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## *The Evolution of the Gold Standard in England*

ANGELA REDISH

In 1816 England officially abandoned bimetallism and made silver coins into tokens that were only limited legal tender. Earlier monetary authorities had lacked the ability to manage a subsidiary coinage, a necessary complement to the monometallic gold standard. A successful token coinage must be both costly to counterfeit and credibly backed to ensure that the tokens do not depreciate to their intrinsic value. These problems were solved in the nineteenth century through the introduction of steam-driven stamping presses and with the assistance of the Bank of England.

**I**n 1816 England ended its official policy of bimetallism and adopted a single gold standard with a gold coinage complemented by a token silver coinage. This monetary system was so successful that it has become the benchmark against which monetary regimes are measured. Yet despite extensive analysis of the gold standard, few economists or economic historians have questioned why this apparently ideal system took so long to emerge. In this article I argue that the critical characteristics of the nineteenth-century gold standard were that it enabled coins of a variety of denominations, in convenient sizes, to circulate at par and that the relative values of coins were expected to remain fixed. I argue that these characteristics could not both be achieved by a single-commodity money; therefore, the gold standard's success depended on the concurrent circulation of the token silver coinage. Finally, I argue that it was not feasible to establish a stable token coinage prior to the nineteenth century.

The historical literature has typically explained the emergence of the gold standard as a matter of happenstance: the legislation of 1816 merely ratified the *de facto* gold standard that had existed in England since

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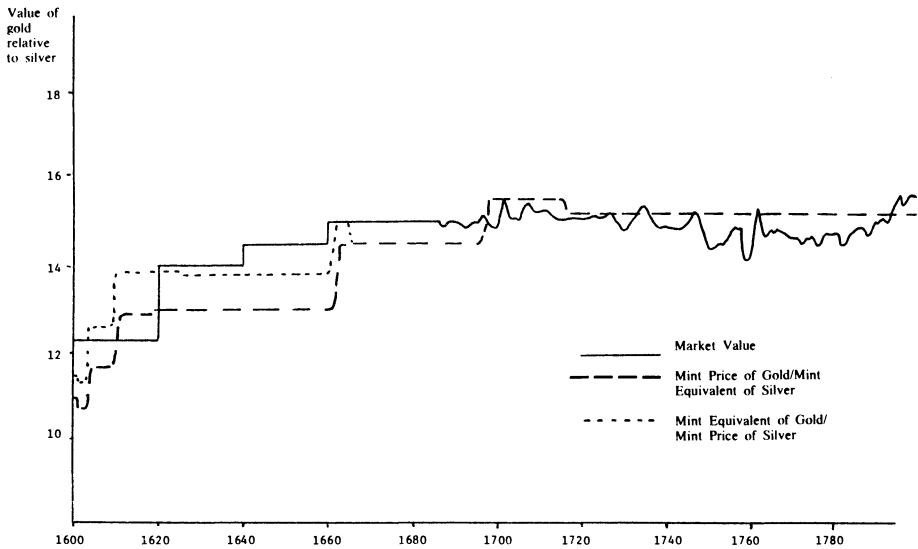


FIGURE 1

## ENGLAND'S VALUATION OF GOLD, 1600-1800

Sources: Mint prices, mint equivalents: A. Feavearyear, *The Pound Sterling* (Oxford, 1963); Market value: J. Laurence Laughlin, *The History of Bimetallism in the United States* (New York, 1885).

Newton's "inadvertent" overvaluation of gold at the beginning of the eighteenth century.<sup>1</sup> This analysis is incomplete for several reasons. First, it ignores earlier monetary history. In the early seventeenth century England had overvalued gold, and silver coin had been driven from circulation (see Figure 1), yet England did not adopt a gold standard. Second, there is no explanation of why the decision to ratify did not occur until 100 years after the overvaluation of gold. Finally, the legislation did not merely ratify the existing monetary system. Under the de facto eighteenth-century gold standard, high-denomination gold coins circulated, but virtually no small-denomination coins were in circulation.<sup>2</sup> The significance of the 1816 legislation is that it introduced token coins that provided a small-denomination medium of exchange. It is the gold standard of the nineteenth century, under which coins of high

<sup>1</sup> Richard N. Cooper, *The International Monetary System* (Cambridge, MA, 1987), pp. 44-45. Similarly, Feavearyear argued that "England did not establish the gold standard by any conscious and deliberate act, and it is doubtful whether anyone foresaw that it would establish itself"; Sir A. Feavearyear, *The Pound Sterling* (Oxford, 1963), p. 142. See also Charles P. Kindleberger, *A Financial History of Western Europe* (London, 1982), p. 59.

<sup>2</sup> It is not clear what people used in the absence of small-denomination coins. Various authorities discuss the manufacture of lightweight counterfeits of farthings and halfpennies (for example, see Peter Seaby, *The Story of British Coinage* [London, 1985]), and presumably there was some demonetization of this part of the economy. For a discussion of these issues, see Angela Redish, "The Monetary Economy of the Labouring Poor in England, 1500-1800" (Ms., University of British Columbia, 1990).

and low denomination circulated concurrently, that is held up as a benchmark, not the monetary chaos of the eighteenth century.

Frank Fetter and Derek Gregory have previously noted that the decision to adopt the gold standard was made “largely on the basis of details of small coin convenience, and not on larger issues of economic policy.”<sup>3</sup> But they preface this conclusion with the comment that “It is amazing that a decision of such importance for England, and by England’s example for the entire world, should have been made without benefit of full analysis.”<sup>4</sup> I maintain that the basis for the decision is not at all amazing: it was the problem of small-coin convenience that had prevented England from adopting a monometallic standard centuries earlier.

A gold standard with token silver coinage would provide a more convenient and therefore less costly medium of exchange than a bimetallic standard. Technological difficulties (the threat of counterfeiting) and institutional immaturity (no guarantor of convertibility), however, made management of such a coinage impossible prior to the nineteenth century. At the turn of the century improvements in minting technology and the Mint’s acceptance of its role in maintaining the value of the tokens led to the success of the token coinage.

#### I. THE MECHANICS OF BIMETALLISM

Under a bimetallic standard, coins of two metals are given legal tender values in the unit of account. For example, in England in 1615 the silver sixpence and the gold unite were legal tender. The sixpence was  $1\frac{1}{2}$  pure (or fine) silver, weighed 46.8 (Troy) grains, and was valued at six pence. (The unit of account was the pound sterling, comprising twenty shillings [20/-], each of twelve pence [12d].) The unite was made of 22-carat gold, weighed 140.8 grains, and was valued at 20 shillings. Coinage was free in the sense that anyone could bring metal to the Mint for coining—at a price.<sup>5</sup> The Mint bought fine gold at 72/- per Troy ounce (of 480 grains) and fine silver at 64.91d per Troy ounce. The ounce of fine silver was coined into 11.19 sixpenny pieces worth 67.13d (called the mint equivalent [ME] of silver), and therefore there was a residual of 2.22d per ounce to cover Mint expenses and the king’s seignorage. Similarly, the ounce of gold that the Mint bought for 72/- was coined into 3.72 unites worth 74.4/- (the ME of gold).<sup>6</sup>

<sup>3</sup> Frank W. Fetter and Derek Gregory, *Monetary and Financial Policy* (Dublin, 1973), p. 16.

<sup>4</sup> This is a view more recently espoused by M. Friedman, “Bimetallism Revisited,” *Journal of Economic Perspectives* (forthcoming).

<sup>5</sup> Free coinage refers to the Mint being required to buy metal from all sellers, not to gratuitous minting. See further.

<sup>6</sup> The quantity of gold and silver coin in circulation was determined by market forces. The Mint should be thought of as an agency that for a fee stamped out coins from metal brought to it. The exchange rate was determined by the numeraire values attached to silver and gold coins by

The objective of adopting a bimetallic standard was to permit concurrent circulation of gold and silver coins at par, thus providing an efficient medium of exchange. Consider the alternatives. If only gold coins were minted, the coins for small retail transactions would be tiny: in 1615 the smallest gold coin—the half crown—weighed 1.14 grams, had a diameter of 16 millimeters, and was valued at  $2/6$ . (Today's Canadian dimes weigh approximately 2.3 grams.) A smaller gold coin would have been very inconvenient, yet  $2/6$  represented four days' wages for a laborer.<sup>7</sup> On the other hand, if only silver coins were minted, they would be very cumbersome for mercantile trade. Silver coins would have weighed thirteen times the same value in gold coin.

A third possibility would be a silver standard in which silver coins were complemented by gold coins with gold coins not given a legal tender value. (If it wished to, the Mint could continue to charge its minting fees.) This would effectively demonetize the gold coin. While demand might exist for such coins, to obviate the costs of using large amounts of silver coins for high-value transactions, it would be less than if gold and silver coins were both given legal tender values because agents would bear information costs in determining (or bargaining over) the value of their coins as well as their merchandise. In addition there would be risks of capital gains and losses to which those who received payments in one metal and made payments in the other would be particularly vulnerable.<sup>8</sup>

The objective of concurrent circulation imposed constraints on the choice of Mint prices (MP) and Mint equivalents of the two metals, and only one of the four variables was a free parameter that the monetary authority could set arbitrarily. To be more precise, define as correct a setting of mint prices and mint equivalents such that agents with foreign debts are indifferent between exporting gold and silver. Those who are owed debts, it follows, are also indifferent between importing gold and

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individual nations. Such terms as "guaranteeing convertibility" or "maintaining the exchange rate" have no meaning in this context.

<sup>7</sup> Henry Phelps Brown and Sheila V. Hopkins, *A Perspective of Wages and Prices* (London, 1981), p. 11. The attempt to introduce a quarter-guinea coin weighing 2.09 gms failed in 1718: "A piece so tiny, and so readily lost, was entirely unacceptable to the British public." J. Craig, *The Mint* (Cambridge, 1953), p. 21. Notwithstanding this small size, essayists in the mid-eighteenth century recommended minting such a coin to reduce the scarcity of small change (*Gentlemans' Magazine*, 1761, p. 615); see also J. Waugh, "Reflections on Coins in General" (London, 1762), reprinted in *A Select Collection of Scarce and Valuable Tracts on Money* (New York, 1966). The quarter guinea (worth  $5/3$ ) weighed less in 1718 than the 1616 crown (worth  $5/-$ ), because the price of gold rose by 16 percent between 1661 and 1717.

<sup>8</sup> Although such a system was occasionally considered, notably in France in 1803, it was never officially implemented because of these costs. The costs of varying rates of exchange between two coins are very similar to those imposed today by the multiplicity of national monetary units. Under flexible exchange rates, agents who wish to use a foreign currency must bear both the costs of finding out the exchange rate and the risks of depreciation or appreciation. Of course today, forward markets reduce the latter costs.

silver. Thus, if there is initially concurrent circulation of gold and silver coins, both will remain in circulation.

Now consider a small open economy in which the monetary authorities establish a fixed mint equivalent of gold ( $\overline{MEg}$ ). Assume that there is a large world bullion market in which the relative price of gold to silver is  $R$ .<sup>9</sup> Further, ignore for the moment all transactions costs other than domestic minting fees (seignorage and brassage), denoted by  $s_i$ , where  $i$  equals silver or gold. In the event of a balance-of-payments deficit a domestic (goods) importer will have to make payments by shipping either gold or silver. By definition of  $R$ , if the foreign debt requires payment of  $X$  ounces of gold, it could be paid with  $R$  times  $X$  ounces of silver. Payment in gold would require melting down coins worth  $X$  times  $\overline{MEg}$ , while payment in silver would require melting down coins worth  $R$  times  $X$  times  $MEs$ . The domestic importer will do whichever is less costly and will be indifferent between the two options if

$$MEs = (1/R) \overline{MEg} \quad (1)$$

A balance-of-payments surplus implies that a foreigner must ship gold or silver to England. If the foreigner's debt is  $\text{£}X$ , the foreigner can ship  $(X/MPg)$  ounces of gold or  $(X/MPs)$  ounces of silver. For the foreigner, one ounce of gold is worth  $R$  ounces of silver, and the foreigner will be indifferent between shipping gold and silver if  $(R \cdot X/MPg)$  equals  $(X/MPs)$ , or

$$MPs = (1/R) MPg \quad (2)$$

The final constraint on the actions of the monetary authorities is the threat of counterfeiting. Assume that counterfeiting is costly but feasible, and let  $c_i$ , where  $i$  equals silver or gold, represent the costs of producing counterfeit coins from one ounce of metal  $i$ . Counterfeiting is profitable whenever

$$MPi + c_i < MEi \quad (3)$$

so that the amount of minting fees ( $s_i$ ) must be less than or equal to  $c_i$ .<sup>10</sup> As  $MEi$  equals  $MPi$  plus  $s_i$ , if equation 3 is binding, equation 1 to equation 3 establishes  $MPg$ ,  $MEs$ , and  $MPs$  in terms of the exogenous variables  $\overline{MEg}$ ,  $R$ ,  $S_s$ ,  $S_g$ ,  $C_s$ , and  $C_g$ .

<sup>9</sup> This simplifying assumption obviates the need for dealing explicitly with mint prices and mint equivalents in other countries and implicitly assumes that the foreign buying and selling prices of gold and silver are the same.

<sup>10</sup> The condition for profitable counterfeiting is more accurately stated as  $Pi + c_i < MEi$  (where  $Pi$  is the market price of the metal), but when ratings are correct,  $Pi$  equals  $MPi$ . When ratings are incorrect, for the relatively overvalued metal  $MP$  equals  $P$ , so that this condition constrains seignorage on the overvalued metal. Other factors affected the level of minting fees, particularly competition between national mints. From 1666 to 1816 such fees were zero for both gold and silver coins in England.

If transactions costs are incorporated, the conditions are slightly more complex. Let  $d_i$ , where  $i$  equals silver or gold, represent transactions costs (in domestic unit of account per ounce) of exporting or importing gold and silver, respectively. These costs include transportation, insurance, interest on metal at the Mint waiting to be coined, commissions, and so forth. Traders in this environment will be indifferent between shipping gold and silver if

$$R = (\overline{MEg} + d_g)/(MEs + d_s) = (MPg - d_g)/(MPs - d_s) \quad (4)$$

Given values of  $R$  greater than 1, if  $d_s$  equals  $d_g$ , the rate of seignorage on silver (per £) must be lower than the seignorage on gold to offset the high transportation cost (per £).

If the monetary authorities chose the mint equivalents and mint prices correctly, and if there were initially concurrent circulation of gold and silver, then continued concurrent circulation was ensured. The impact of incorrect ratings depended on the margin of error. If the ratings were slightly (as defined below) wrong, there would be a tendency for the currency to degenerate toward monometallism. For example, if gold were undervalued (that is,  $R > [\overline{MEg}/MEs]$ ) it would be exported in years of balance-of-payments surplus, while silver would be imported in years of balance-of-payments deficits. The progression toward monometallism would typically take a number of years, as the size of balance-of-payments deficits and surpluses was small relative to the money stock.

If, on the other hand, coin ratings were more than slightly incorrect, bilateral arbitrage—the export of one metal to import the other—would be profitable and the currency would very quickly degenerate into monometallism. Again, temporarily ignore transactions costs other than domestic minting fees. It would be profitable to export one ounce of gold to import  $R$  ounces of silver (for sale to the Mint) if  $R$  times the mint price of silver exceeded the mint equivalent of gold ( $\overline{MEg} < R \cdot MP_s$ ). Similarly, the export of silver for gold would be profitable if the mint price of gold divided by  $R$  exceeded the mint equivalent of silver ( $ME_s < (1/R) \cdot MP_g$ ). Using the relationship  $ME_i$  equals  $MP_i$  plus  $s_i$ , bilateral arbitrage would be profitable if

$$ME_s < (\overline{MEg}/R) - (s_g/R)$$

or

$$ME_s > (\overline{MEg}/R) + s_s \quad (5)$$

Again, allowing for transactions costs makes the condition more complex. Arbitrageurs would export gold if  $\overline{MEg}$  plus  $d_g$  plus  $R$  times  $d_s$  were less than  $R$  times  $MP_s$ , and would export silver if  $ME_s$  times  $R$  plus

$d_s$  times  $R$  plus  $d_g$  were less than  $MP_g$ . Thus, bimetallic arbitrage would be profitable if

$$ME_s < (\overline{ME}_g - s_g - d_g)/R - d_s$$

or

$$ME_s > (\overline{ME}_g + d_g)/R + s_s + d_s \quad (6)$$

That is, if the mint equivalent of silver were low enough to cover the seignorage and transaction costs, it would pay to export silver coins and import gold for sale to the Mint. Alternatively, if the mint equivalent of silver were sufficiently high, it would be profitable to export gold and import silver. Transactions costs expand the range within which an incorrect rating would not lead to bimetallic arbitrage.

Figure 1 shows the available annual data on the relative price of gold and silver from 1687 to 1800. Even if the ratings were correctly set at one point in time, the fluctuations in  $R$  would require changing the mint equivalents and mint prices if the ratings were to remain correct: that is, if  $R$  rose (fell), either the mint equivalent of gold must rise (fall) or the mint equivalent of silver must fall (rise). The monetary authority could raise the mint equivalent of gold by raising the legal tender value of each gold coin ("calling up" the coin) or by reminting the gold coins and making coins of the old value with a lower gold content. Coin values were frequently chosen to be aliquot (dividing evenly without a remainder) parts of the unit of account, and calling up coins might yield coins of nonaliquot or awkward values. (For example, calling up a penny by 5 percent would yield a coin worth 1.05d.) This was particularly problematic for the lower-denomination coins. On the other hand, reminting coins involved real resource costs, and to encourage coin holders to sell their old coins to the Mint the mint price would need to be raised at least to the old mint equivalent.

The mint equivalent of silver could be lowered by calling down the silver coins (and possibly losing their aliquot property) or by reminting them with a lower silver content. The political unpopularity of calling down the money and the costs of reminting meant that the adjustment was most frequently made by calling up the undervalued coin. If this were done on an annual basis to correct the coin ratings, however, the currency would have a persistent tendency to depreciate—that is, for the amount of specie per unit of account to decrease. To illustrate this process, I calculate the effect of adhering to such a rule over the period from 1687 to 1800 (a period for which there are annual data on the gold-to-silver ratio). If the monetary authorities adjusted the coinage according to the rule above once a year, the gold content of the pound would have fallen by 40 percent, even though the relative market value of gold rose only 5 percent (from 14.94 to 15.68 times the value of



silver).<sup>11</sup> In practice the depreciation would probably have been greater, as the monetary authorities would have had to adjust the coinage more frequently than once a year.

In practice the costs of keeping the coin ratings correct meant that over much of the early modern period the monetary authority did not adjust the coin ratings when they became incorrect, and the undervalued coins were driven from circulation. When silver coin was undervalued it was exported or melted and there was a scarcity of small coins. Undervalued gold coins, however, were not all melted or exported; some circulated at a premium, entailing the same information and risk costs (described above) as a silver standard with gold coins that were not legal tender.

The history of bimetallic standards shows that they rarely accomplished the objective of concurrent circulation of high- and low-denomination coins circulating at par.<sup>12</sup> A monometallic gold standard accompanied by a managed subsidiary coinage could, however, provide a medium of exchange with coins of a convenient size for both large and small transactions, no need for recoinage or revaluation of coins if the relative price of gold and silver changed, and coins that circulated at par rather than at some varying premium. Because neither a bimetallic standard nor a monometallic (gold or silver) standard alone could offer all these advantages, the gold standard with token silver provided a better medium of exchange.<sup>13</sup>

It is important to note here that the medium-of-exchange function is only one of the functions of money. Money also acts as a unit of account, and for that function other properties, such as stability of value, are important. Which properties matter most depends on the relative importance of the two functions. Before the nineteenth century the importance of coins as a medium of exchange caused economists and policy makers to emphasize the properties that characterized a useful medium of exchange. Fetter, in his study of monetary theory in the nineteenth century, notes

<sup>11</sup> The silver content of the pound would have fallen by 36 percent. This calculation uses Soetbeer's annual data on the relative values of gold and silver and omits the initial depreciation necessary to bring the coin ratio up to the market ratio in 1687. Soetbeer's data are reprinted in J. Laurence Laughlin, *The History of Bimetallism in the United States* (New York, 1885).

<sup>12</sup> Friedman argues that bimetallic standards were far more stable than is conventionally believed. His only evidence for this argument is the experience of France between 1800 and 1875. I believe he overstates that evidence and that the experience of most European countries before and during the nineteenth century (and that of the United States) suggests that bimetallicism typically resulted in a de facto monometallic standard with a "scarcity" of either gold or silver coins. Friedman, "Bimetallism Revisited."

<sup>13</sup> A monometallic silver standard with token gold coins would have many of the same advantages. If gold coins were tokens, however, they would by definition be worth less on the international market than domestically, so agents would either bear the costs of silver for international exchange or accept the losses from using gold. A monometallic gold standard with token silver would avoid these costs.

I find practically no mention in any literature before 1797 of the idea that figured in discussions for a few years before and after the resumption of 1821, and was so prominent in the bimetallic controversy in the last quarter of the nineteenth century: that one metal would give more stable prices than would the other, or that the use of two metals as a standard would give greater price stability than would a single gold or silver standard.<sup>14</sup>

To understand the evolution of the gold standard, it is therefore appropriate to emphasize the superiority of the gold standard with token silver as a medium of exchange.<sup>15</sup>

## II. THE MECHANICS OF A TOKEN CURRENCY

If a monometallic currency complemented by a token currency offers a more efficient medium of exchange than a bimetallic currency, why were bimetallic standards so common before the nineteenth century? The answer lies in the difficulty of managing a token currency that was not subject to widespread counterfeiting, was not melted down or withdrawn from circulation, and maintained its value. I will examine these problems in turn.

Under a monometallic gold standard the unit of account is defined as a fixed weight of gold. Gold is the numeraire. The market price of silver ( $P_s$ ) must equal the mint equivalent of gold divided by the ratio of the market price of gold and silver:  $P_s$  equals  $\overline{MEg}/R$ . A token coin can be defined as one whose legal tender value exceeds the market value of its components. A silver coin is a token if  $ME_s$  is greater than  $P_s$ . As noted earlier, the difference ( $ME_s$  less  $P_s$ ) is limited by the threat of counterfeiting. If, over the planning horizon, the price of silver is expected to lie within the range ( $P_s^L$ ,  $P_s^H$ ), the monetary authority must set  $ME_s$  less than  $P_s^L$  plus  $c_s$  to avoid counterfeiting. If, on the other hand, the coin is to remain a token, the authorities must set  $ME_s$  greater than  $P_s^H$ . (If  $ME_s$  is less than  $P_s$ , the tokens will be melted down or exported.) These two conditions imply that a token coinage is possible only if the costs of counterfeiting are large relative to the expected fluctuations in the price of silver. I will argue later that technological changes in the early nineteenth century significantly increased the costs of counterfeiting, making a token coinage feasible in that century.

The remaining task facing issuers of a token currency is to ensure that the token does not depreciate. Consider the problem of an "automatic" token currency: that is, assume that the monetary authority wishes the quantity of tokens in circulation to be established by market forces rather than by government fiat. To prevent the token coins driving the gold coin out of circulation, the authority must set the mint price of

<sup>14</sup> Frank W. Fetter, *The Development of British Monetary Orthodoxy* (Cambridge, MA, 1965), p. 3.

<sup>15</sup> The corollary of course is that during the nineteenth century, as coins became dominated by notes and cheques in the stock of media of exchange, these properties became less important.

silver less than or equal to the market price. Silver will not be sold to the Mint, however, if the mint price is less than the market price. Therefore a supply of tokens requires that the Mint buy silver at exactly the market price. Because the monetary authority must change the mint price regularly to ensure the supply of tokens, this system would not be automatic but would require constant monitoring by the monetary authorities.

Typically, monetary authorities attempted to alleviate the need for the mint price to reflect the market price by introducing limited legal tender laws. A law that limited the legal tender of tokens (for example, to amounts less than 40/-) would reduce the de facto mint price of silver, because individuals bringing one ounce of silver to the Mint would get coins valued at *MPs*, but those coins could only be used for small transactions. Thus, it was hoped, a mint price above the market price of silver would not cause a flood of silver to the Mint. Rather, the amount of silver brought in would be limited to “the needs of the circulation.”

Although framers of limited legal tender laws typically justified them in this way, theory suggests (and experience bears out) that such laws were likely to be less than completely effective. For example, employers could pay their wages in silver and would, if *Ps* were less than *MPs*, buy silver to have it minted for such payments. Workers would spend the coins at retail stores, however, and retailers would have difficulty spending the silver, as their purchases would tend to be amounts larger than forty shillings. They could spend the silver by selling it at a discount, which would be limited by the intrinsic value of the coin. Thus limited legal tender laws alone would not achieve the objective of par circulation of coins. Rather, they would imply that instead of undervalued coins circulating at a premium, the overvalued coins (the tokens) would circulate at a discount.

While limited legal tender laws could accompany free coinage of silver, an alternative supply strategy would be for the monetary authority to eliminate the free coinage of silver. The monetary authority would purchase silver at the market price and have it coined into tokens according to the needs of the circulation. This would prevent the overissue (and consequent depreciation) possible under free coinage with limited legal tender laws. It would require, however, that the monetary authority correctly anticipate the “needs of the circulation,” a task demanding at least as much monitoring and action as maintaining the mint price of silver equal to its market price.

An alternative strategy would be for the monetary authority to guarantee the value of the coins; for example, by making them convertible into gold. This would require that the guarantee be credible and that the guarantor control the supply of coins. Such a guarantee is therefore incompatible with the free coinage of silver, with or without limited legal tender laws.

## III. THE NINETEENTH-CENTURY TOKEN COINAGE

Throughout the eighteenth century the overvaluation of gold had caused a scarcity of silver coins, but the costs involved in correcting the coin ratings had forestalled a change that might have permitted the concurrent circulation of gold and silver coins.<sup>16</sup> In 1816 the government introduced legislation aimed at eliminating the scarcity of small change. By raising the mint equivalent of silver and leaving the mint price unchanged, the legislation made silver coins into tokens. Simultaneously their legal tender status was limited. The government had introduced tokens before (for example, the copper tokens coined by the Royal Mint after 1672), but these had been counterfeited or depreciated. The silver tokens were not widely counterfeited and circulated at par. The success of the tokens was due both to changes in minting technology that made counterfeiting more costly and to the Mint's willingness to guarantee the convertibility of the tokens.

*The Technology*

Before 1800 the major change in the technology of minting dated back to the 1660s.<sup>17</sup> At that time the old process of making coins by hammering (a blank was placed between two dies and the imprint made by a hammer blow struck on the upper die) was replaced by a more mechanized process. The blanks were struck by a fly-press, and the edges of coins were engraved (or "milled"). While there was some gain in uniformity, the major advantage of the mechanization was that the blanks were exactly centered under the die, so the coins had sharp edges and clipping of coins became more obvious and therefore less common. Culling (sorting out the heavier coins for export or melting down), however, remained a profitable operation and, because the fly-press was also used in many branches of manufacturing, many people had the tools necessary for counterfeiting.

In the 1780s the scarcity of small-denomination coin led to the creation by the Privy Council of a Select Committee of Council on Coin (SCC). This committee did little until it was reconstituted in 1798, when it decided that improvements in the stock of coin required the introduction of new minting methods. After examining European practice, the committee asked the advice of Matthew Boulton (of Boulton and Watt fame). In 1786 Boulton had established a private mint at Soho, near Birmingham, which he used primarily for coining copper tokens for private and foreign orders. The Soho mint had the unique feature of

<sup>16</sup> The monetary problems of the eighteenth century were induced in part by the monetary authority's decision not to charge minting fees for coining either gold or silver. As equation 6 shows, this implies that from an initially correct rating even a small change in the relative price of gold and silver could trigger bimetallic arbitrage.

<sup>17</sup> See Craig, *The Mint*, chap. 9.

employing steam power for the rolling mills, the cutting presses (that made the blanks), and the coining presses. Boulton extolled the advantages of his mint to the committee:

The work performed by the Steam Engine will also be perfectly uniform, But that of the Men will vary as their strength respectively does; and even the work of the same Men will not be constantly uniform as there must unavoidably be a difference between the blow of a Man coming fresh to his Work and when fatigued in several hours severe labour: the effect of which will appear in the difference of Diameter and Thickness of the pieces of Coin when examined by a correct steel gauge; whereas if a Steam Engine be used a proper proportion of Power may be measured out for the different sorts of Coin, and when duly adjusted, every blow will be uniformly the same and consequently will produce uniform effects upon the Coins.<sup>18</sup>

Later an independent report commissioned by the Committee supported this claim, stating that, if the coining presses were steam powered, “not only a great saving would be made in manual labour, but the Coin would be much more perfect—advantages which need not be pointed out to Your Lordships.”<sup>19</sup> The *Encyclopedia Britannica* of 1875 listed among Boulton’s achievements that he erected coining machinery “so extensive and complete that the operation was performed with equal economy and precision, and the coins could not be imitated by any single artist for their nominal value.”

In addition to using a screw press with the steam engine, Boulton recommended the use of steel collars:

To make counterfeiting more difficult and at the same time facilitate the detection of false money, I advise that the pieces be made perfectly round and of the same exact diameter and thickness and to this end that they be struck in Polished Steel Collars. The highest possible Polish and Beauty ought also to be given to the Coin, such Coin being more difficult to counterfeit and more easily detected than Coin of inferior Workmanship. It has been objected that the use of steel collars exposes the Dies to break and become rough at the Edges; but this I can effectually prevent by a contrivance I have very lately invented so that I can now affirm that I can strike millions of pieces of money without breaking the edge of the Die or any way injuring it by the steel collars. And this new method being secret, the difficulty of counterfeiting will be thereby much increased.<sup>20</sup>

These improvements, he argued, would enable the Mint to do away with milling the edges of coins.

I recommend that instead of milling the edges should be made perfectly smooth. Milling is of no use whatever but it is in itself a defect in coining as it tends by its roughness to cause friction and waste from which a perfect piece of coin ought to be as far as possible

<sup>18</sup> Board of Trade, “Minutes of the Privy Council Committee on Coin,” vol. 6 (henceforth BT6), 118, p. 108, 9/5/1798.

<sup>19</sup> *Ibid.*, p. 166, 10/7/1798.

<sup>20</sup> *Ibid.*, p. 107, 9/5/1798.

intirely free. Indented inscriptions on the Edges would be much more durable as well as Neater than milling and are subject to no inconvenience.<sup>21</sup>

Boulton later wrote, concerning the minting of gold coins,

I have also made more experiments relative to the Coining of Gold upon the Construction which I advised in my reply to Question Number 2 to which I beg leave to refer and am more and more convinced of the Importance and the Superiority of it over all others that have hitherto been practiced, insomuch that I am fully persuaded that all great Nations will sooner or later make their money upon that Plan and work their Presses by my new Method.<sup>22</sup>

In a further letter he argued that of the three popular methods for reducing the weight of coins (that is, by shaking them in a bag, filing and milling the edges, and dissolving a part from the surface in aqua regis), “it is impossible to perform either of those Operations upon Guineas of my Construction without rendering such operation visible to the Eye of the Peasant and easily detectable by the steel gauge.”<sup>23</sup>

Boulton’s advice was accepted by the committee and between 1805 and 1811 the new Royal Mint, virtually a carbon copy of the Soho mint, was erected.

Between 1798 and 1816 the SCC seemed content to address the problems of the copper coinage and the renovation of the Mint, but with the return of peace in 1816 they once again considered renewal of the silver coinage. Following the Bank of England’s successful management of the silver-token coinage during the Napoleonic Wars, the committee suggested in May 1816 that “the Bank take upon itself the Coinage.” But the Bank’s Committee of Treasury resolved “that the Bank ought to decline taking upon itself the responsibility of the silver coinage but that they shall be much disposed, without making any change to offer their best assistance to carry so desirable a measure into effect.”<sup>24</sup>

The SCC then reported to the House of Commons, recommending a general recoinage and reorganization of the silver currency. The committee recommended “gold coin alone to be the standard coin of the

<sup>21</sup> *Ibid.*, p. 110, 9/5/1798.

<sup>22</sup> *Ibid.*, p. 157, 5/7/1798.

<sup>23</sup> *Ibid.*, p. 159, 10/7/1798.

<sup>24</sup> Bank of England, “Minutes of the Committee of the Treasury” (henceforth MCT), G8/18, p. 121, 17/5/1816. During the Napoleonic Wars, the Bank of England had attempted to alleviate the inconvenience caused by the lack of a small-denomination medium of exchange by issuing stamped dollars. The dollars were valued at 5/- until 1811 and 5/6d after 1811. After 1811 the Bank also provided tokens valued at 1/6d and 3/-. (They were not permitted to coin tokens that were aliquot parts of the official coinage.) These coins, struck by both the Royal Mint and a private mint owned by Matthew Boulton, were all overvalued (that is, the value of their silver content was less than the value at which the bank accepted them), and they were withdrawn after 1817. It is possible that the experience with token coins during the war was influential in the introduction of the token coinage in 1816. It is clear, however, that Lord Liverpool’s recommendations preceded that experience and that he expected his proposals to be accepted. In Feb. 1798 Bank of England officials returned from a meeting with the SCC saying that a coining of silver at a new standard was imminent. Bank of England, “Minutes of the Court Directors” (henceforth MCD), vol. Z, G4/27, p. 351, 22/2/1798.

realm, and that the silver coins are hereafter to be considered merely as representative coins and to be a legal tender only in payment of sums not exceeding two guineas."<sup>25</sup>

The Coinage Act closely followed the committee's recommendations, though it reduced the legal tender limit on silver to £2.<sup>26</sup> The weight of the silver coins was reduced so that 5/6d was coined from one ounce of sterling silver. The mint price remained at 5/2d per ounce of sterling silver. The old silver coin was to be brought in and exchanged for new at par. In February 1817 the government announced its readiness for the exchange to begin and allowed two weeks for individuals to bring in their old silver coin to exchange it for the new.<sup>27</sup>

### *Convertibility*

The Act of 1816 creating the token silver coinage was based on Lord Liverpool's proposal to the SCC in 1798.<sup>28</sup> He recommended that one ounce of sterling silver be made into 66d (rather than 62d), that seignorage be charged on the coinage, and that silver coin be legal tender only for payments of up to two guineas.

If the Coinage Act had been implemented as envisioned by Lord Liverpool and the SCC, the gold standard would have been very short-lived. In 1817 the market price of silver was 5/-, and therefore the mint price of 5/2d would have induced many people to sell silver to the Mint. The limited legal tender of token silver might have limited sales somewhat, but it is likely that silver coin would have been used

<sup>25</sup> The Committee's recommendations are in the Mint Records, "Privy Council on Coin Papers—Miscellaneous," vols. 1–54 (henceforth M1–54), 3rd head, pp. 156–59, 10/5/1816.

<sup>26</sup> 56 Geo. III c. 68.

<sup>27</sup> The exchange was fraught with difficulties. The banks, which had promised to assist, avoided the "odium and responsibility" (MCT, G8/18, p. 178, 6/2/1817) of allowing the exchange to take place on their premises, as it would mean throwing open their buildings to "all Ranks of the Community" and "their Property would be endangered" (M1–54; 6th head, p. 418, 21/2/1817). This attitude stands in contrast to their cooperation with the gold exchange in 1774, doubtless because gold coin was not held by "all ranks of the community." A second difficulty in implementing the recoinage concerned whether or not to accept the counterfeit coin and indeed how to distinguish it from the Royal Mint coin. The Master of the Mint suggested that if a teller were uncertain a coin was good, he should call in an intelligent shopkeeper: "such a person probably would be a better judge upon such a subject than a more scientific man" (M1–54; 6th head, p. 351). The Master of the Mint (W. W. Pole) also recommended that tellers be given instructions to give those bringing in coin the benefit of the doubt, with the proviso that "you will be very careful not to divulge the nature of your instructions. Were the full extent of the indulgence to be granted known it is to be feared that many attempts would be made to pass large Counterfeits in the exchange." Nicholas Vansittart, the Chancellor of the Exchequer, commented on these instructions that "it is vain to expect that a secret entrusted to so many will be kept" and suggested that giving express authority to be indulgent was "quite unnecessary and liable to abuse" (M1–54, 6th head, p. 373, 23/9/1816). Lord Liverpool agreed with Vansittart: "it would be by no means expedient to give as great a latitude as Pole proposes"; the final instructions reflected these views.

<sup>28</sup> BT6–127, pp. 1–12, 7/2/1798. Lord Liverpool subsequently expanded these ideas and, after a four-year illness, published them. Charles Jenkinson, *A Treatise on the Coins of the Realm* (1805, reprinted in New York, 1968).

whenever possible and would have accumulated in the pockets of retailers, who would be able to dispose of it only at a discount.

At the proclamation of the Coinage Act, however, the clause allowing the public to sell silver to the Mint was reserved, as the Mint was busy preparing for the exchange; it was never subsequently promulgated. The Mint bought silver at the prevailing market price in the quantity it thought necessary and believed that by limiting the quantity of silver coin supplied it could maintain the value of the coins above the value of their silver content; that is, the supply limitation would give value to the fiat component of the currency. In 1819 the Master of the Mint explained the process in a memo to the Secret Committee of the Lords on Resumption:

The Mint, having constant communication with the Bank and the London Bankers is enabled to afford information on the state of the silver currency to the Lords of the Treasury; and their Lordships being also in possession of other means of knowing the wants of the country, regulate the issues in such manner as they conceive will best afford the necessary accommodation throughout the Kingdom for the facility of exchange and Commerce without throwing into circulation any superabundance of silver. The silver coinage can never therefore while it is preserved upon its present footing exceed the amount which the Government, from the best information they can procure, conceive to be necessary for the accommodation of the Public.<sup>29</sup>

By the 1830s the Treasury had realized that supply limitation was not sufficient to maintain the value of the silver coin and that in fact it was the willingness of the Bank of England to guarantee implicitly the convertibility of the coins, at par, into gold that gave the silver coin its value. The bank did this through its willingness to accept silver in unlimited quantities at par. In 1831 Lord Althorp (then Chancellor of the Exchequer) noted that “if the Bank of England refused to receive the silver coin of the Realm in larger sums than that for which it is a legal tender the greatest confusion would be produced in the retail trade of the Metropolis.”<sup>30</sup> Indeed, the Governor of the Bank of England reported explaining to Lord Althorp “the necessity of the Bank receiving such coin in order to prevent its being depreciated in the general currency of the Country, to which Lord Althorp assented and admitted the necessity.”<sup>31</sup>

The conflict between the bank’s behavior and profit maximization came to a head in the 1830s. By 1831 the bank’s acceptance of silver coin had yielded an inventory of about £1 million in silver coin.<sup>32</sup> These coins could not be paid out by the bank in exchange for its notes, and the market value of the silver coins was about 10 percent less than their official value. The difference was owing to a decrease in the weight of

<sup>29</sup> M1–54, 6th head, pp. 594–95, 3/5/1819.

<sup>30</sup> Treasury Papers (henceforth T1), 3141/6277; 3/3/1831.

<sup>31</sup> MCT, G8/26, p. 55, 6/3/1833.

<sup>32</sup> MCD, Eb G4/56, p. 258, 2/1/1834.



the coin as a result of wear and tear and the difference between the mint equivalent of the coins and the market price of silver (still about 5/-). The bank wished to sell £600,000 of this silver to the Mint and, perhaps foolishly, suggested that “it should be left for the future decision of their Lordships whether any and what allowance should be made to the Bank to repay them for the loss.”<sup>33</sup> Noting that the question of compensation required “deep consideration,” the Lords of the Treasury agreed to reserve the question.

The bank sold the silver coin at its market price to the Mint; that is, silver coin they had accepted for 5/6d was sold to the Mint for less than 5/-. Two years later, when the bank wished to increase its supply of silver coin, they argued that they should not have to pay the official value (5/6d per ounce) for the coins. The bank accompanied its request with a not-so-subtle threat:

Should Lord Althorp not deem it expedient to adopt that course or to take any other measure for discharging the debt now due to the Bank, and at the same time to relieve them from future responsibility, The Court request the Governor and Deputy Governor respectfully to represent that they must decline the general receipt of Silver further than may suit their own convenience; and the Court will from time to time apply to the Master of His Majesty’s Mint for any supplies of silver coin which they may require for the use of the public.<sup>34</sup>

The argument over the “debt” raged on for several years until in 1833 a general operating principle was agreed on: “The Bank shall be at liberty at their discretion to return all silver coin [to the Mint at its par value] which they may receive from the Public above a balance to be retained by the Bank of £250,000.”<sup>35</sup> The monetary authorities had

<sup>33</sup> T1 3141/6277; 3/3/1831.

<sup>34</sup> MCD, Eb G4/56, p. 218, 5/12/1833.

<sup>35</sup> MCT, G8/26, p. 55, 6/3/1833. Their Lordships had replied to the bank’s threat by stating that they could not give the bank special privileges with respect to the price at which they bought and sold silver; that they thought that the renewal of the Bank Charter had “cancelled all former claims”; and that if a proposal of the kind the bank suggested were put to Parliament, “the proposition would be rejected” because

the melting of the silver coin [in 1831] was adopted at the suggestion and for the convenience of the Bank;—as it was effected at the expense of the public, and as it now appears that this measure was decided upon an erroneous view of what were to be the permanent wants of the public; at least in the extent to which the operation was carried it would not be just to saddle the country with the expense consequent upon this transaction. (MCD, Eb G4/56, p. 255, 2/1/1834)

The bank agreed that “so long as the Mint continues to issue silver coin at a seignorage, and the public are allowed to pay an unlimited amount of that Coin into the Bank at its current value in exchange for Notes or gold; So long will common justice require that the Bank should be allowed to throw back upon the Mint at the same value any excess beyond the fair wants of the public” (MCD, Eb G4/56, p. 257, 2/1/1834). In 1834 a tentative agreement was reached. The Mint would coin £600,000 without charging the bank seignorage, but the bank would pay the expenses of coining. The bank agreed so long as it had the right to send in any excess over £250,000 (MCD, Eb G4/56, p. 281, 18/1/1834). Finally the bank accepted the terms and in Jan. 1836 sent the Mint

finally learned that for silver tokens to circulate at a value in excess of the market value of their silver would require not only limited legal tender and controlled supply but also an agency that would convert them on demand into a money form that was unlimited legal tender.

#### IV. CONCLUSION

I have argued that England abandoned bimetallism in 1816 because a gold standard with a complementary token silver coinage offered the possibility of a medium of exchange with high- and low-denomination coins circulating concurrently. The gold standard succeeded because the new technology employed by the Mint was able to make coins that counterfeiters could not copy cheaply and because the Mint accepted the responsibility of guaranteeing the convertibility of the tokens.

This thesis raises two interesting questions that are beyond the scope of this article. The first pertains to the experiments with copper tokens in early modern England. From Elizabethan times until the nineteenth century, the government had attempted to establish a coinage of copper tokens to provide a medium of exchange for transactions for which silver was too valuable. I would interpret the failure to establish such a currency as support for the hypothesis that it was not technically or institutionally feasible to manage a token currency prior to the nineteenth century, but this requires further examination. Second, we should inquire about international experience. Boulton and Watt exported steam-powered mint machinery to some European mints in the 1830s, so presumably the technology to make expensive-to-counterfeit coins was widely accessible. Why, then, did other European and North American countries not follow Britain and adopt the gold standard in the first half of the nineteenth century? Only a detailed examination of the technical, political, and institutional constraints on the choice of monetary standards in those countries can answer this question.

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£600,000 to be coined. The bank would bear the costs of coining, of loss from wear and tear, and the interest on the deficiency of silver (MCD, Gb G4/58, p. 328, 7/1/1836).