y/V is the real money stock; multiplication by P converts into nominal dollars. Only the product of SPR and y/V, which I have designatd by k^1 and which equals the real value of the specie reserve, enters in the subsequent analysis. (In principle, all of the symbols should be followed by an H, but since no confusion arises except for the real price of silver, I have omitted it.)

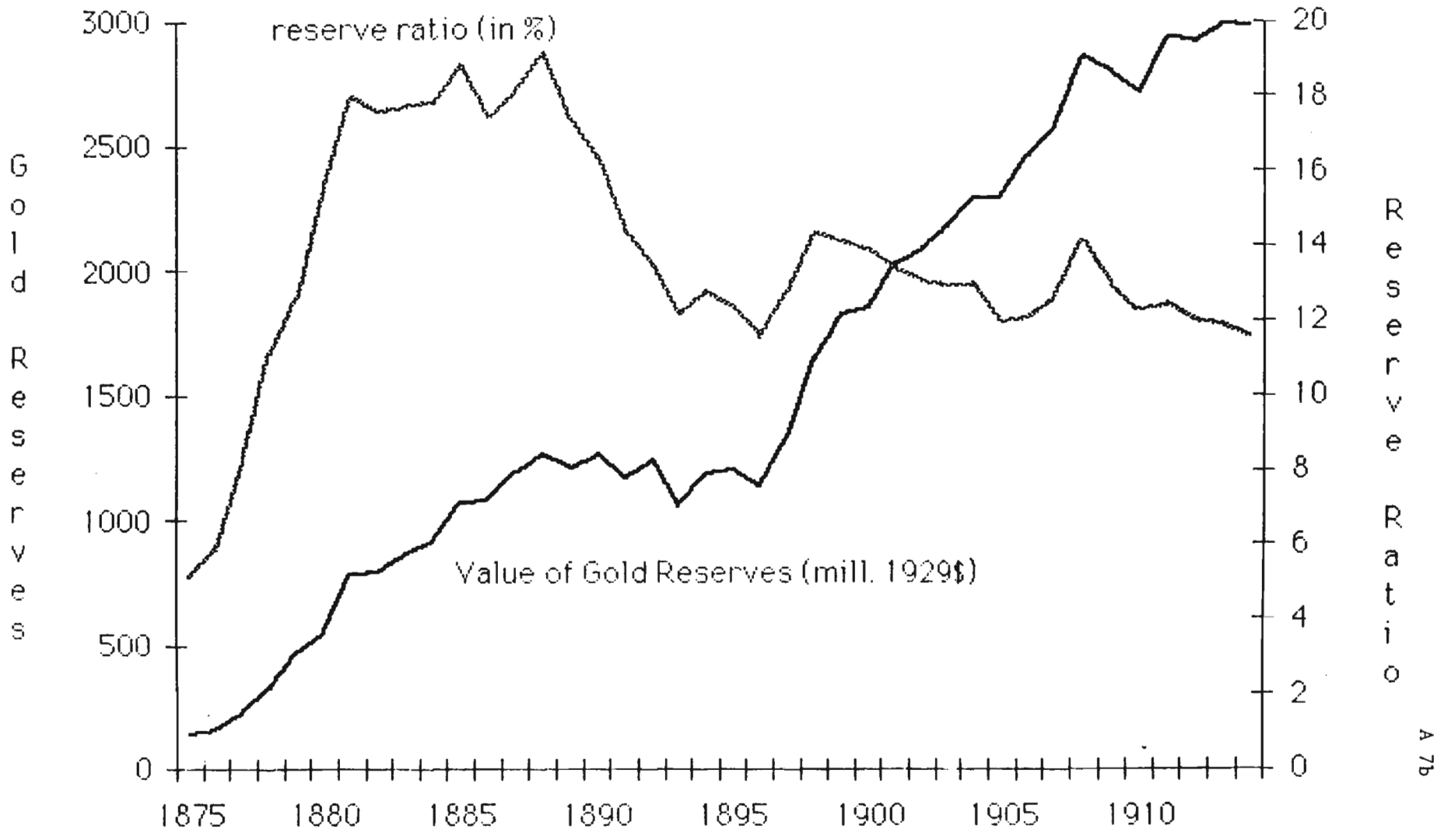
The reason for expressing the money stock as the product of the real stock and the price level is because the price level is what we are seeking to estimate. The second form of stating the right-hand side of equation (6) introduces the hypothetical real price of silver in place of the nominal price level. Once we have that, we can readily get an estimate of the nominal price level by using equation (1).

In computing the actual values in equation (5), we regarded silver in circulation or held by the Treasury as "monetary silver." However, in using the data for the gold standard period to estimate hypothetical values of the specie reserve ratio and of specie reserves, we cannot treat "monetary silver" as part of specie reserves, though it would have had that status under a bimetallic or silver standard. It was simply a governmental asset accumulated as part of an attempt to prop up the price of silver (like government stocks of wheat at present).

Accordingly, we have used only the data on monetary gold stocks for the present purpose. Figure A3 plots the gold reserve ratio (the ratio of the dollar value of monetary gold to the quantity of money) and the value in 1929 dollars of gold reserves (actual gold k_1). The rapid rise in the reserve ratio during the first five years after the passage of the Resumption Act (1875 through 1879) was to be expected in preparation for resumption. Presumably, a similar rise would have occurred if resumption had been on

FIGURE A3

Gold Reserve Ratio and Real Value of Gold Reserves, 1875-1914



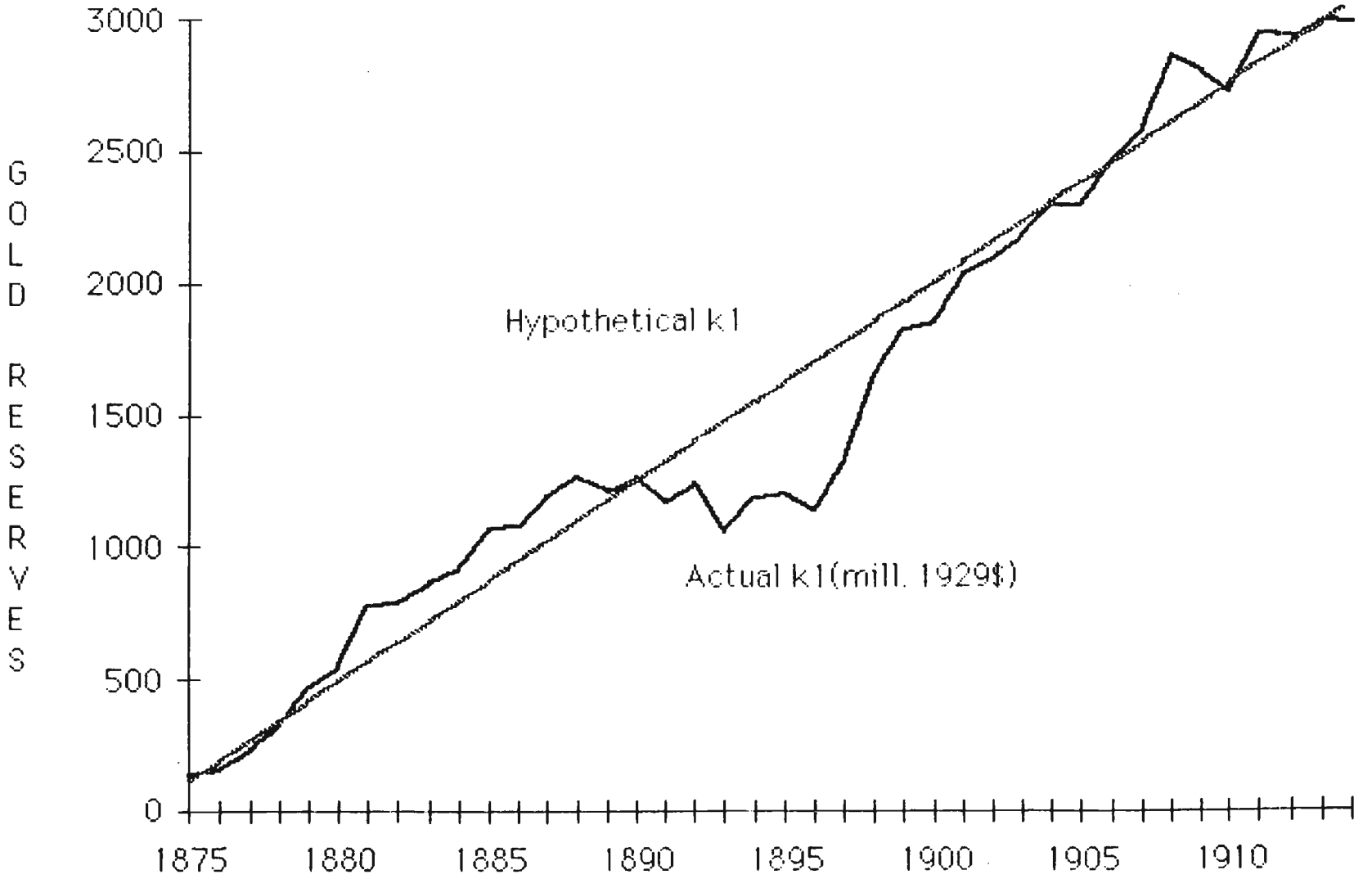
silver instead of gold, with the sole difference that silver would have been accumulated rather than gold. In either case, the accumulation of reserves required a surplus on the current account of the balance of payment or capital inflows. And a sizable surplus was generated from 1876 to 1881 followed by sizable capital inflows. I see no reason to suppose that the initial buildup of reserves would have been different under silver than it was under gold.

By 1879, the specie reserve ratio reached roughly the same level that it reached in the early 1900s after the end of the period of uncertainty generated by the monetary disturbances of the 1880s and 1890s. The subsequent further rise was probably prompted by an effort to persuade the public, not only at home but equally abroad, that the gold standard was here to stay. As the agitation for a more expansive monetary policy mounted, however, that effort failed and, especially after the pro-silver movement gained steam, led to continuous pressures on gold reserves, producing a sharp decline in the reserve ratio and a slightly declining level of real reserves. After the defeat of Bryan in 1896, there was a temporary spurt in the reserve ratio and an even sharper rise in real reserves as the higher reserve ratio was re-enforced by a rapid increase in the real money supply — itself partly a consequence of a return of confidence that both lowered velocity and fostered a higher real income. Reasonably steady conditions were not attained until the end of our period.

After trying many alternative ways of estimating what specie reserves would have been under an unchallenged and fully accepted silver standard, I finally settled on a purely empirical expedient: a straight-line trend between the average values of gold reserves during the first five and the last five years of the period from 1875 to 1914. As Figure A4 shows, such a

FIGURE A4

ACTUAL AND HYPOTHETICAL K1, 1875-1910



trend eliminates both the initial bulge and later decline that I attributed in the prior paragraph to the monetary disturbances and their aftermath. For 1875 to 1879 and 1901 to 1914, it approximates the actual pattern.

The U.S. hypothetical annual monetary demand for silver is simply the increment in the U.S. hypothetical silver stock:

(7) $$UMDSH(t) = \Delta UMSH = UMSH(t) - UMSH(t - 1).$$

The possible errors in this approach are numerous. Some simply affect the year-to-year movements as a result of the use of a trend for k^1. Any systematic bias presumably arises primarily from the assumption that the specie reserves that would have been maintained under a silver standard in the early and late years of the period would have been the same as the specie reserves that were maintained under a gold standard. The possible sources of error are different for the specie reserve ratio and the real stock of money. The desired specie reserve ratio might have been affected by a different pattern of prices. Rising prices under a gold (silver) standard means that the real value of gold (silver) is falling, and conversely. A falling real value makes it less expensive to hold the specie reserves, and conversely. It is doubtful, however, that any such price effect has a significant influence on the decision by the monetary authority on how large a specie reserve is desirable -- any financial benefit or loss is subtle and accrues to the government at large and not specifically to the monetary authority. A more important factor is surely the threat of a specie drain, which would have been largely absent under a secure silver standard.

The real stock of money would have been affected by the reduction in uncertainty as a result of settling on a definitive silver standard. The reduced uncertainty have have tended to lower velocity and raise real in-

come, both of which would have raised the real money stock -- as appears to have happened after 1896. Neglect of these effects produces an underestimate of the hypothetical silver stock. Such an underestimate introduces a downward bias in estimating the real price of silver, or a bias in the opposite direction from the possible bias introduced in estimating item (1), the production of silver.

b. Demand for Silver. The quantity of silver demanded for nonmonetary use depends primarily on world real income, the real price of silver, and the real price of gold. I have estimated a demand curve with these variables in two variants: logarithmic and linear. In general, the logarithmic form is preferable. However, in this particular case I do not believe it is. The logarithmic form forces the nonmonetary demand for silver to be positive, yet it is easily possible for additions to monetary stocks of silver to exceed the world production of silver, as happened most recently under the silver purchase program of Franklin Delano Roosevelt in the 1930s. In that case, the quantity of silver available for nonmonetary purposes is negative if it is estimated in accordance with equation (5), which gives the nonmonetary supply of silver out of current production, not the nonmonetary use of silver.

World real income is tricky to estimate. Warren and Pearson report index numbers of the physical volume of world production. A footnote to the Warren and Pearson tables says that for 1865 to 1932 the index was prepared by Carl Snyder of the Federal Reserve Bank of New York. Warren and Pearson report similar index numbers of U.S. physical volume of production. The trend of the index of U.S. production is steeper than the trend of U.S. real income (estimates from Monetary Trends). On the other hand, the general ups and downs are very similar. Accordingly, I used the Warren and Pearson

estimates of world production but subtracted out a trend at a rate equal to the difference between the logarithmic trends of U.S. production and U.S. real income, which was four-tenths of 1 percent per year. For some reason that I now no longer recall I also used the Warren and Pearson figures divided by two, so I have used the same figure throughout in all the calculations; it has no effect on the final result.[5]

For the real price of silver and the real price of gold, I simply used the actual prices divided by the U.S. deflator. This procedure assumes that the real price of silver and the real price of gold were the same throughout the world, surely a not unreasonable assumption for those two monetary metals.

The two equations are as follows for 1880-1914:

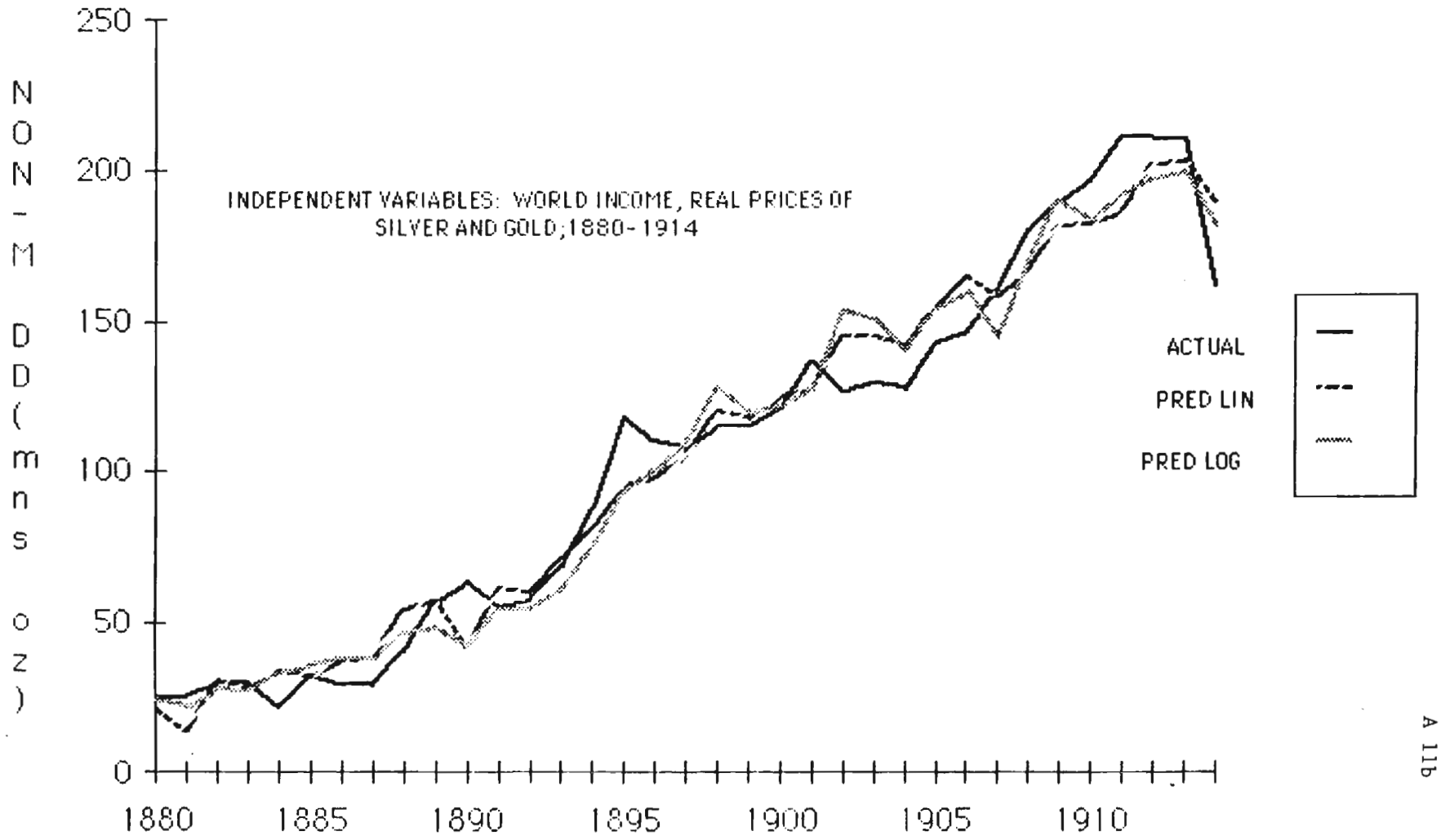
$$\log SNM = \underset{}{-9.00} + \underset{(4.9)}{2.00} \log WI - \underset{(6.1)}{0.79} \log RPS + \underset{(2.8)}{1.66} \log RPG, \quad (8)$$

$$SNM = \underset{}{-28.36} + \underset{(0.4)}{3.65} WI - \underset{(6.3)}{40.88} RPS + \underset{(2.7)}{0.60} RPG, \quad (9)$$

where WI stands for world income. As usual, the values in parentheses are the absolute t-values. All of the coefficients in the log equation are highly significant; in the linear equation, only the coefficients of world income and the real price of silver are. However, in terms of the goodness of fit of the equation as a whole, there is little to choose as can be seen graphically in Figure A5 as well as from the adjusted R^2s, which are .950 for the log equation and .956 for the linear equation. The standard error of estimate for the log equation is .165, which is comparable to an estimate of the coefficient of variation for the linear equation. That works out to be .124 if the denominator of the coefficient of variation is the arithmetic

FIGURE A5

NONMONETARY DEMAND FOR SILVER:ACTUAL VS PREDICTED BY LINEAR & LOG REGRESSION



mean of the dependent variables, and .155 if it is the geometric mean. In either case, the result is lower for the linear equation than for the log equation.

Estimating a hypothetical price level using the linear equation is mathematically far more tractable than using the log equation, which reenforces the theoretical consideration in favor of the linear equation, i.e., that the silver available for nonmonetary use out of current production can be negative. Hence, from here on, I use only the linear equation.

c. Equating Supply and Demand. Equating equations (5) and (9), and rearranging terms:

(10) UMDSH = SPROD - EWMDS + 28.36 - 3.65WI - 40.60RPGH + 40.88RPSH.

To simplify, let k_2 equal all the terms on the right-hand side of (10) except the last, and let x equal the hypothetical real price of silver that is our objective. All of these are also functions of time. However, given assumptions up to this point, we have estimates of the values of k_1 and k_2 for all the years from 1875 to 1914.

In terms of these symbols, we can rewrite equation (7), using equation (6), as

$$(11) \qquad UMDSH(t) = \frac{k_1(t)}{x(t)} - \frac{k_1(t-1)}{x(t-1)} .$$

Equating equations (10) and (11), and simplifying:

$$(12) \qquad 40.88\, x^2(t) + \left[k_2(t) + \frac{k_1(t-1)}{x(t-1)}\right] x(t) - k_1(t) = 0.$$

Equation (12) is now in the form of a straightforward quadratic equa-

tion except for the troublesome presence of the term including $x(t - 1)$ in the denominator. $x(t - 1)$ is one of the unknowns that we are trying to determine. As a first approximation, assume that the real price of silver does not change from year to year, i.e., that $x(t)$ equals $x(t - 1)$. That assumption converts equation (12) into the simplified equation (13) which involves only the current year's value of the unknown x, although it does involve the prior year's value of k_1, via substituting Δk_1 for $k_1(t)$.

$$40.88\, x^2 + k_2 x - \Delta k_1 = 0. \tag{13}$$

The solution to this equation is a first approximation to x.

For a second, third, etc. approximation, we can return to equation (12) and replace $x(t - 1)$ by the prior approximation estimate. The successive approximations do converge, though rather slowly. The main changes are not in the level or general pattern but rather in the year-to-year movements. However, each approximation involves losing one value at the beginning of the series. Since our main interest is for the period from 1880 on, I stopped with the seventh approximation, at which point 1880 is the first year for which there is an estimate.[6] Given this estimate of the real price of silver, it is only necessary to divide the legal price by the real price to estimate the hypothetical price level under a silver standard. I have filled in the years between 1875 and 1880 by linear interpolation between the actual price level in 1875 and the hypothetical price level for 1880. This hypothetical price level for the United States is plotted in Figure A1 as the sophisticated estimate.

d. Gold-Silver Price Ratio. Since we have already estimated the hypothetical price of gold, it is trivial to get the hypothetical price

ratio of gold to silver. The result is plotted in Figure A6 along with the actual and legal gold-silver price ratio. This figure is restricted to the period 1880-1914 because 1880 is the first year for which we have a sophisticated estimate. The fascinating feature of the figure is the tendency for the hypothetical gold-silver price ratio to vary closely around the legal ratio of 16-1 except for the period from 1891-1904, for which our estimates presumably remain affected by the speculation that the U.S. would go off the gold standard and its aftermath. The estimated ratio declines below 16-1 in some early and some late years. However, it is not likely that such minor declines, even if they had occurred, would have led to the substitution of gold for silver as the standard, since they were shortly reversed. In any event, the actual gold-silver price ratio under a U.S. silver standard would almost surely have fluctuated much less than our estimates of the hypothetical gold-silver price ratio, given the arbitrary assumptions and inevitable measurement errors that affect our estimates.

Table A1 gives the numerical values for the curves plotted in Figures A1, A2, and A6.

These estimates strongly support the view that, if the United States had returned to a bimetallic standard in 1879 and had stayed on it consistently throughout, the market gold-silver price ratio would have remained roughly equal to the U.S. legal price ratio, just as for close to a century it remained roughly equal to the legal price ratio in France.

5. **An Even More Sophisticated Estimate.** In principle, it would be possible to get a fully simultaneous solution for both the real price of silver and the real price of gold by following the same procedure for gold as for silver, that is, subtracting from (a) total gold production in each year (b) the annual quantity of gold absorbed by the U.S. for monetary uses

FIGURE A6

GOLD-SILVER PRICE RATIO: LEGAL, ACTUAL, HYPOTHETICAL;1880-1914

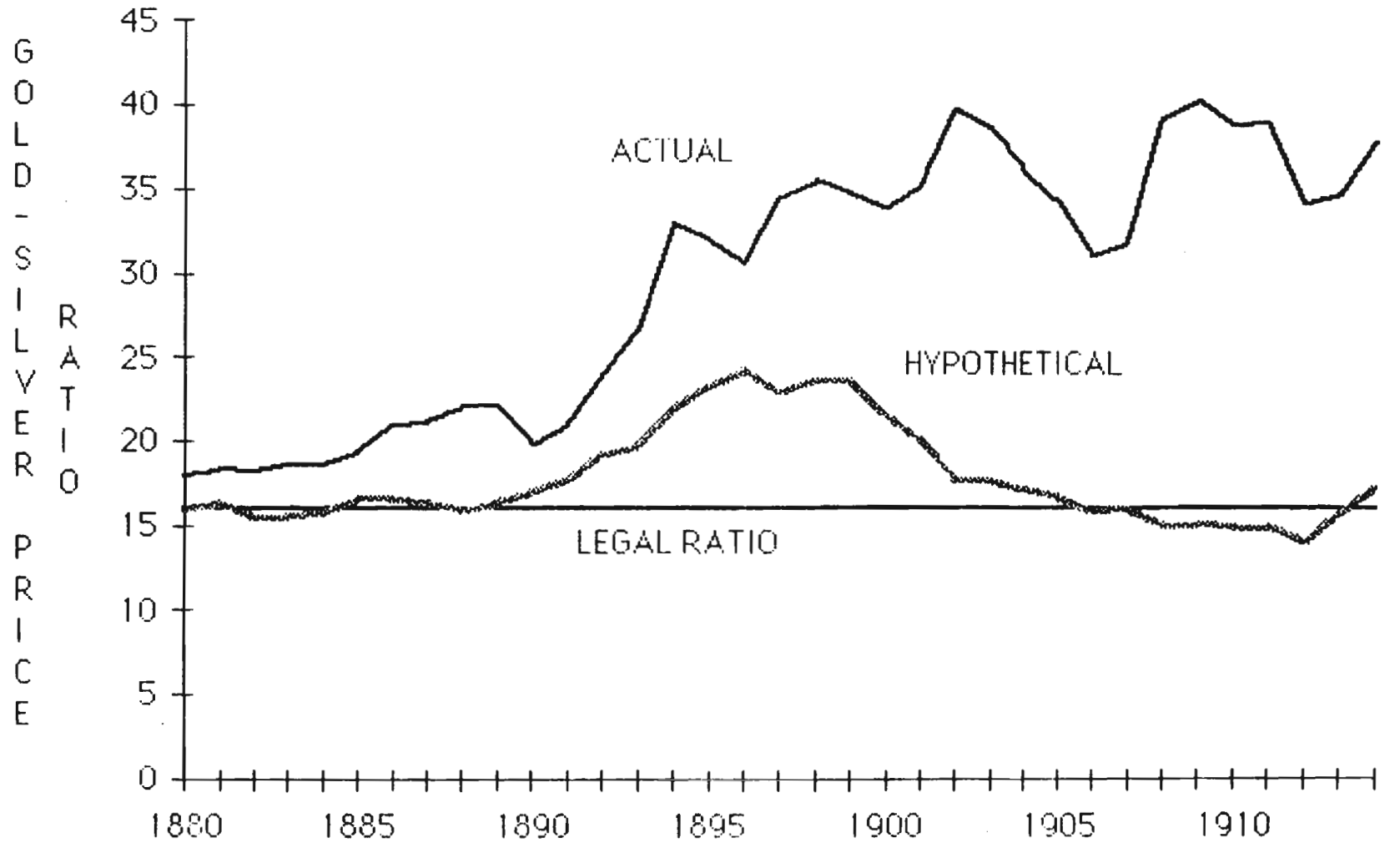


TABLE A1. Estimated Effect on U.S. and World Prices of U.S. Being on Silver Standard

YEAR	U.S. PRICE LEVEL				UK PRICE LEVEL		GOLD-SILVER PRICE RATIO	
	ACTUAL	HYPOTHETICAL			1929=100			
		NAIVE	16-1	SOPH	ACTUAL	HYP	ACTUAL	HYP
	86.5	86.5	55.1	86.5	59.8	59.8	15.4	
1866	82.6	82.6	58.7	82.6	62.0	62.0	15.5	
1867	77.6	77.6	56.3	77.6	61.6	61.6	15.6	
1868	76.2	76.2	54.6	76.2	59.8	59.8	15.6	
1869	72.7	72.7	54.7	72.7	58.7	58.7	15.6	
1870	68.7	68.7	59.8	68.7	56.3	56.3	15.6	
1871	69.8	69.8	62.5	69.8	57.8	57.8	15.6	
1872	66.3	66.3	59.0	66.3	61.4	61.4	15.6	
1873	65.5	65.5	57.6	65.5	63.5	63.5	15.9	
1874	64.8	64.8	59.6	64.8	61.5	61.5	16.2	
1875	63.3	63.3	56.3	63.3	59.2	59.2	16.6	
1876	60.4	60.4	55.6	62.9	57.8	59.2	17.8	
1877	58.2	59.8	57.2	62.5	56.2	57.9	17.2	
1878	53.9	60.1	55.4	62.0	55.2	57.2	17.9	
1879	52.0	60.0	54.7	61.6	52.8	55.6	18.4	
1880	57.4	64.5	61.3	61.2	55.0	58.7	18.0	16.0
1881	56.3	64.4	60.8	61.8	53.8	58.1	18.3	16.2
1882	58.1	66.0	62.8	60.5	54.6	59.0	18.2	15.4
1883	57.4	66.8	62.3	60.3	54.0	58.6	18.7	15.5
1884	54.4	63.2	59.1	58.0	52.5	57.0	18.7	15.7
1885	50.8	61.6	55.4	57.4	51.1	55.7	19.4	16.6
1886	50.1	65.1	54.8	56.5	50.3	55.0	20.9	16.5
1887	50.6	66.3	55.8	56.8	50.5	55.7	21.1	16.3
1888	51.5	70.9	56.7	56.1	50.5	55.6	22.0	15.8
1889	51.8	71.5	56.8	57.9	51.2	56.1	22.0	16.3
1890	50.8	68.8	55.8	58.9	52.1	57.1	19.7	16.9
1891	50.3	65.8	55.0	60.4	51.9	56.7	20.9	17.6
1892	48.3	71.3	52.5	62.8	51.8	56.2	23.8	19.2
1893	49.5	81.8	53.8	66.0	51.5	55.9	26.6	19.6
1894	46.4	95.2	50.0	68.2	50.6	54.6	32.9	21.8
1895	45.7	90.5	49.0	71.0	49.9	53.5	31.9	23.2
1896	44.4	85.5	48.1	72.7	49.7	53.9	30.5	24.2
1897	44.6	96.5	48.6	69.3	50.2	54.6	34.5	22.8
1898	45.9	101.8	51.0	75.0	50.5	56.1	35.5	23.5
1899	47.1	102.3	52.6	77.4	51.2	57.1	34.8	23.5
1900	49.6	104.5	55.8	74.9	54.6	61.4	33.8	21.5
1901	49.3	108.1	55.7	69.8	54.2	61.2	35.1	20.0
1902	51.0	126.5	57.9	63.7	53.3	60.4	39.7	17.6
1903	51.5	124.4	58.6	64.5	53.2	60.4	38.6	17.6
1904	52.3	118.2	59.4	63.3	53.3	60.5	36.2	17.0
1905	53.4	114.4	60.8	63.2	53.6	61.0	34.3	16.6
1906	54.5	105.4	62.7	61.7	54.0	62.2	31.0	15.7
1907	56.8	112.4	65.2	65.0	54.9	63.0	31.8	15.9
1908	56.7	138.6	65.0	60.7	55.1	63.2	39.1	14.9
1909	58.7	147.5	67.0	62.9	54.9	62.5	40.2	15.0
1910	60.2	145.6	68.7	63.5	55.2	63.0	38.7	14.8
1911	59.7	144.9	68.3	63.4	55.9	63.9	38.9	14.9
1912	62.3	132.4	71.4	62.1	57.5	65.9	34.1	13.9
1913	62.6	135.3	71.9	70.3	57.9	66.5	34.6	15.6
1914	63.5	149.7	71.8	76.9	58.2	65.8	37.8	17.1

(which was positive in fact but would have been negative under the hypothetical situation, and (c) an estimate of the desired addition to the monetary stock of gold of the rest of the world, expressed as a function of the real price of gold, to get (d) the world's nonmonetary demand for gold. This estimate of the gold available for nonmonetary use could then be set equal to the demand as estimated from a demand function for gold like equation (9) for silver. Estimates of actual world gold production are available. It might be reasonable to assume for gold as for silver that actual production would have been unchanged by the decrease in its real price likely to occur under a U.S. silver standard, given the important role of technological change during the period in question. However, that is less clear for gold than for silver because the sharp rise in the real price of gold in the 1880s and 1890s played an important role in stimulating technological innovation.

A major sticking point is that it would also be necessary to assume something about how the U.S. gold stock would have been disposed of. My earlier rough approximation evades this question. For a full solution, however, we cannot do so. Demand functions for gold and silver refer to annual quantity demanded and we need to equate that demand function with annual supply, which means that we would need to add to total gold production the amount of gold that the U.S. released to the rest of the world from its stock on a year-by-year basis. I see no way to estimate the annual release except by purely arbitrary assumptions.

In lieu of such a full analysis I have tried to check if the earlier results are reasonable. I have calculated demand functions for nonmonetary use of gold similar to the one I calculated for silver, with results that are equally satisfactory in terms of goodness of fit, but not in terms of

economic logic. The logarithmic and linear demand functions are as follows:

$$\log WGNM = \underset{(3.3)}{4.4882} + \underset{(2.1)}{0.5125} \log WI - \underset{(4.0)}{0.8176} \log RPS - \underset{(5.6)}{1.2471} \log RPG, \quad (14)$$

$$WGNM = \underset{(4.2)}{11.1134} + \underset{(4.8)}{0.1} \log WI - \underset{(3.0)}{1.7989} RPS - \underset{(7.4)}{0.2073} RPG, \quad (15)$$

where WGNM is the world nonmonetary demand for gold. As with silver, both equations give high multiple correlations (adjusted R^2s of .93 for the log equation and of .96 for the linear equation) and relatively small standard errors. The standard error of the log correlation is .12. The corresponding estimate for the linear equation of the coefficient of variation is .095 if the denominator is an arithmetic mean of the dependent variable, and .105 if the denominator is a geometric mean of the dependent variable. In either case, the coefficient of variation is less for the linear equation than for the log equation, as was true with silver.

The feature of the equations that is disturbing is the negative sign of the coefficient of the real price of silver. Presumably silver is a substitute for gold, which means that a rise in the price of silver should increase and not decrease the quantity of gold demanded for nonmonetary use. In the equations for silver we did get the expected positive coefficients for the real price of gold though the coefficient for the linear equation was not statistically significant. For gold, the coefficient of the real price of silver is highly significant for both log and linear correlations.[7] The gold and the silver equations thus are in clear contradiction with the economic logic expressed in the Slutsky cross-equation condition. On a purely statistical level, the inconsistency could be eliminated by introducing cross-equation restrictions that would require the implicit coefficient

of substitution of silver for gold in consumption to be the same in both equations. However, that would be complex and, more important, the result would deserve little confidence, given the drastic differences between the two separate equations.[8]

I am thus left in a quandary: I am unhappy with what I have done, but I am at least as unhappy with the most obvious alternative to it, a highly simplified general equilibrium analysis. A comprehensive general equilibrium analysis would have to include the determinants not only of gold production and silver production, which I have completely neglected, but also the determinants of the fraction of gold production and silver production which go into monetary and nonmonetary use. Construction of such an expanded general equilibrium model would be extremely laborious and would deserve little confidence. Under the circumstances, I am inclined to leave well enough alone and to stick to where I am, while at the same time acknowledging that the estimates are subject to a wide margin of error -- particularly with respect to year-to-year movements.

NOTES

1. Many years ago, I suggested to Professor Louis Drake that he estimate the effect on U.S. and world prices of the U.S.'s having remained on a bimetallic standard. He worked on the project for years and accumulated much data, but was never sufficiently satisfied with his results to publish them. After his death in 1982, colleagues and friends edited a preliminary paper that was found in his files, retaining in full his original calculations, and published the result in Louis S. Drake, "Reconstruction of a Bimetallic Price Level," Explorations in Economic History 22 (April 1985): 194-219. When I began the paper to which this memorandum is appended, I thought that I could simply use his results. But when I read his paper in detail, I appreciated the reservations about his results that presumably led him to refrain from publication. In consequence, I have produced an independent set of estimates, though benefitting from some of his data and analysis. Not surprisingly, my final results differ drastically from his.

2. I owe this approach to Hugh Rockoff. It replaces a less attractive assumption I had made initially.

3. See Drake, "Reconstruction of a Bimetallic Price Level," Table A, pp. 208-209.

4. The data are from The Annual Report of the Secretary of the Treasury on the State of the Finances, for the fiscal year ended June 30, 1899, p. 207.

I am indebted to Anna J. Schwartz for finding these data.

5. I also experimented with using a simple average of U.S. and U.K.

real income estimates, after converting the U.K. estimates from real pounds to real dollars. However, it gave poorer results in demand estimates than the Warren and Pearson series.

6. 1874 is the first year for which I have an estimate for EWMDS, which explains why the first year for which I can estimate the first approximation is 1875.

7. In an Appendix to chapter 4 of the Report of the U.S. Gold Commission, demand equations linear in the logarithms of the variables are estimated for the industrial demand for gold for 1950-1980, and 1969 to 1980. The independent variables are conceptually the same as those that I used: the real price of gold, the real price of silver, and real income. Both sets use two alternative deflators to estimate the real prices: the U.S. wholesale price index, and the world consumer price index. The difference between the two sets of equations is that the one for the longer period uses U.S. income only whereas that for the shorter period uses three alternative real income variables: for seven major industrial countries, for the U.S., and for the world.

All the equations that use U.S. income give a negative coefficient for the real price of gold, though only one out of four comes close to statistical significance. On the other hand, the four others (all for the shorter period) are all positive, in line with theoretical expectations, though none comes close to statistical significance.

This evidence clearly does not contribute to resolving the puzzle.

8. A simultaneous solution not only raises the statistical problem of imposing the cross-equation condition, but ends up with requiring the solution for each year of a 4th degree equation in the U.S. price level.

RECORD OF NOTATION

EWMDS actual monetary demand for silver in rest of world (external)

EWMG rest of world actual monetary gold stock

$k_1 = SPR \cdot y/V$

$k_2 = SPROD - WMDS + 28.36 - 3.65WI - 0.60RPGH$

LP legal price of silver

P U.S. price level

PHN naive estimate of hypothetical price level

PH16 hypothetical price level on assumption that gold-silver price ratio is 16 to 1

PS nominal price of silver

RPG real price of gold

RPGH hypothetical real price of gold

RPS real price of silver in 1929 dollars

RPSH hypothetical real price of silver in 1929 dollars

RPSH16 hypothetical real price of silver on 16 to 1 ratio assumption

SNM silver available for nonmonetary use

SPR specie reserve ratio

SPROD total silver production

UKP British price level

UKPH hypothetical British price level

UMDS actual annual monetary demand for silver in U.S.

UMDSH hypothetical U.S. annual monetary demand for silver

UMG U.S. actual monetary gold stock

UMS actual U.S. monetary stock of silver

UMSH	hypothetical U.S. monetary stock of silver
V	velocity
WI	real world income (including U.S.)
WNMG	world nonmonetary demand for gold (including U.S.)
x	RPSH
y	U.S. real income