Following the yellow brick road: How the United States adopted the gold standard

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Introduction and summary

In 1900 L. Frank Baum published a children's tale, *The Wonderful Wizard of Oz.* In it, a little girl from the Midwest plains is transported by a tornado to the Land of Oz and accidentally kills the Wicked Witch of the East, setting the Munchkins free. Yearning to return home, she takes the witch's silver shoes[1] and follows the Yellow Brick Road to the Emerald City, in search of the Wizard who will help her. She and the companions she meets on her way ultimately discover that the wizard is a sham, and that the silver shoes alone could have returned her to Aunt Em. Littlefield (1964) and Rockoff (1990) have decoded Baum's tale as an allegory on the monetary politics of late nineteenth century America. The silver shoes are the silver standard, the witch of the East represents the "monied interest" of the East Coast, the scarecrow and the tin man are the farmers and workers of the Midwest, while the cowardly lion is their unsuccessful champion, William Jennings Bryan. The yellow brick road is the gold standard, whose fallacy is exposed by Dorothy's triumphant return home borne by the silver shoes.

William Jennings Bryan, as nominee of the Democratic Party in the presidential election of 1896, campaigned on a platform to reverse the so-called "crime of 1873." The phrase referred to the change in the United States' monetary system from bimetallism, in which gold and silver are used concurrently, to the gold standard. Bryan lost, and in 1900 a law was passed firmly committing the United States to the gold standard. The bimetallic controversy soon died away. The United States had taken the yellow brick road.

In this article, I recount the historical background to the bimetallic controversy, replacing it in its international context. Bimetallism, which until 1873 had been the system in a number of other countries, disappeared abruptly. I use a model to understand how bimetallism could have been viable in the first place, why it disappeared so suddenly, and whether the United States could have taken another road.

Definitions

I begin with some definitions. A *commodity money system* is a monetary system in which a *commodity* (usually a metal) is also *money*; that is, the objects that serve as medium of exchange are made of that commodity. The essential feature of such a system is that the commodity be easily turned into money and back. This requires: 1) unrestricted minting, in the sense that the public mint always be ready to convert any desired amount of metal into coin; and 2) unrestricted melting and exporting, allowing money to be converted into the commodity, or into other goods at world prices.

A commodity money system based on gold or silver is also described as a gold or silver *standard*. In such a standard, the medium of exchange may not be limited strictly to coins, but may include notes (privately or publicly issued), as long as the notes are convertible on demand and at sight into coin.

The *double standard* is one where both gold *and* silver are money. This is also called a bimetallic standard, or *bimetallism*. The characteristics of bimetallism include:

1. Concurrent use of gold and silver as money,
2. Free minting and melting of both metals, and
3. A constant exchange rate between gold and silver coins.

Condition 1 usually means that both gold and silver coins are unlimited legal tender. Any limitation

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on the size of debts that can be paid in coins of either metal is therefore a departure from condition 1.

All three characteristics should be present to have a proper bimetallic system. For example, conditions 1 and 2 alone define a regime where one metal is the standard (say, silver) and the price of the gold coin is not fixed, but varies according to the market. The fluctuating coin is called *trade money*. Conditions 1 and 3 alone, but with only one metal freely minted, result in a *limping standard*. It is similar to a single standard based on the metal freely minted, except that some portion of the money stock is made up of the other metal. The government regulates the size of that portion. A number of countries moved from a bimetallic to a limping standard, as we shall see later.

Bimetallism used coins of silver and coins of gold with a fixed exchange rate between the two. For example, the gold eagle and the silver dollar were expected to circulate at a rate of 10:1 (10 silver dollars for one gold eagle), and the values "$10" and "$1" were inscribed on the coins themselves. Moreover, anyone could take any amount of silver to the mint in exchange for $1 coins and any amount of gold in exchange for $10 coins.[2]

Let X be the amount of gold in a gold eagle, and Y the amount of silver in a silver dollar. If both coins circulate, then, as money, X ounces of gold are worth $10Y$ ounces of silver. The ratio $(10Y/X)$ is called the *(gold–silver) legal ratio*. In the United States, after 1834, an eagle contained 232 grains[3] of pure gold, while a dollar contained 371.25 grains of pure silver, so the legal ratio was 16. The relative price of gold and silver as metals in the market is called the *market ratio.*

The history

We are so used to our current system of fiat money, where the only thing that matters about a coin or a note is the number inscribed on it, that it takes a slight effort to think of money in earlier times.[4]

In the Middle Ages, various objects were used as money: round disks made of gold, silver, and copper (or silver alloyed with copper). These disks had designs on them by which one could determine where they came from and how much metal they contained. But they did not have any numbers or other quantitative indication of value. And, in fact, the exchange rates between these objects were not necessarily constant. One should think of such a system as one in which various goods are simultaneously used as means of exchange, because some are more suited to certain transactions than others.

For a long time, governments endeavored to stabilize the relation between the various monetary objects, with limited success. The way this was done was by assigning a "legal tender" or "face" value to each coin. The government assigns a number N_i to coin i, such that coin i is legal tender for a debt of N_i units of account. Often, $N_j = 1$ for some particular coin j, and that coin was by definition the unit of account. For a long time, governments had difficulties enforcing these laws, and market rates between two coins often diverged far from the ratio of their legal tender values. Nevertheless, governments kept trying, and by the eighteenth century it was commonly seen as a desirable goal to achieve stability in the relative price between the objects that served as money, so that it might not matter which ones were used in payment of an obligation. By 1800, enough stability had been achieved that denominations could be inscribed on the coins with increasing frequency. But the stability had not necessarily been extended to the whole range of coins, including silver and gold. In practice, a variety of monetary systems existed in Europe by the middle of the nineteenth century:

- Gold in Great Britain, Portugal, and some colonies;
- Silver in Central and Eastern Europe and the East (India, China), with gold as trade money in some countries (Netherlands, Germany); and
- Bimetallism in France, Latin America (with a 15.5 legal ratio), and U.S. (with a 16 legal ratio).

The controversy

Bimetallism became controversial in the mid-nineteenth century and remained so until around 1900. I first describe the nature of the controversy and then sketch its history.

The controversy around bimetallism ultimately stems from the fact that it is a system that appears to defy economic logic. One of the textbook functions of money is to provide a unit of account and a standard of deferred payment. Accounts are kept in dollars, and debt contracts promise payment of a known quantity of dollars. Thus, money serves as "numeraire." The gold standard is a straightforward example, because a dollar is simply defined to be X ounces of gold. In reality, then, it is gold that is used as a numeraire. This poses no particular problem in economic theory. In equilibrium, prices are determined as a vector, or list of numbers, that sets the sum of excess demands for each good to zero (or clears markets). Since nothing changes when all units are consistently changed by a given number, the price vector is indeterminate up to a constant rescaling. Any good (gold, say) can be chosen to be the unit of measurement of value, by setting the price of X ounces conventionally to one. All

prices in the economy are thus expressed in ounces of gold or gold dollars.[5]

But bimetallism is something else: It defines the dollar to be *X* ounces of gold *or Y* ounces of silver. As money, the two metals have a fixed relative price, the "legal ratio" (16 in the United States), whatever the market prices of gold and silver might be. This appears to defy basic economic theory, because it amounts to choosing two goods as numeraire, but prices are indeterminate only up to a single rescaling. In other words, it amounts to fixing by government fiat the relative price between two commodities.

Thus, the very existence of bimetallism was at the heart of the controversy. Some argued that, as a monetary system, it was an impossibility and could never be implemented or maintained over any period of time. Rather, they argued, bimetallism would necessarily revert to a single standard, gold or silver, depending on which metal was cheaper on the market. Consider a country with a legal ratio of 16, like the United States. Suppose the market ratio was p, in grains of silver per grain of gold. A legal obligation of $100 could be extinguished by tendering $100 in gold (2,320 grains of gold) or $100 in silver (37,125 grains of silver). Suppose the debtor had $100 in gold in hand, would he tender it? The alternative would be to melt the gold, sell it on the market in exchange for 2,320 p grains of silver, and have the mint turn the silver into $2,320 p/371.25 = $100 ($p$/16), and tender $100 in silver; the net profit being 100(p –16)/16. If p is greater than 16, it would be better to use silver than gold. In other words, whenever the market price is above the legal ratio, bimetallism would be de facto a silver standard. Should it fall below the legal ratio, the country would suddenly switch to the gold standard. In either case, the cheaper metal (compared with the legal ratio) would replace the other, a mechanism described as Gresham's Law in action. Only when the market price happens to coincide exactly with the legal ratio would both gold and silver be used concurrently. We could take into account minting and melting costs: This would determine a narrow band around the legal ratio, within which the market price would be compatible with bimetallism. But as soon as the market price wanders out of the band, bimetallism would collapse to a single standard.

At best, according to this argument, bimetallism works occasionally, so that any virtues ascribed to it would be operational only a small part of the time. The rest of the time, the costs of alternating between one standard and the other (minting and melting costs incurred by society as a whole) make bimetallism wasteful and inefficient. It would be better to settle on a single standard on a permanent basis.

The bimetallic camp argued that the system, far from degenerating into an alternation between standards, could successfully maintain gold and silver in concurrent circulation at the legal exchange rate. How was this possible?

A model

Velde and Weber (2000) present a simple model that formalizes the intuition underlying the bimetallists' arguments. Clearly, the key to the argument is that the existence of bimetallism somehow influences the market price. If the market price is completely independent of the monetary system, and is left free to vary far from the legal ratio, then the reasoning we have sketched above applies, and, depending on the market price's relation to the legal ratio, gold or silver either disappears or circulates at a premium. Either way, bimetallism cannot survive.

To give bimetallism a chance, then, we must allow for the market price to be determined within the model, as well as being exposed to demand or supply shocks. This requires specifying explicit supply and demand for gold and silver aside from their monetary uses. One way to do so is to make consumers care about the total stock of gold and silver in nonmonetary uses, which we'll call "jewelry."

Let's begin with the case of a single metal used as money, say, gold. The price of gold relative to other goods is a function of the total stock of gold jewelry. When gold coins are melted, this stock increases, and the value of gold falls. When new coins are minted, the stock of jewelry decreases and the value of gold goes up. A certain amount of gold has to be in the form of coins, that is, cash balances, in order to provide liquidity services and serve as medium of exchange. How is the appropriate stock of coined gold versus uncoined gold determined?

Let m be the stock of gold coins (in ounces) and let p be the price level, in ounces of gold per consumption good. The total real value of the cash balances, m/p, depends only on the volume of transactions Y, not on the particular metal used as medium of exchange; in the classic quantity theory equation (setting velocity to 1 for simplicity), $m/p = Y$. Imagine now that all existing gold is in nonmonetary use: $m/p = 0$, which is not enough. At the other extreme, imagine that all the gold is in the form of coins, so that none is left for nonmonetary uses—then the price of gold would be very high, and the price level (the inverse of the price of gold) would be very low; so m/p would be very high, perhaps infinite. In between these two extremes, there is some value of m that will make $m/p = Y$. The key is that m and p are affected at the same

time by a single variable, the split between money and jewelry; and the equation $m/p = Y$ only has one unknown, which is that split.

With a single standard, then, the price level and the money stock are determined, given the volume of transactions. What happens with two metals? Things become more complicated. On one hand, we have gold and silver jewelry, and the relative value of gold and silver are each decreasing functions of the stocks of jewelry. On the other hand, cash balances can take the form of either gold coins (m_1) or silver coins (m_2), with silver coins valued at a certain ratio in terms of gold coins (e). That ratio must itself be equal to the ratio of relative prices of gold and silver, as explained earlier. Prices can be expressed in ounces of gold per good, noted p as before, or in ounces of silver per good, p/e. We have an equation of the form $(m_1 + e\, m_2)/p = Y$, but we now have two variables affecting the equation: the split between gold coin and gold jewelry and the split between silver coin and silver jewelry. Two unknowns in one equation mean that there are many possible solutions. (Box 1 presents the model in more detail.)

In other words, many different gold–silver ratios are possible. Start from a given ratio, with corresponding quantities of gold and silver jewelry. If one wanted a higher gold–silver ratio, with gold more valuable relative to silver, one could reduce the stock of gold jewelry and drive up the price of gold; then gold coins would be minted, and silver coins would have to be melted to make room for the gold coins, driving down the price of silver. One could do so until the relative price of gold to silver was pushed up to the new ratio. This suggests that there is a whole range of possible gold–silver ratios, with corresponding quantities of coined silver and gold: the higher the ratio, the more silver there is in the money stock. It also suggests that there is ample room for a government, or a large enough group of governments at any rate, to settle on a particular ratio between gold and silver, and that there are no fundamental forces that would push away from that arbitrarily chosen ratio. The relative price of gold and silver is indeterminate, within the range.

The model says more than this. Suppose there is a large disturbance to the supply of gold, say, a large increase in gold supplies. How is the monetary equilibrium modified? Part of the new supply of gold can be turned into jewelry, which would tend to cheapen gold and move us away from the existing ratio. But part of the new supply can also be minted; as a result, some silver coins would have to be melted down to make room for the new gold coins. The melted silver would increase the stock of silver jewelry, and cheapen silver. If minting of gold takes place at the right pace, the melting of silver can exactly compensate for the increase in gold jewelry so as to keep the ratio e exactly constant.

Of course, there are limits to this process. In particular, the gold–silver ratio can be stabilized around an arbitrary value only so long as there are stocks of gold and silver coins to act as buffers against shocks to gold and silver supplies. Suppose a particularly large discovery of gold takes place. Part of it will have to be minted, and that may completely displace silver from the monetary circulation. If it does, no more silver circulates as coin, and no further increases in silver jewelry can offset the cheapening of gold. Bimetallism turns into a gold standard, and the gold–silver ratio falls. To restore bimetallism requires changing the ratio to a new value more compatible with the existing gold stocks (in our example, reducing the ratio).

Thus, for any given worldwide stocks of gold and silver, there exists an upper bound, as well as a lower bound, for values of the ratio compatible with effective bimetallism. Given the stocks, a relatively high ratio requires putting more gold into coins to drive up the relative price of gold jewelry and putting less silver into coins. Too high a ratio cannot be sustained because it would require taking all silver out of coinage, making the system effectively a gold standard. Similarly, too low a ratio leads to a silver standard. This band of possible ratios moves around with changes in world stocks. For example, if the stock of silver increases, it makes it possible to sustain higher ratios. As the relative quantities of gold and silver change over time, so do the bands that constrain the feasible ratios, and we would expect to see the ratio of prices broadly follow the ratio of stocks over long periods.

The history (continued)

Figure 1 suggests that this was so. The figure plots, in ratio, an estimate of gold and silver stocks since the discovery of the New World. It dips at first, showing that relatively more gold than silver flowed in from the New World. Then, from about 1530, it rose steadily as vast quantities of silver began to come out of the mines in Peru. The ratio of stocks stabilizes in the late seventeenth century, as flows of Brazilian gold increase. We can see that the market ratio followed these movements, as European countries sought to maintain concurrent use of both coins. After 1820, the market ratio is remarkably stable, up to 1873. By contrast, something happens to the ratio of stocks around 1850.

Bimetallism became controversial around 1850. The date is not a coincidence. In 1849, it was discovered that the Sierra Nevada Mountains of California

BOX 1

The model

Time is infinite and discrete. There are three types of goods in the model: a nonstorable general consumption good c, and nondepreciating stocks of gold and silver metal, Q_1 and Q_2 (in ounces). I treat gold and silver symmetrically. In each period, there is a given amount of consumption good and given increases (or decreases) in the stocks of gold and silver. Total quantities of all goods are thus exogenous.

The quantities that are determined within the model are the share of gold and silver stocks in monetary and nonmonetary uses. Gold and silver can each be in either of two forms: coined or uncoined. For simplicity, all gold coins are of the same size and weigh b_1 ounces each; likewise with silver coins, each weighing b_2 ounces. Let m_i (i = 1,2) be the number of existing coins and d_i the quantity of either metal in uncoined form. We then have an adding-up condition:

$$Q_i = b_i m_i + d_i \qquad b_i \text{ oz per coin } i.$$

I assume that it is costless to convert metal from one form to the other. Converting from coined to uncoined is melting, and converting from uncoined to coined is minting. A key feature of a commodity money standard is that both operations be unimpeded.

A representative household's preferences are defined over the consumption good and over the stocks of uncoined metal. That is, the household derives direct utility from the uncoined metal only. Let the total utility derived each period be $u(c) + v(d)$, where d stands for (d_1,d_2). The household discounts future consumption by a factor $\beta < 1$.

Metal is coined because money is needed for purchases of the consumption good; in other words, there is a cash-in-advance constraint. Both coins are perfect substitutes in the constraint at an *endogenous* ratio or exchange rate e (in gold coins per silver coin). If p is the price of the consumption good denominated in gold coins, then the constraint is:

1) $pc = m_1 + em_2$.

The household maximizes utility subject to the cash-in-advance constraint and a budget constraint. The first-order conditions for the household's problem include two equations that determine the optimal holding of uncoined metal. Consider the marginal gold coin held by the household. One could spend the coin and consume $1/p$ more units of consumption good today, bringing a marginal utility $u'(c)/p$. The alternative is to melt the coin and hold b_1 more ounces of uncoined metal, which would bring a marginal utility of $b_1 v_1(d)$ today (where $v_1(d)$ is the derivative of v with respect to its first argument d_1); and then, in the next period, convert the metal back to coin and consume $1/p$ more, bringing a marginal utility $\beta\, u'(c)/p$ (discounted because it takes place in the future). For a silver coin, the tradeoff is the same, except that a silver coin buys e/p units of good. At the optimum, the alternatives should bring the same utility, so that:

2) $$\frac{u'(c)}{p} = b_1 v_1(d) + \beta\frac{u'(c)}{p},$$

3) $$e\frac{u'(c)}{p} = b_2 v_2(d) + e\beta\frac{u'(c)}{p}.$$

In equilibrium, the metal stocks that the household chooses to hold, coined and uncoined, must add up to the existing supply:

4) $b_1 m_1 + d_1 = Q_1$,

5) $b_2 m_2 + d_2 = Q_2$.

Equations 1, 2, 3, 4, and 5 are all the equilibrium conditions. The unknowns are e, m_1, m_2, p, d_1, and d_2. This leaves one more unknown than we have equations, so we are free to choose e.

Formally, there exists a range $[\underline{e},\overline{e}]$ of possible ratios, with a different distribution of uncoined metals (d_1,d_2) for each ratio. At the upper end, there is almost no silver in monetary use, and the world is on the edge of the gold standard. At the lower end, there is no gold coin, and the world is almost on a silver standard.

Note that, in any equilibrium, equations 2 and 3 imply that

$$\frac{b_2}{eb_1} = \frac{v_1(d)}{v_2(d)},$$

in other words the legal ratio always equals the market ratio.

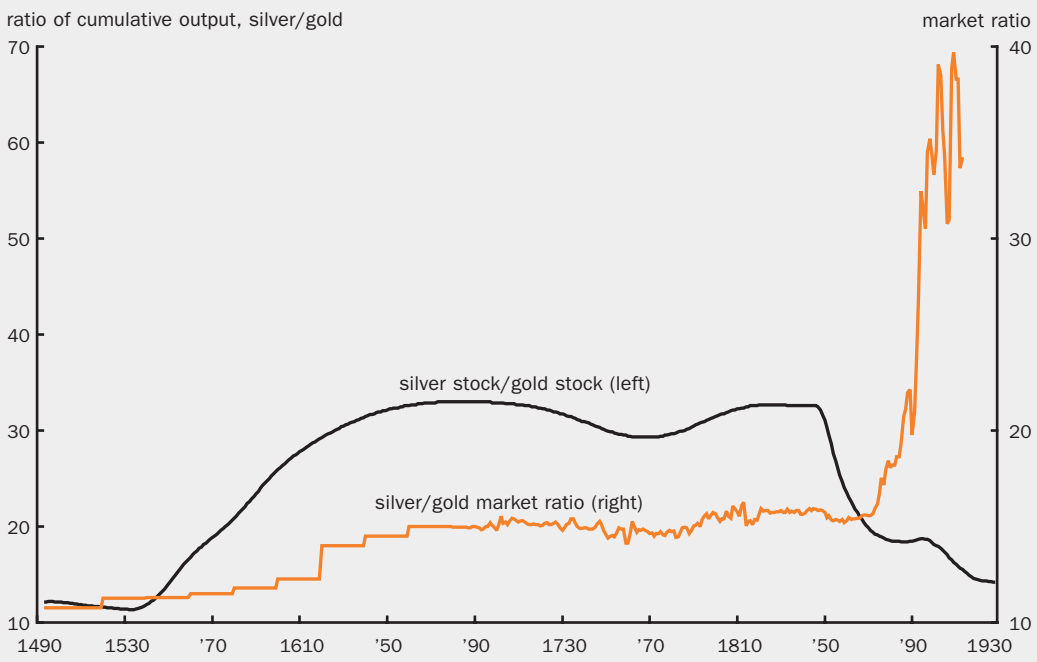
One can reduce the equilibrium conditions to a single equation in the two unknowns d_1 and d_2:

6) $$u'(x)x = \frac{1}{1-\beta}[v_1(d)(Q_1 - d_1) + v_2(d)(Q_2 - d_2)].$$

The right-hand side of equation 6 is the real value of money balances, at market prices. This value is the same in all bimetallic equilibria: No matter what the gold–silver ratio is, the same resources are devoted to monetary transactions. If one changes the legal ratio, say, by increasing it, then silver shifts to nonmonetary uses, driving down the marginal utility of uncoined silver (and hence the relative price of silver). At the same time, gold flows into monetary uses to make up for the lost silver, which drives up the price of gold and maintains real balances constant. This brings the market ratio in line with the legal ratio.

FIGURE 1

Ratio of gold and silver stocks and market ratio



Source: Velde and Weber (2000).

were full of gold, hitherto untouched. Figure 2 shows how large this discovery was, relative to existing stocks, and how the ensuing flow of new gold remained large into the early twentieth century.

Returning to figure 1, the market ratio ceases to be stable around 1873. In fact, the value of silver compared with gold collapses and reaches unprecedented levels by 1900. At the same time, major changes take place in the world's monetary system in rapid succession.

In December 1871, newly unified Germany announced that it would switch from the silver standard, predominant in the preexisting German states, to the gold standard. The Scandinavian countries followed in December 1872, as did the Netherlands a few months later. The year 1873 saw the collapse of bimetallism. Germany began implementing its move by retiring existing silver coins, selling them on the world market, and buying gold to coin in replacement. In February, the U.S. suspended the free coinage of silver (see the next section). By the end of the year, the European countries that collectively adhered to bimetallism within the framework of the Latin Monetary Union of 1865 (namely, France, Switzerland, Belgium, Italy, and Greece) had all restricted free minting of silver, and in 1878 they agreed to suspend it indefinitely. The price of silver fell. In 1892, Austria, traditionally a silver country but under an inconvertible paper currency, resumed convertibility; but, as the U.S. did after the greenback, Austria made its currency redeemable in gold, and only gold was freely minted. Russia did the same in 1897. In 1893, India suspended free minting of silver, and adopted a variant of the gold standard in 1899. Latin American countries, traditionally silver-based, increasingly switched to the gold standard. In the Far East, Dutch, English, and French colonies followed suit, as did the Philippines under U.S. control. By 1913, China was the sole major country with free minting of silver.

What explains the collapse of a system that had been working for decades? The very large shock to gold supplies in 1850 that is apparent in figure 2 is a clear suspect. The model tells us that a discovery of gold will lead to increased coinage of gold and displacement of silver, leading possibly to the complete replacement of silver. How large of a change in the supply of either metal can be accommodated by a bimetallic system will therefore depend on the shares of the metals in the monetary stock. If very little silver is coined to begin with, it would not take a large increase in gold supply to drive bimetallism to a gold standard. The stability of the market ratio around 15.5, the legal ratio in the European bimetallic countries, suggests that the

mechanics of bimetallism were operating as the model predicts, at least initially.

Further evidence comes from estimates of the share of gold in the French money stock, shown in figure 3. France, by its size and political importance, was the pivotal bimetallic country in Europe. Figure 3 shows that the share of gold in the French money stock mirrors the movements of the ratio of metals in figure 1. It rises sharply from 1850, then stabilizes in 1865, when silver discoveries in Nevada lead to increased production and coinage of silver, and starts falling slowly thereafter.

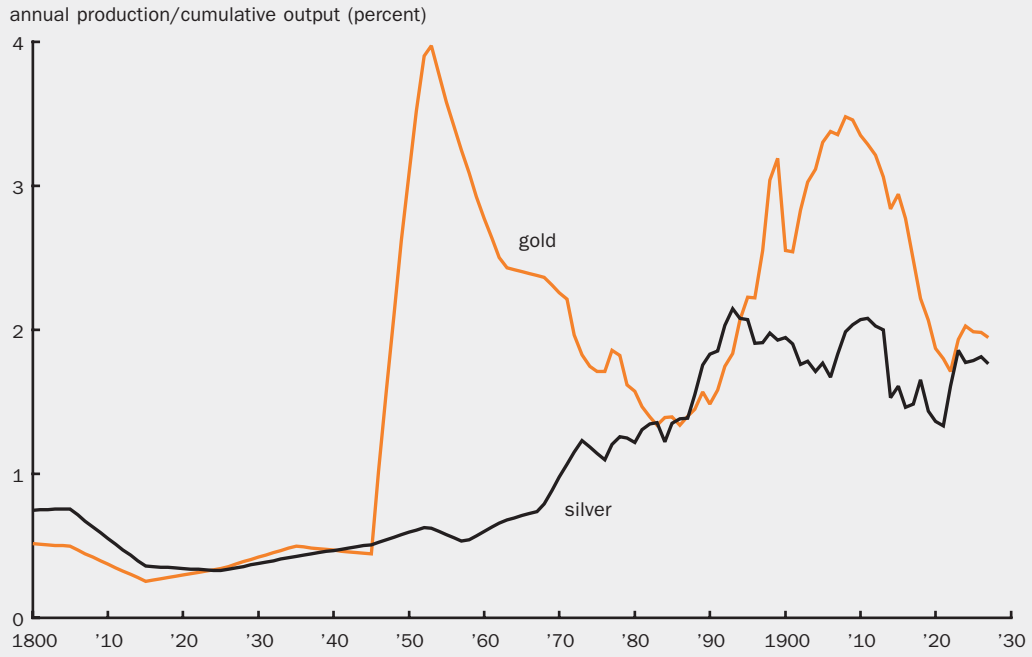
The model allows us to consider quantitatively whether bimetallism was nearing its breaking point, whether it could have survived longer, and whether the action of Germany alone could have precipitated its downfall. I use estimates of nonmonetary stocks of gold and silver and data on the market ratio between 1873 and 1913 to estimate a model of the demand for gold and silver. I then use this model to predict what the bounds on the ratio were. I do this under three counterfactual assumptions: One is that the monetary system of the world (who was on the gold, silver, or bimetallic standard) remained as it was up to 1871—I call this the 1871 system. The second is that Germany alone switches from the silver to the gold bloc—I call this the 1872 system. Third, I suppose that Germany, Norway, Sweden, the United States, and the Netherlands also switch to gold—I call this the 1873 system. Details of the model are in the appendix.

The model suggests three points. One is that, in the early 1870s, the world was indeed close to replacing all silver with gold and ending in a gold standard, but that the relative abundance of silver in the 1880s and 1890s would have removed that threat. The second is that Germany's switch to the gold standard actually relieved the immediate pressure on bimetallism: By increasing the monetary demand for gold, Germany was helping to absorb the vast quantities of gold that were threatening the bimetallic standard. The third point is that Germany, by decreasing the monetary demand for silver, was also raising the *lower* bound on the bimetallic ratio (the lower line in figure 4), since it gave the remaining silver and bimetallic countries a larger mass of silver to absorb into monetary and nonmonetary uses. Figure 4 shows even the move to gold by Norway, Sweden, the Netherlands, and the U.S. was not enough to turn bimetallism into a silver standard, at least immediately.

These conclusions make the sudden collapse of bimetallism in 1873 something of a mystery. If bimetallism could continue, and if Germany's choice

FIGURE 2

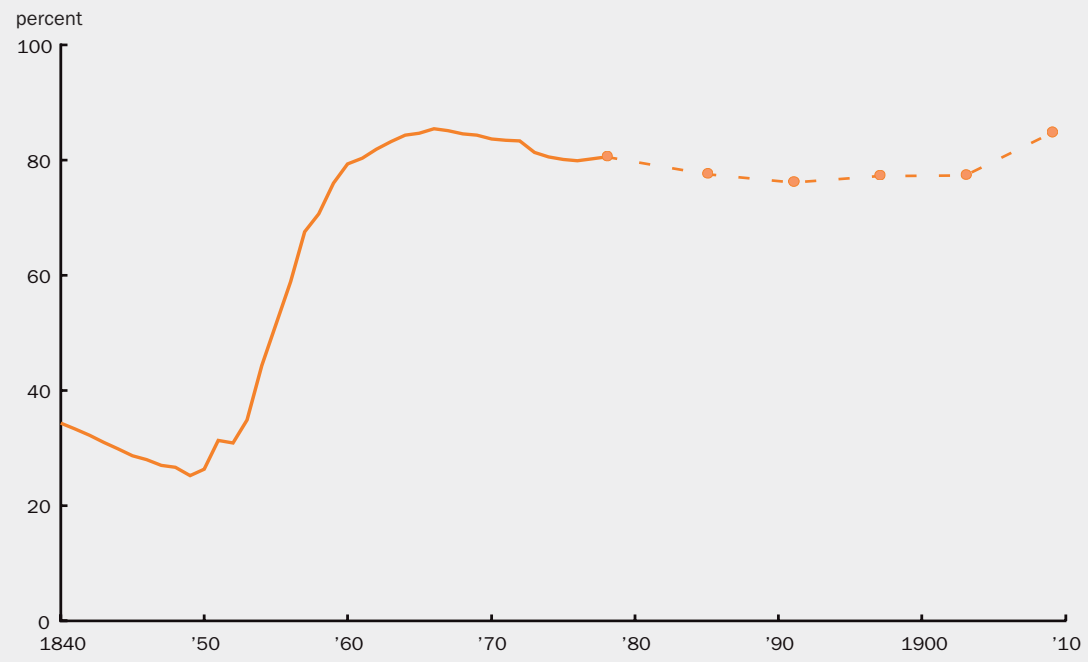
Annual world production as percentage of existing stocks, 1800–28



Source: Velde and Weber (2000).

FIGURE 3

Gold share of total French coin stock



Sources: Flandreau (1995) and Sicsic (1989).

of monetary regime actually made it easier to do so, why the sudden rush to abandon bimetallism?

Bimetallism could have survived long after 1873; it only took enough countries to remain committed to silver, either alone or in a double standard. Conversely, once silver was abandoned by enough countries, its price fell and anyone who stayed on that standard endured a depreciating currency and inflation. The currency depreciates, moreover, not only because its exchange rate falls, but also because the value of the country's money stock, as metal, is falling: The coins are literally losing their value.

The politics of the Latin Monetary Union after 1873 illustrates the problem (Willis, 1901). Founded under the aegis of France in 1865, the union consisted of setting a common bimetallic standard for all member countries and making all coins legal tender throughout the union. As long as the market value of a coin was very close to its face value, be it gold or silver, this was a relatively innocuous provision. With the collapse in the price of silver, free minting of silver was suspended by the member states in 1873. The silver coins remained legal tender everywhere but were now a token coinage. Did the issuing state bear any responsibility to redeem silver coin in gold at its face value? The question was posed when the treaty came up for renewal in 1878, and countries found that a sizable amount of their silver coinage was circulating in other states. Much as some states wished to leave the union, they could not afford to redeem the coins, and were forced to remain. They eventually developed a framework for the redemption of the coins, and the union continued with a limping standard until after World War I.

This suggests an explanation for the events of 1873. Once the commitment to bimetallism of a few countries wavered, there was a rush for the door, so to speak. The last one to abandon silver would be left holding the bag, namely, a lot of depreciated silver coins. Germany moved first, and for a few years was able to sell its silver stock at 15.5:1 for gold. When the price of gold started rising, it halted its silver sales, and resigned itself to a limping standard. Other countries like France were able to suspend free minting of silver while their holdings of silver were still relatively low. Indeed, figure 3 shows that France was in fact simply letting itself go to a gold standard, exchanging its silver at 15.5:1, when the growth in silver output of the 1860s, followed by Germany's decision, reversed the trend and made it acquire silver. Should bimetallism ever end, it would be left holding the bag. Faced with that possibility, it may have seemed better to abandon bimetallism.

The collapse of 1873 reflects a deep feature of my model of bimetallism. Recall that the model displays a multiplicity of equilibria, represented by the range of possible gold–silver ratios; at the extremities of that range are the gold standard and the silver standard. This multiplicity is a familiar result for fiat currencies in models that only generate demand for one type of currency; with two currencies, there is nothing to pin down the real value of balances held in either form, as long as the rates of return are the same on both. In a commodity money system, a similar effect takes place, except that quantities of gold and silver jewelry have to adjust in order to maintain equal rates of return on both currencies (that is, maintain a fixed price ratio). What is properly an indeterminacy in a fiat money world (nothing determines nominal prices, and real prices and quantities are identical in all equilibria) is a multiplicity in the bimetallic world (some quantities are different across equilibria, but some nominal values are indeterminate).

The collapse of 1873 may be seen as a sudden shift from one equilibrium (bimetallism at a 15.5 ratio) to another equilibrium (a gold standard equilibrium). What prompts the sudden shift is the fact that, while monetary functions are carried out just as well by a mixture of gold and silver at a 15.5 ratio, or by gold alone, the relative price of gold and silver can be very different in the two cases. In other worlds, holders of silver are not indifferent at all about which equilibrium prevails. In the 1860s, France was on the verge of ridding itself of all silver, and then saw that it was acquiring silver again: This made it a potential loser should bimetallism end. Rather than run the risk, France abandoned bimetallism, thus precipitating the event it feared. We will see that the interests of holders of silver were also at play in the American segment of our story.

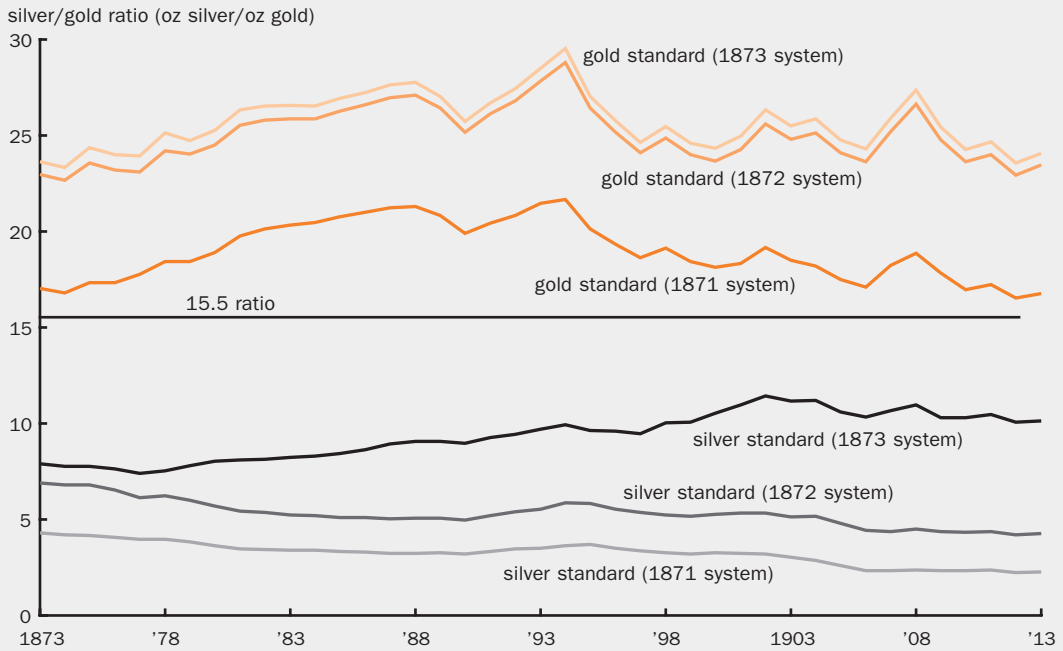
The "crime of 1873"

In the United States, the end of bimetallism became known, by those who regretted it, as the "crime of 1873." Let us briefly review the historical background.

The United States had been officially on the bimetallic standard from 1792; coins of $1 and less were made of silver, coins of $5 and more of gold. Initially, the ratio was set at 15:1. In practice, very little was minted in either metal, mostly old Spanish silver continued to circulate (the "dollar" was in fact the colonial name of the Spanish piece of 8 reals, minted in abundance in Mexico with silver from Peru). In 1834, the ratio was changed to 16:1 by debasing the gold coin. In the late 1840s and early 1850s, the California discoveries resulted in a great amount of gold coins

FIGURE 4

Limits on gold–silver ratio implied by model, three counterfactuals



being minted—a new mint had to be set up in San Francisco to handle the flow. At the same time, as the model predicts, silver coinage was melted down. The loss of small coins became particularly acute, prompting Congress to take a first step toward a gold standard in 1853.

Until then, fractions of the dollar, ranging in value from 5 cents to 50 cents, contained exactly the right amount of silver in proportion to their face value: A 5 cent coin contained 1/20 as much silver as the dollar, etc. After 1853, the fractions of the dollar contained only 93 percent of the silver that they used to. Moreover, their capacity as legal tender, which had been unlimited, became limited to debts of $5 or less. Finally, the coins were not issued freely in exchange for silver brought to the mint. Instead, the quantities minted were regulated by the Secretary of the Treasury, and the coins were to be sold to the public in exchange for gold coins.

This made the smaller denominations partly token: Their face value was 7 percent higher than justified by their content, and they were made on demand by the government. For these coins, the "legal ratio" (the ratio of the silver contained in $10 of dimes, divided by the gold contained in a gold eagle) was 14.88 instead of 16. For those coins at least, the threat of being melted down was held at bay. But the U.S. remained on a bimetallic standard, because the silver dollar was still minted on demand in unlimited quantities and was unlimited tender.

With the Civil War, the U.S. ceased to be on a bimetallic system. Instead, during the "greenback" era from 1862 to 1879, the government issued an inconvertible paper currency called the "greenback." It was legal tender just like coins. Instead of seeing bad money displace good money, gold coins continued to circulate, but at a premium over greenbacks, a premium that varied with the fortunes of war and reached 150 percent in 1864. Once the war ended, the premium fell back under 50 percent and slowly declined over time, as the government kept the quantity of greenbacks under tight control. After some debate, the decision was taken in 1873 to resume convertibility, scheduled for January 1, 1879.

Meanwhile, a law was passed in February 1873 to "revise and amend" minting laws. Of course, no minting had taken place during the years of the greenback era, since the mint would have paid any incoming gold or silver in greenbacks at face value. The act prescribes the minting of gold coins and subsidiary silver coins as before 1862, but does not mention the silver dollar at all. The silver dollar would not be coined on demand anymore.[6]

This was the "crime of 1873." Not much notice was taken at the time, but it became much more controversial later, during the deflation of 1879–96. The deflation had two sources. One was the fact that the U.S., having expanded its money supply in the form of greenbacks during the Civil War to finance its expenditures, now had to reduce it (or at any rate let it grow more slowly) in order to bring the value of greenbacks up to par. Resumption of convertibility, in fact, required that a dollar in greenback be worth the same as a dollar in gold. After resumption, however, deflation continued for another 15 years. The second source of deflation, one that affected all countries on the gold standard, was the fact that these economies' demand for gold, driven in part by income growth,[7] grew faster than the supplies of gold; and the fact that, because of the collapse of bimetallism, the number of countries on the gold standard increased as well.

One interest group suffered from the end of bimetallism, namely the silver producers of the western states. But the silver party drew wider support. The plank of a return to bimetallism at 16:1 was seen by many as a remedy to the deflation, which was hurting debtors, particularly farmers in the Midwest. A greenback party had formed to oppose the return to convertibility and the deflation that it required; that party disappeared after 1880, but the agitation then turned to silver.

The strength of the political forces aligned in favor of silver was never quite sufficient to reverse the crime of 1873. In practice, free minting of silver never returned. But the silver dollar regained full legal tender status in 1878, and from 1878 to 1893, the government was compelled by Congress to purchase quantities of silver and turn them into money. This, as well as the numerous nearly successful attempts at restoring free coinage of silver, was enough for some to question the United States' commitment to the gold standard for 30 years.

The monetization of silver took place under two distinct regimes. In the first regime, from 1878 to 1890, the Bland–Allison Act of 1878 required the U.S. Treasury to purchase between $2 million and $4 million in silver every month, at market value, and mint it into dollars (actual purchases were between $2 million and $3 million per month). By the end of 1889, there was $438 million in gold and $311 million in silver in circulation in the U.S. As a result, the United States was on a limping standard. Both metals were legal tender, but only one metal was freely minted. Coins of the other metal were becoming token: While the face value of silver dollars remained $1, the value of their intrinsic content, which was close to $1 when the market ratio

was close to 16, fell as the market ratio fell, to 80 cents by 1890.

The second regime of silver purchases began with the Sherman Silver Purchases Act of July 1890, which followed the shift in the balance of forces in Congress after five western states were admitted to the Union in 1889 and 1890. On the surface, the act seemed to go further toward monetizing silver, since it increased the required monthly purchases to 4.5 million ounces at market prices (about $4.5 million at the time). This represented the whole silver production of the United States and about 40 percent of world silver production. However, Treasury policy actually mitigated the effect of the act in the following way. The amount was specified in ounces and, as the market price of silver fell, so did the amount spent. The purchased silver, rather than being minted into dollars, was to be held by the Treasury as bullion. In payment of the bullion, the Treasury issued notes which were fully legal tender and redeemable on demand into gold or silver at the Treasury's discretion. Had the Treasury systematically redeemed them in silver, the effect would have been the same as simply minting the purchased silver. The Treasury in fact pursued a policy of redemption in gold. In effect, the government was mandated to buy a given amount of some commodity, and issued (gold-backed) notes in payment.

The seeds of further trouble, the "disturbed years from 1891 to 1897" (Friedman and Schwartz 1963, p. 104) were contained in the act. The mandated purchases of silver were adding a strain on government finances, increasing expenditures by 25 percent at a time when the McKinley Tariff Act reduced revenues. The result was the disappearance of the federal surplus by 1893. The U.S. federal government finished the fiscal year 1890 with a surplus of $105 million and a gold reserve of $190 million. By June 1894, with $134 million in Treasury notes outstanding, the surplus had turned into a $70 million deficit. The act also left the Treasury holding a growing and increasingly worthless stockpile of silver. In July 1890, when the act was passed, silver was worth $1.06 per ounce. By November 1893, it had fallen to 72 cents. Over that period, the Treasury had bought 169 million ounces of silver, at a cost of $156 million, which, as of November 1893, was worth $121 million. Should the Treasury decide to mint its silver, it could turn each ounce into $1.29 of legal tender, making its stockpile worth $218 million. In effect, the government held a large put option on the private sector.

What prevented the Treasury from exercising that option, by coining its silver and repaying the outstanding notes with it? Nothing but its own interpretation of the law that "the policy of the United States [is] to maintain the two metals on a parity with each other upon the present legal ratio." In other words, the policy of redeeming notes in gold at par could change overnight. Redeeming notes in silver instead of gold would mean an abandonment of the gold standard and a large devaluation.

Should the government run out of gold with which to redeem its notes, it might well be led to redeem them with silver. The very prospect led many to present their notes for redemption in exchange for gold. As a result, the government's gold reserve, which was intended to secure the parity of the legal tender notes (the remaining greenbacks of the Civil War), dwindled from $190 million in June 1890 to $65 million in June 1894.

The years 1893–94 bear interesting similarities with modern currency crises: rising deficits, shrinking reserves, capital flight, and speculation against the currency (Grilli, 1990, and Miller, 1996). President Cleveland took office in March 1893, and his administration's commitment to the gold standard seemed open to question when the Treasury secretary was saying that the Treasury would redeem its notes in silver if it was "expedient" to do so. In June 1893 India suspended free coinage of silver and the price of silver immediately fell. This prompted a major banking crisis, with hundreds of banks failing, and a sharp recession, with industrial production falling by 27 percent between April and September.

The Treasury nevertheless continued to redeem its notes in gold. Faced with a dwindling reserve, it tried to sell bonds for gold. The only bonds it had legal authority to issue were "coin bonds," which were redeemable in coin, that is, either gold or silver, and Congress refused to authorize gold bonds, arguing that the Treasury ought to use its large silver stockpile. The Treasury therefore had to pay a risk premium on the bonds it was able to sell, because of the risk that they would be paid at maturity in silver; and when a bond issue was announced, notes were presented for redemption to withdraw gold in order to sell it back to the Treasury. This "endless chain" was repeated several times.

The matter came to a head with the election of 1896, in which Republicans promised to return to bimetallism as soon as a worldwide consensus to do so could be arranged, while Democrats argued for a return to bimetallism at a 16:1 ratio, "without waiting for the aid or consent of any other nation." William Jennings Bryan, the Democratic nominee, campaigned for bimetallism with a speech known for its peroration: "You shall not press down upon the brow of

labor this crown of thorns, you shall not crucify mankind upon a cross of gold."[8] He lost the election to the Republican William McKinley.

The year 1896 was the high watermark of bimetallism in the U.S., even if it took a few years to formally seal the country's commitment to gold, partly because of the silver party's continued clout in the Senate[9] and partly because McKinley's first term was taken up with tariffs and the Spanish-American War. In March 1900, however, the Gold Standard Act was passed, unambiguously defining the U.S. dollar as 23.22 grains of fine gold. It also enacted that "all forms of money issued or coined by the United States shall be maintained at a parity of value with this standard, and it shall be the duty of the Secretary of the Treasury to maintain such parity" and maintained the legal tender status of the silver dollars; moreover, the Treasury notes issued since 1890 could now only be repaid by the Treasury in gold. A gold reserve was created, and the Treasury was authorized to borrow in order to maintain that reserve.

In the ensuing years, the root cause of the silver agitation disappeared, as deflation turned to inflation in the wake of large gold discoveries in Australia and Alaska and improvements in methods of extraction. The U.S. would remain firmly on the gold standard until 1934.

What if?

Friedman (1990a, b) revisits the crime of 1873. In his estimation, the "crime" of 1873, although not a crime, was a mistake. Had the U.S. restored its bimetallic minting policies in 1873, it would have effectively been on a silver standard and, by his calculations, would have enjoyed a steadier price level than it did.

I can use my model to evaluate one assumption underlying Friedman's calculations. He assumed that the rest of the world would have pursued the monetary policies it did, and that the U.S. would necessarily have been on a silver standard. That is, the ratio of 16:1 would have been outside of the bounds I defined earlier. Figure 5 shows that, in my model, this would not have been so, at least initially. Indeed, in the 1870s the U.S. would still have been on a gold standard, and, from 1880 to 1903, it would have been effectively bimetallic. During that period, movements of the price level in the U.S., in the gold-standard countries, and in the silver-standard countries would have been the same. As Velde and Weber (2000) show, bimetallism does stabilize the price level relative to either single standard, as long as the shocks affecting the markets for each metal are not perfectly correlated.

However, figure 5 also shows that, ultimately, the U.S. would have been forced onto silver. This is partly due to the growth in the number of gold-based countries and their increasing demand for gold as a medium of exchange, the very causes of the deflation experienced by gold-standard countries in that period. Over the course of the 1880s and 1890s, that demand would have progressively drained the U.S. of its gold coinage. But the other factor driving the bounds in figure 5 upward is the progressive abandonment of silver by other countries, notably Austria, Russia, and India. Those countries might perhaps have stayed with silver had the U.S. remained bimetallic and held out the prospect of continued stabilization of the gold–silver ratio. Indeed, one might speculate that, as far back as 1873, a U.S. commitment to bimetallism might have persuaded France to keep its mints open to silver.[10]

The need for cooperation on the "international financial architecture" was well understood at the time. While Bryan and his more extreme followers rejected it, moderate supporters of bimetallism in the U.S. insisted that international cooperation was needed to make a return to bimetallism a realistic proposition. But the difficulties of achieving such cooperation after the events of 1873 is illustrated by an international conference that took place in August 1878 in Paris.[11] According to the report of the American delegates, the participants for the most part adhered to the notion that silver had a monetary role to play, a change from the 1865 international monetary conference that had endorsed the gold standard. But the European delegates did not believe there was anything that could be done about the fall in the price of silver, whereas the Americans believed that "a policy of action" could alter it. The Europeans were not a little suspicious of American intentions and abilities, plausibly reading the support for bimetallism as a disguised push for inflation.

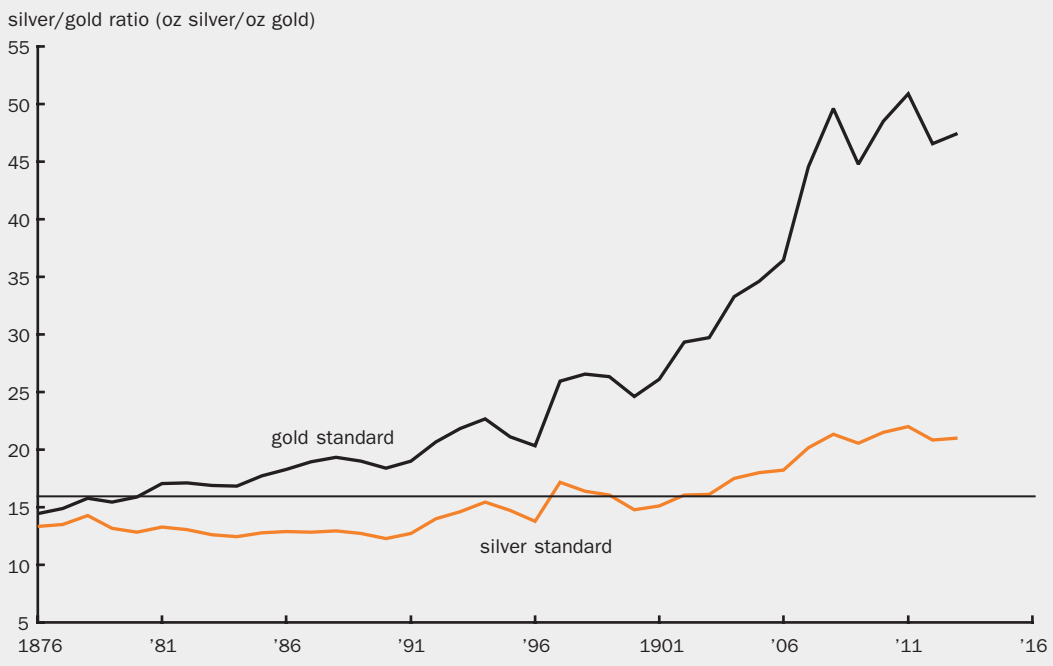
Nevertheless, a maintained commitment to bimetallism would have altered politics inside the U.S. and the country's relations with other countries. Whether U.S. adherence to bimetallism could plausibly have convinced other countries, such as India, to stay on silver and whether this would have prolonged bimetallism up to World War I are questions for future research.

Conclusion

The very fact that bimetallism was abandoned by all countries that adhered to it in a short space of time has been seen, in and of itself, as an indictment of that monetary system. I show that bimetallism was not an absurdity. Rather, economic theory predicts that such a system would have a multiplicity of possible outcomes,

FIGURE 5

Limits on gold–silver ratio, U.S. alone on bimetallism



Note: Assumes U.S. alone is on bimetallism, with a gold–silver ratio of 16:1.

ranging from a low to a high gold–silver ratio, corresponding to a silver standard and a gold standard, respectively, with bimetallic regimes for all the intermediate ratios. The parameters determining the range include the number of countries that are willing to use silver or gold indifferently as money. Thus, bimetallism was a viable monetary arrangement that could be maintained for long periods, if enough countries adhered to it.

Moreover, the sudden collapse is understandable as a consequence of the very property that made bimetallism viable: Should the number of countries suddenly change, bimetallism might not be feasible at the existing ratio anymore, prompting a switch to either the gold or silver standard, with potential losses for holders of the other metal. Rather than be the last one left with silver, countries rushed for the door in 1873 and adopted the gold standard.

Thus, the decision to abandon bimetallism might seem justified *a posteriori*, but not necessarily *a priori*. I show that the United States could have plausibly remained on a bimetallic standard after 1873, in spite of what other countries were doing. But other forces were at work—growth rates in gold-standard countries and flows of new discoveries—that could have ultimately forced the United States off bimetallism. It would then have had to choose between the yellow brick road and the white brick road, and the speculative attacks that plagued the U.S. dollar in the 1890s would no doubt have accompanied that difficult decision.

APPENDIX: COMPUTING COUNTERFACTUALS

I wish to compute two counterfactuals. The first one assumes that the monetary systems of all countries remain unchanged from 1871 to 1913 and determines whether bimetallism could have continued, or whether the gold standard was bound to occur. To answer this question, I compute the values of the gold–silver ratio at which a gold standard and a silver standard become inevitable for each year.

The second counterfactual assumes that the "crime of 1873" did not take place, and that the United States had remained on a bimetallic standard at 16:1 which, in practice (given what all other countries did), would have meant a silver standard. Would the price level have been more stable as claimed by Friedman (1990a, b)?

My strategy is to use historical data to compute or estimate parameters of the model, and then modify certain parameters as dictated by the counterfactual assumptions. Then I compute the values of the endogenous variables (prices and quantities) by solving the model's steady state equations for the new parameters.

Data

I make use of the following annual data, from 1873 to 1913:

1. the average value in December of the gold–silver ratio,
2. the total stock of gold and silver in the world at the end of the year, and
3. the stock of gold and silver coin in each country at the end of the year.

Series 1 and 2 are described in Velde and Weber (2000). The same paper uses worldwide stocks of gold and silver coin in 1873, taken from Kitchin (League of Nations, 1930) and Drake (1983). With these series, however, the ratio of gold to silver nonmonetary stocks rises by 15 percent from 1873 to 1890, even as silver depreciates by percent relative to gold. This is difficult to reconcile with the kind of preferences for gold and silver that I wanted to use.

Kitchin and Drake both estimated monetary stocks as residuals: They estimated how much gold and silver was produced each year, and how much went into industrial uses, the remainder accruing to money stocks. To get another estimate, I added up directly national money stocks for each year. The *Annual Reports* of the Director of the Mint provide estimates of these stocks for a growing list of countries in 1873, 1878 to 1883, 1892 to 1907, and 1909 to 1913. For a number of countries, better and continuous series can now be found. Thus, for the United States, the United Kingdom, Germany, France, Italy, Spain, Portugal, the Netherlands, and Japan, I have used the same sources as Rolnick and Weber (1997). Furthermore, for India, I have relied on Atkinson (1909) and Keynes (1913). These countries together accounted for about 50 percent to 55 percent of world output in that period (based on Maddison, 1995). They thus represent a large, but not sufficient fraction of the world. I have relied on the Director of the Mint's estimates for the remaining countries.

As it turns out, the estimates for 1873 are quite close to those of Kitchin and Drake as used in Velde and Weber (2000), but diverge after that date. Figure A1 plots the market ratio against the ratio of estimated stocks. The slope is negative, which is an improvement.

Estimation

The specification of preferences over stocks of nonmonetary metal that I use is a constant elasticity of substitution:

$$v(d_1,d_2) = [(ad_1)^{\rho} + d_2^{\rho}]^{1/\rho}.$$

My specification obviates the need for a time series of world income.

In equilibrium, the market ratio is the ratio of marginal utilities:

$$e = a^{\rho}\left(\frac{d_1}{d_2}\right)^{\rho-1}.$$

I regress the log of the ratio of worldwide nonmonetary stocks of silver to those of gold on the log of the market ratio and a constant:

$$\log(e) = \alpha \log\left(\frac{d_1}{d_2}\right) + \beta.$$

As figure A1 suggests, there is a somewhat anomalous period from 1893 to 1903. In 1893, India discontinued free minting of silver, and at the same time Austria and Russia committed to a gold standard and the American silver purchases came to an end. The resulting fall in the price of silver was not accompanied by an immediate adjustment in quantities (see the horizontal movement in figure A1). I use the sample from 1873 to 1892 and 1904 to 1913 only. By ordinary least squares (OLS), I find $\alpha = -0.23$ (standard error: 0.022) and $\beta = -2.36$ (standard error: 0.068). I then estimate $\rho = 1/\alpha + 1$ and $a = \exp\left[-\beta\left(\frac{\rho-1}{\rho}\right)\right]$, and I find $\rho = -3.34$, or an elasticity of substitution between gold and silver of 0.23. It is not very satisfactory to exclude

the 11 observations from 1893 to 1903. A modified version of the model with adjustment costs would probably better match the data, at the cost of some complexity.

Counterfactual

The aim is to determine the range of possible gold–silver ratios for which bimetallism was possible ($[\underline{e},\overline{e}]$ in the notation of box 1). The upper end of the range $\overline{e}$ corresponds to the point at which as much silver as possible is in nonmonetary uses (driving down its value relative to gold), and the world uses no silver as money. In reality, a significant part of the world was under a silver standard, in which gold could not have replaced silver as medium of exchange, so the limit on silver in monetary use is not 0, but rather the amount necessary to carry out transactions in the silver countries. Likewise, the lower end of the range, $\underline{e}$, corresponds to the point at which only gold-standard countries use gold.

Let ξ_s (respectively, ξ_g) be the share of world transactions carried out in silver-standard (respectively, gold-standard) countries. Then, at the upper end of the range of ratios, the stocks of gold and silver in nonmonetary uses are such that

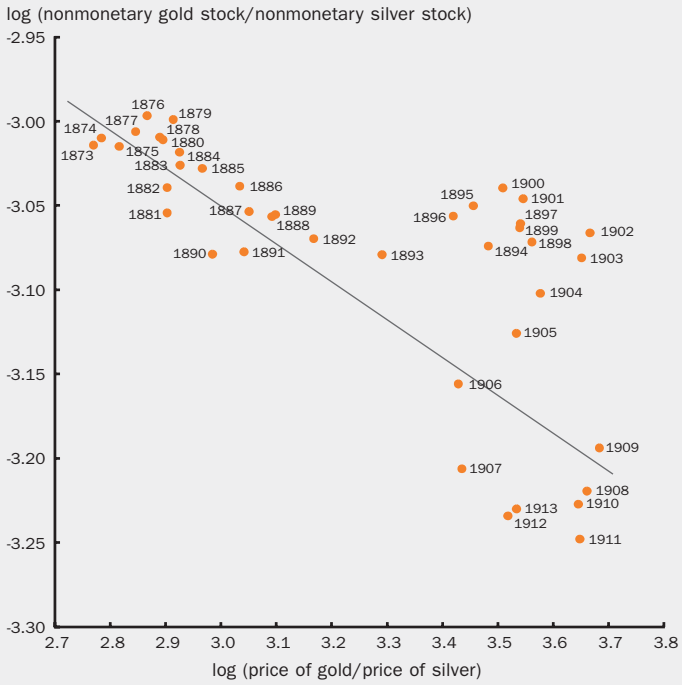
7) $(Q_1 - d_1)v_1(d) = \xi_g x, \qquad (Q_2 - d_2)v_2(d) = (1 - \xi_g)x,$

where x is the world volume of transactions (the left-hand side in equation 6, box 1). Similarly, at the lower end,

8) $(Q_1 - d_1)v_1(x) = (1 - \xi_s)x, \qquad (Q_2 - d_2)v_2(d) = \xi_s x.$

FIGURE A1

Gold–silver market ratio plotted against ratio of estimated world nonmonetary stocks



Notes: Gold–silver market ratio is the December average for each year. Estimated worldwide nonmonetary stocks are in logs. The regression line is computed using 1873–92 and 1904–13 only (see text).

Having the actual money stocks and values for the parameters of preferences, I compute a series for x for 1873–1913. I find the series ξ_s and ξ_g by taking the money stocks of the countries that were on a silver standard in 1871, as share of the world money stocks. I can solve for d_1 and d_2 in equations 7 and 8 and compute the corresponding ratio of marginal utilities, that is, the gold–silver ratio. The results are shown in figure 4 (p. 50).

NOTES

[1]They became ruby slippers in the movie version.

[2]Other gold coins were minted as well (double eagles and half eagles).

[3]A troy ounce contains 480 grains.

[4]This narrative draws on Flandreau (1996), Redish (2000), Friedman and Schwartz (1963), and Dewey (1922).

[5]One could also use any linear combination of goods in fixed proportion, defining the dollar as *X* ounces of gold *and Y* ounces of silver. This system, proposed by Alfred Marshall, is called *symmetallism*.

[6]The Revised Statutes of 1874 limited its legal tender to debts of $5 or less.

[7]Real per capita income grew by 20 percent in the U.S. and 27 percent in the United Kingdom during the deflation of 1879–96 (Maddison, 1995).

[8]Bryan can be heard delivering his speech on the Web at <www.historicalvoices.org/earliest_voices/bryan.html>.

[9]In 1898, the Senate passed a resolution declaring that repayment of the U.S. debt in silver did not constitute a breach of faith.

[10]The matter of the differing legal ratios in the two countries (15.5 in Europe and South America, 16 in North America) would necessarily have been addressed. Prior to the Civil War, costs of transportation and information probably restricted the ability of arbitrageurs to narrow the gap between the ratios across the Atlantic.

[11]The Bland–Allison Act of 1878 had required the U.S. president to invite foreign governments to an international conference on restoring bimetallism.

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