CHAPTER 22

U.S. Specie Standard

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22.1 The U.S. Specie Standard, 1792-1932: Some Monetarist Arithmetic

Critical to research on the monetary history of the United States is availability of a monetary-base series that is consistent, complete in coverage, and continuous over a long period. It is also important to have a balance-of-payments series with these same properties. Furthermore, the balance-of-payments series should be "monetary" in nature, reflecting the intimate relationship between the monetary base and balance of payments. Notwithstanding the pioneering research of Milton Friedman and Anna J. Schwartz, and the follow-up work of their students and others, these series do not exist. The main objective of this article is to develop these monetary-base and balance-of-payments series. The series can be used for new historical explorations and also for possible amendments of hitherto unchallenged results of previous investigations. Some examples are provided in the article, and the series are tabulated for further use by researchers.

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When the First Bank of the United States opened for business on December 12, 1791, the United States was effectively on a specie standard, based predominantly on the Spanish silver dollar. The Mint Act of 1786 established a bimetallic standard with domestically produced coin, but this act had not been put into effect. The specie standard was formalized into legal bimetallism (Mint Act of April 2, 1792) and then gold monometallism (Act of June 22, 1874), and it remained the norm for the country until March 6, 1933, when President Roosevelt prohibited banks from paying out gold. Successive congressional and presidential action over the next 10 months eliminated both the specie standard and any mechanism for a return to it. By contrast, during the period 1792–1932, deviations from a specie standard and fixed exchange rate—that is, paper standards and floating exchange rates—were temporary aberrations.

This 141-year period witnessed three episodes of central banking, two Independent Treasury Systems, the classic pre-1914 gold standard, and occasional suspensions of specie payments. The comparative macroeconomic performance of logically determined subperiods composing 1792–1932 is the subject of this study. A generalized exchange market pressure model is used, and annual data series are developed to fit the model, also to examine monetary pyramiding and price and income behavior. Foremost among these series is the monetary base.

The famed Friedman and Schwartz (hereafter, FS) (1963, 1970) series of the monetary base for 1867–1932 is adjusted in light of a somewhat different methodology and is extended back to 1789. Consideration is also given to the work of Rutner (1974), who provides a monetary-base series in the FS tradition for 1833–1860, and Temin (1969), who generates a series autonomously for 1820–1857. Then the monetary balance of payments, consistent with the new monetary base, is generated for the full 1790–1932 period. The monetary-base and balance-of-payments series are presented as fundamental data contributions, beyond the analysis to which they are put in this study.

The methodology of the historical monetary base is discussed in Sect. 22.1.1. Whether or not the First and Second Banks of the United States were central banks seriously affects both the base and payments series, and this issue is considered in Sect. 22.1.2, leading to separation of 1792–1932 into subperiods (Sect. 22.1.3). The new monetary-base series is generated in Sect. 22.1.4 and presented in Sect. 22.1.5. Comparisons with the FS, Rutner, and Temin series, including amendments to historical findings, follow in Sect. 22.1.6. The monetary balance of

payments is generated in Sect. 22.1.7. The new monetary-base and balance-of-payments data, along with specially developed series of price, income, and other variables, are put to use in a comparative evaluation of the performance of central-banking and other periods spanning 1792–1932 (Sect. 22.1.8). Following conclusions (Sect. 22.1.9), an appendix provides details on data sources and construction of variables; the text is devoted purely to analysis.

22.1.1 Methodology of the Historical Monetary Base

The importance of the monetary base is twofold. First, the money supply is the product of the money multiplier and the monetary base, with the multiplier being an explicit function of the commercial-banks' reserve/deposit ratio and the nonbank-public's currency/deposit ratio. This formulation is one of the great accomplishments of FS (1963, pp. 776–798), and they, followed by many imitators, use it repeatedly in their history to delineate the absolute and relative importance of the three determinants in changes in the money supply. Second, the monetary base is closely related to the monetary balance of payments, with a payments imbalance constituting the effect of international transactions on the monetary base. More generally, the monetary base and balance of payments, together with the exchange rate, combine to define exchange market pressure in the foreign-exchange market.

The monetary base is composed of all assets that are actual or potential reserves for the consolidated commercial-banking system. To make the definition operational, six questions must be answered:

1. Who holds the monetary base?
2. What are the assets that constitute the base?
3. For each asset separately, what is the time period for which it is included in the base?
4. What should be the dating pattern of the monetary-base series?
5. In what money should the base be denominated?
6. What data should be used, what interpolative techniques for missing data points, and under what circumstances is information so poor that, for example, a legitimate asset should be omitted from, or an illegitimate holder should be included in, the base on statistical grounds?

Monetary-base developers (and users) can reasonably differ on answers to each of these questions, depending on their objectives and the criteria that they use. The current study differs from the work of predecessors in making fully explicit these objectives and criteria.

The objectives are (a) to achieve consistency over a long duration, 1792–1932; (b) to consider the United States as on a virtual, if not actual, specie standard throughout the time span; and (c) to ensure compatibility with the monetary balance-of-payments measure. The criteria are (i) to apply strictly the definition of the monetary base and operate in accord with the objectives in answering questions 1–5, and (ii) to use all available information to maximum effectiveness in answering question 6. Administering criterion (ii) inevitably involves considerable judgment, and again reasonable researchers can differ in their decisions. The advantages of the current study over predecessors in this respect emanate from the work of FS and their students, the existence of specialized studies pertinent to the monetary base written since their time, and spreadsheet/statistical programs that were not available to FS.

22.1.2 Were the First and Second Banks Central Banks?

FS (1970) do not address the issue of whether the First and Second Banks were central banks. However, in showing data for these banks separate from state banks, they leave the question open. For the current study, the pertinent central-banking criterion is whether the Banks' note circulation (and, by extension, non-Treasury deposit liabilities) served as actual or potential reserves for the state banking system and hence constituted part of the monetary base.[1] While the question has not been directly addressed for the First Bank, many have answered in the affirmative for the Second Bank.[2] Yet it would be a reasonable position that, given the controversial nature of these institutions and the long tradition of considering specie as ultimate money, the Banks' liabilities were considered just ordinary money. Fortunately, a variety of empirical evidence exists on the matter.

First, Fenstermaker (1965, p. 43) and Rutner (1974, p. 25, n. 1) note, for the First and Second Banks, respectively, that Bank notes were sometimes included with specie in the statements of state banks.[3] Second, Fenstermaker (1965, pp. 11–12, 69–76) synopsizes the entire history of the Second Bank in terms of its credit contraction/expansion with multiple effect on credit contraction/expansion of the state banking

system.[4] Third, Engerman (1970, p. 726) and Rutner (1974, pp. 23–30, 121–146) show that the nonbank public considered Second Bank notes and deposits as substitutes for specie, the primary base money; and Rutner provides even stronger evidence for this treatment on the part of the state banks. Furthermore, the base-money characteristic of Bank note and deposit liabilities continued many months after February 1836 (the date of replacement of the Bank's federal charter with a Pennsylvania charter) and even after the Bank's initial suspension of specie payments (May 1837 to August 1838)—by Rutner's evidence, until "sometime in 1839," probably with the Bank's second suspension in October.[5]

The same reasons underlying the monetary-base property of Second Bank note and deposit liabilities apply to those of the First Bank, and hence the positive empirical findings for the Second Bank may be extrapolated to the First Bank. Each Bank was a balance-sheet giant in comparison to contemporary state banks, and, as national institutions, each had branches in the major commercial cities of the country.[6] Each was the fiscal agent of the government and served as a major (First Bank) or sole (Second Bank—to 1833) depository of the Treasury. These circumstances generated a large and steady stream of state bank notes (and checks) to the Banks, which generally presented them regularly to the state banks for redemption in specie. These banks, in turn, could avoid specie loss by presenting the Bank with the Bank's notes and drawing down its deposits at the Bank. Therefore, Bank note and deposit assets were considered by the state banks as part of reserves.

The Banks' redemption practice was a technique of monetary control that was fostered by the conservative credit policy of the First Bank and by the conscious regulation of the state banks on the part of the Second Bank under President Nicholas Biddle. When the First or Second Bank chose not to redeem its state bank notes, it became a still greater creditor of these banks, thereby enhancing future control. Hammond (1947) argues that this regulatory power—different from modern central banking in the creditor rather than debtor status of the central bank with respect to commercial banks—was "simpler, more direct, and perhaps more effective than those of the Federal Reserve Banks" (p. 2).[7]

The notes of the Banks were clearly superior to state bank notes. By federal charter, Bank notes were legal tender for all payments to the government. Combined with interstate banking, this gave rise to universal acceptability in the private sector—not a characteristic of state banks at the time. The conservative note-issuance policy of the First Bank and the

effectiveness of the Second Bank in reducing the deviation of domestic exchange rates from parity were additional elements in producing Bank note issue that compared favorably to the specie stock in uniformity and cost of transfer.[8]

22.1.3 Delineation of Subperiods

As suggested in the introduction, and consistent with the "contingent-rule gold-standard" concept developed by Bordo and Kydland (1995) and Bordo and Rockoff (1996), there is a real sense in which the United States was on a metallic standard throughout 1792–1932, with deviations from paper-currency convertibility deemed to be, and in fact, temporary. Nevertheless, subperiods of interest may be distinguished, primarily by identification of a monetary authority (First and Second Banks, Federal Reserve Banks, Independent Treasury) and secondarily by the longest suspension of specie payments (greenback period) and the "classic" gold standard that followed.[9]

With the First Bank in operation from December 12, 1791, to the expiration of its charter on March 4, 1811, 1792–1810 is naturally the first period of central banking. The interregnum between the First and Second Banks is 1811–1816, a period of issuance of the first Treasury currency component of the monetary base (Treasury notes) and, beginning August 30, 1814, the first major suspension of specie payments. The Second Bank opened for business on January 7, 1817, and was treated as a central bank by the state banking system into 1839, yielding 1817–1838 as the second period of central banking.[10] Another interregnum, 1839–1846, includes paper standards (parts of 1839–1842 over much of the country) and the aborted first Independent Treasury System (July 4, 1840, to August 13, 1841).

The years 1847–1861 constitute the (second) Independent Treasury System, which began on January 1, 1847, when all payments to the Treasury were by law in specie or Treasury notes (not state bank notes). From April 1, 1847, payments from the Treasury were similarly made. Throughout this period, funds were kept within the government; banks were not used as depositories. The Act of August 5, 1861, began erosion of the policy, permitting proceeds of the first substantial Civil War loan to be deposited in state banks.

On December 30, 1861, virtually all banks ceased converting their notes and deposits into gold coin, and the Treasury suspended the right of holders of its demand notes to redeem them in gold. Resumption occurred on January 1, 1879, defining 1862–1878 as the greenback period. After the classic gold standard, 1879–1913, the third period of central banking began with the creation of the Federal Reserve System by the Act of December 23, 1913. The United States abandoned the gold standard on March 6, 1933, making 1932 the specie-standard's last full year of operation.

22.1.4 The New Monetary Base, 1789–1932: Construction

22.1.4.1 Structure

In the FS tradition, the monetary base consists of all assets—gold or specie, nongold metallic money, (paper) currency, and deposits—that the consolidated private banking system can use as reserves either actually (these assets held by banks) or potentially (these assets held by the public). By definition, assets in (domestic) circulation are the sum of assets held by the banks and by the public. The monetary base is provided by "outside" agents, and increases or decreases in components of the base occur via transactions of the "inside" entities (the banks and public) with the outside. The outside agents are (1) the foreign sector (affecting the specie stock via international transactions), (2) the nonmonetary sector (altering the specie stock via production of bullion and consumption of bullion or coin), (3) the Treasury (producing nongold metallic money and paper currency but reducing the base by using specie as backing for issued currency), and (4) the central bank (providing paper currency and deposits, using specie as reserves for same).[11] Also incorporated are gold certificates (circulating warehouse receipts for gold deposits at the Treasury), lost currency, foreign-held currency, and nonunitary specie price of currency.

As the supply of base money ($BASE_S$), the monetary base is the sum of the net contributions of specie, the Treasury, and the central bank. The contribution of specie is the amount of specie in the country (commonly called the "specie stock") *minus* lost gold certificates. The gross contribution of the Treasury is its currency (excluding gold certificates) in official circulation *minus* lost currency *plus* nongold coin in circulation.[12] For the Treasury net contribution, there are two deductions: Treasury net specie (Treasury gross specie *less* Treasury gold held against gold

certificates) and Treasury currency held by foreigners. Treasury gold held against gold certificates equals these certificates in official circulation: the sum of certificates in circulation and certificates lost. The gross contribution of the central bank is its currency in official circulation *minus* lost currency *plus* non-Treasury domestic deposit liabilities. The central-bank net contribution is obtained by subtracting its specie and its currency held by foreigners.

Monetary variables are expressed in millions of "gold dollars" (incorporating "specie dollars" prior to 1860), except that the components of the gross contribution of the Treasury and the central bank are in millions of paper dollars. To convert to gold dollars, the gross contributions are multiplied by the specie price of currency (par of unity).[13]

22.1.4.2 Comparison with Other Historical Monetary-Base Series

Composition of base. The new monetary base centers on the *net* liabilities (fiduciary contributions to the base) of the authorities, which measures the Treasury and central-bank contributions given the specie stock. There are no precedents for this partitioning of the historical monetary base. The usual breakdown of the historical base focuses on the *gross* liabilities of the *combined* authorities; the specie stock is replaced by specie in circulation (specie stock *less* Treasury and central-bank specie), while Treasury and central-bank currency are combined. This composition—found in FS (1963, pp. 130, 179, 704–722, 735–744) and Rutner (1974, pp. 151–183) as well as in Kindahl (1961, p. 40)—minimizes the role of specie and does not delineate the contributions of the respective authorities to the base. However, the monetary-base *aggregate* is not affected by these alternative partitions.

Classification of gold certificates. Circulation of gold certificates (first issued in nontrivial amount in 1866) is subsumed in the gold stock and therefore in the contribution of that stock to the monetary base. This placement is in accord with the net-liabilities format and enhances the role of specie relative to the Treasury. It is in contrast to the FS treatment of gold certificates as currency. However, FS (1963, p. 25, n. 12) themselves provide two justifications for the former procedure: the pure warehouse-receipt nature of the certificates and (during the greenback period) the market's refusal to recognize a premium on the certificates

below that for gold itself. Again, the monetary-base aggregate is invariant to where gold certificates are placed.

Dating pattern of series. Uniform end-of-year dating is adopted, for consistency over the 1789–1932 time span and for compatibility with the monetary balance-of-payments series.[14] FS provide end-of-year figures only from 1907, while Rutner has 6 years that lack this dating, but their objective is rather to maximize the frequency of observations subject to a given level of data reliability. Temin's series pertains to the end of the fiscal (rather than calendar) year, because that is the timing of the flow data underlying his series.

Definition of the public. Temin includes both the Treasury and the Second Bank in the public. The result is that the monetary base reduces to the specie stock. Because the Treasury did create money during the ante-bellum period (recognized but not emphasized by Temin), which money was used as bank reserves, Rutner is justified in treating the Treasury as an outside agent. Also, Rutner's decision to classify the Second Bank as a central bank was supported in Sect. 22.1.2. Therefore, it is reasonable to follow Rutner in rejecting Temin's additions to the public.

The FS monetary base *includes* not only Treasury and Federal Reserve currency held by the domestic public and banks but also such currency held by the foreign public and banks (FS 1963, p. 778; 1970, pp. 58–60). However, the FS base *excludes* U.S.-issued gold and silver coin held by foreigners. While Garber (1986) is correct in observing this inconsistency in the definition of the public, FS are simply following official data on currency and coin in circulation. It is the reporting of currency data by issuers rather than holders of money that leads to the inconsistency in the FS base. Indeed, FS note that "in principle" and "ideally defined," foreign-held dollars should be excluded from the base. The FS (and Garber) ideal is followed in the current study, because data do exist to exclude foreign-held dollars from the base.

Denomination of base. FS (1963) sum gold-dollar-denominated and paper-dollar-denominated components of the monetary base during the greenback period. They are well aware that this arithmetic is analogous to adding apples and oranges: "Treating one greenback dollar as equal to one gold dollar... [is], strictly speaking, meaningless: it is like adding current Canadian or Hong Kong dollars to U.S. dollars on a one-to-one basis" (FS 1963, pp. 27–28). The same issue arises during May 1837

to August 1838, when the Second Bank suspended specie payments and its notes depreciated in terms of gold. The depreciation of Second Bank money is ignored by Rutner; but FS justify their simple summation of gold and depreciated dollars on two grounds: "[It] is done…in every other summary of monetary statistics for the greenback period we know of" (FS 1963, p. 28), and the necessary correction declines over time with the decrease in the gold premium.

Because the United States is considered in essence to be on a specie standard throughout 1789–1932, and because consistency over time is desired, the new monetary base is uniformly expressed in gold (or specie) dollars. This is done via deflation of base components that traded at a discount in terms of gold during periods of paper-currency depreciation.[15] The specie price of currency for the central bank is non-unity only for 1837, and that for the Treasury is non-unity only for the greenback period. There was no central bank during the greenback period, and the depreciation of Second Bank liabilities during 1837–1838 did not affect the par value of Treasury currency.

Attention to lost currency. Official currency in circulation, used in the FS base, includes "currency irretrievably lost, destroyed, in collections, or otherwise so disposed as never to be presented for redemption" (Laurent 1974, p. 213, n. 1); such "lost currency" is deducted in constructing the new monetary base. FS (1963, pp. 442–443, n. 20) are aware of the issue and estimate the loss for national bank notes at about 0.1% per year, but they do not adjust their monetary base for lost currency. It may be that they judged the correction to be quantitatively unimportant based on their finding for national bank notes, or perhaps they did not see how to estimate the deduction for other forms of currency.

Treatment of state bank notes. State bank notes, included in the FS base to mid-1878 (see FS 1963, pp. 722, 724, 808), are clearly not high-powered money, are removed from the FS base by Joines (1985, p. 348), and are not a component of the Rutner base. They are excluded from the new monetary base. FS neglect to make this correction as well, probably because they deemed it to be of minor quantitative importance.

Treatment of national bank notes. FS (1963, pp. 20–23, 50, 780–782) include national bank notes in the monetary base—reasonably because this currency served as a reserve for state banks and was legal tender for Treasury transactions (with exceptions). However, the current study

places national bank notes in Treasury currency (and therefore in the monetary base) only from 1874, for reasons stated by FS themselves. Legally, a reserve requirement had been imposed on both notes and deposits of national banks, beginning with the first National Banking Act (February 25, 1863). Only with the Act of June 20, 1874, was the reserve requirement removed from national bank notes, while being retained on deposits. Furthermore, this act—and not the, earlier, National Banking Acts—provided for Treasury redemption of national bank notes in U.S. notes at par (based on a fund to which banks contributed 5% of their note issue, countable toward their reserves on deposits). Empirically, there was the potential, and in at least one instance (early 1873) the actuality, of national bank notes trading at a discount for U.S. notes.

Whether or not national bank notes should be included in Treasury currency and therefore in the monetary base prior to 1874, as done by FS, is a matter of judgment. On the side of inclusion is the fact that national bank notes were backed more than fully (111% of value of notes issued) by government bonds deposited with the Treasury and therefore can be construed as an indirect obligation of the government, that is, as Treasury currency at one remove. On the side of exclusion, viewed in this study as preponderant, are the existence of a reserve requirement, the absence of a redemption fund, and the trading of national bank notes at a discount in terms of greenbacks. As stated by FS, "[In] the period before 1874…[national bank] notes were more nearly identical with deposits than with the notes issued by the Treasury," and "[To] treat national bank notes as part of the currency obligations of the monetary authorities…is of questionable appropriateness for the first few years covered by our series" (FS 1963, pp. 781–782).[16]

Selection of data. In respect of data used, the new monetary base is closer to FS than to Rutner or Temin. The antebellum specie stock is constructed via a new technique and with substantially different data from those of Rutner and Temin. Also, Treasury gold and Treasury notes during the antebellum period have different data sources from those of Rutner. By contrast, the FS gold stock, specie stock, gold certificates, and nongold coin series are accepted and extended back to 1860. Prior to 1874, only part of Treasury currency is consistent with FS. From 1874, the entirety of Treasury currency (and of Federal Reserve liabilities, from 1914) has data compatible with FS.

The result is that the new monetary base is different from the FS, Rutner, and Temin series. Components of the net-liabilities composition of the new base are discussed below. Subsequently, Sect. 22.1.5 presents empirically the contributions to the base emanating from both the net-liabilities and an alternative breakdown, authorities' net assets. Then Sect. 22.1.6 shows just how different the new base is from its predecessors.

22.1.4.3 Components of Net-Liabilities Composition of the Monetary Base

Specie stock and nongold coin. Prior to 1860, data on the specie stock include both gold and silver, although by the late 1850s silver is in the form only of domestic subsidiary coinage.[17] From June 30, 1860, official specie-stock series are limited to gold, consisting of domestic gold coin in circulation and gold in all forms (domestic coin, foreign coin, and bullion) in the Treasury or Federal Reserve. From that date, nongold coin (standard silver dollars, subsidiary silver coin, and minor coin) became separate official series. The specie stock for the new monetary base follows the official line—gold and silver to the end of 1859 and gold alone thereafter. The specie stock, its distribution, and nongold coin circulation agree with the corresponding FS series.

Contribution of Central Bank to monetary base. Both the First and Second Banks issued not only banknotes (payable in specie on demand) but also postnotes (payable in specie on demand at a specified future date after issuance). For the First Bank, postnotes are included in central-bank currency, because (1) they were issued regularly only by the main office and in the ordinary course of business, and (2) "[Total] note circulation was deliberately restricted to guard specie" (Wettereau 1937, p. 283); there was never a question of suspending specie payments. For the Second Bank, postnotes are excluded. The Second Bank first issued postnotes in March 1837 decidedly not in the ordinary course of business, while specie payments were suspended, in an attempt to obtain specie.[18]

Contribution of Treasury to monetary base. The FS composition of Treasury currency is followed in its inclusion of national bank notes (from 1874), silver certificates (receivable for all payments to the Treasury from inception in 1878, and a legal reserve for national banks by the Act of July 12, 1882), Treasury notes of 1890 (a full legal tender), U.S. notes (greenbacks, first issued in 1862, a legal tender with exception for

certain payments to the Treasury), fractional currency (instituted in 1863, a substitute for subsidiary silver coin), and certain Civil War issues designated as "other U.S. currency" in official statistics: old demand notes (payable for all public dues, made legal tender by the Act of March 17,1862), Treasury notes of 1863, and compound-interest notes (both interest-bearing but legal tender on the same basis as U.S. notes).

However, Treasury currency differs from the FS concept in two respects. First, gold-certificate circulation is subsumed in the gold stock, in contrast to the FS treatment of gold certificates as currency. Second, 3% certificates, issued after the Civil War, were a legal reserve for national banks and so are included in Treasury currency.[19] Also, the FS concept must be broadened in two respects for extension prior to 1867. First, postage currency, issued for nearly a year beginning July 1862 and replaced by the fractional currency, is included in Treasury currency (in fact, the two types of currency are intermixed in official statistics).[20] Second, Treasury notes, issued between 1812 and 1861, also are included in Treasury currency; interest-bearing, they had the same legal-tender characteristic as did Bank of United States notes, were used as bank reserves, and (in small denominations) even served as hand-to-hand currency.[21]

22.1.5 The New Monetary Base, 1789–1932: Presentation

22.1.5.1 Net-Liabilities Breakdown

The new monetary base for 1789–1932 is listed in Table 22.1. The contributions of the specie stock, Treasury, and central bank are presented as period averages in Table 22.2. The contributions of the Treasury and central bank can be interpreted as the reduction in the monetary base should the Treasury or central bank be reclassified to the private sector. In particular, treating the First and Second Banks as commercial banks would reduce the monetary base by 18 and 20%, on average. In principle, the contribution of the Treasury or the central bank can be negative, and in fact that of the Treasury is negative during 1849–1857 and 1917–1932, averaging −$813 million during 1914–1932. FS (1963, pp. 391–393, 399) consider a hypothetical policy of a Federal Reserve $1 billion open-market purchase of securities in 1930 or 1931, which would have moderated, and possibly prevented, the crises that led to the Great Depression. All the while, the Treasury was immobilizing a *greater* amount of gold; its net contribution to the base was *negative* $1167,

Table 22.1 Monetary Base and monetary balance of payments, 1789–1932 (millions of gold dollars)

Year	*Monetary Base (end of year)*	*Balance of Payments*[a]		*Year*	*Monetary Base (end of year)*	*Balance of Payments*[a]	
		Direct	*Indirect*			*Direct*	*Indirect*
1789	9			**1861**	317	−5	−8
1790	16		7	**1862**	416	−41	−47
1791	18		2	**1863**	482	−74	−84
1792	22		3	**1864**	421	−72	−82
1793	24		1	**1865**	506	−59	−69
1794	25		−3	**1866**	452	−45	−54
1795	21		−3	**1867**	399	−46	−53
1796	20		−1	**1868**	369	−46	−51
1797	18		−2	**1869**	410	−24	−28
1798	22		3	**1870**	442	−41	−48
1799	22		1	**1871**	436	−50	−58
1800	22		0	**1872**	419	−39	−47
1801	21		0	**1873**	426	−25	−32
1802	18		0	**1874**	700	−34	−42
1803	22		2	**1875**	672	−38	−43
1804	22		1	**1876**	700	−12	−17
1805	23		1	**1877**	732	2	−2
1806	23		2	**1878**	746	2	1
1807	24		0	**1879**	867	39	78
1808	23		0	**1880**	1001	87	67
1809	25		0	**1881**	1113	50	63
1810	26		0	**1882**	1148	4	−28
1811	21		1	**1883**	1180	−6	23
1812	25		1	**1884**	1210	−1	−10
1813	28		1	**1885**	1202	−3	11
1814	35		1	**1886**	1219	5	8
1815	48		6	**1887**	1285	28	37
1816	33		−1	**1888**	1315	−13	−27
1817	38		−1	**1889**	1333	−28	−42
1818	35		−1	**1890**	1420	−38	−7
1819	30		−1	**1891**	1483	−35	−43
1820	29	−1	1	**1892**	1502	−44	−63
1821	33	−3	2	**1893**	1598	−46	−16
1822	32	−6	0	**1894**	1498	−17	−83
1823	31	1	2	**1895**	1441	−54	−72
1824	34	−2	−2	**1896**	1501	−17	43
1825	41	1	3	**1897**	1569	75	1

(continued)

Table 22.1 (continued)

Year	*Monetary Base (end of year)*	*Balance of Payments*[a]		*Year*	*Monetary Base (end of year)*	*Balance of Payments*[a]	
		Direct	*Indirect*			*Direct*	*Indirect*
1826	38	2	1	**1898**	1732	77	140
1827	41	−1	−1	**1899**	1821	23	9
1828	44	2	2	**1900**	2025	3	28
1829	44	4	2	**1901**	2099	7	0
1830	48	5	2	**1902**	2195	−1	11
1831	56	−5	−5	**1903**	2309	6	19
1832	51	6	4	**1904**	2413	−12	−36
1833	55	6	0	**1905**	2505	8	7
1834	61	14	11	**1906**	2715	59	104
1835	76	5	4	**1907**	3021	68	97
1836	73	8	7	**1908**	3054	13	−25
1837	74	−3	−3	**1909**	3084	−63	−88
1838	90	9	7	**1910**	3161	−13	9
1839	76	13	13	**1911**	3238	20	24
1840	75	−1	−1	**1912**	3320	−10	23
1841	74	−4	−3	**1913**	3403	−35	−35
1842	82	6	6	**1914**	3386	−18	−168
1843	86	14	12	**1915**	3788	288	416
1844	81	−2	−2	**1916**	4413	516	461
1845	78	−2	−2	**1917**	5436	219	250
1846	90	11	9	**1918**	6302	−216	−219
1847	102	6	6	**1919**	6504	−284	−287
1848	97	−4	−4	**1920**	6670	−108	−125
1849	94	−1	−2	**1921**	5668	610	630
1850	118	−13	−19	**1922**	5804	155	174
1851	142	−31	−36	**1923**	6029	253	259
1852	165	−30	−36	**1924**	6340	248	270
1853	191	−29	−34	**1925**	6529	−39	−54
1854	202	−44	−45	**1926**	6481	61	67
1855	201	−47	−47	**1927**	6621	−57	−33
1856	205	−49	−50	**1928**	6599	−225	−208
1857	216	−45	−46	**1929**	6485	152	158
1858	244	−45	−45	**1930**	6678	364	367
1859	235	−57	−56	**1931**	7287	−239	−237
1860	250	−21	−43	**1932**	7673	160	148

[a]Net specie imports

Table 22.2 Contributions to monetary base: net-liabilities breakdown (period means—end of year)

Period	*Millions of Gold Dollars*			*Percentage of Monetary Base*		
	Specie	*Treasury*	*Central Bank*	*Specie*	*Treasury*	*Central Bank*
1791–1810	18	–	4	82	–	18
1811–1816	25	7	–	82	18	–
1817–1838	38	1	9	79	1	20
1839–1846	76	5	–	94	6	–
1847–1861	185	0	–	101	−1	–
1862–1878	149	364	–	31	69	–
1879–1913	931	983	–	47	53	–
1914–1932	3708	−813	3141	61	−11	50

$1091, and $1359 million during 1929–1931. Treasury action to increase its monetary-base contribution to *zero* was a logical alternative to Federal Reserve policy.

As expected, the share of specie in the monetary base is highest during the Independent Treasury period and lowest during the greenback period. Perhaps surprising is that only during the latter period and 1879–1913 does the Treasury make a large relative contribution to the monetary base.

22.1.5.2 Assets Breakdown

The composition of the monetary base that leads directly to the balance of payments centers on the assets of the combined Treasury and central bank (with new variables measured in millions of gold dollars). The monetary base ($BASE_S$) is the sum of (1) the specie stock (SPST), (2) net foreign assets (*excluding specie*) of the Treasury and central bank (NFA), and (3) the residual contribution of the Treasury and central bank to the base (RCON):

$$BASE_S = SPST + NFA + RCON \tag{22.1}$$

NFA consists of Treasury and central-bank currency held by foreigners (liabilities of the authorities, therefore with negative sign) *plus* central-bank net foreign assets other than foreign-held currency.

The residual contribution of the authorities (RCON) has two positive, and three negative, components. The positive terms are (i) Treasury

currency in official circulation *less* currency lost *plus* nongold coin in circulation (from 1860, previously in the specie stock) and (ii) central-bank currency in official circulation *less* currency lost *plus* non-Treasury domestic deposits at the central bank, with both (i) and (ii) multiplied by the pertinent specie price of currency. These two terms represent fiat currency of the Treasury, central-bank domestic credit, and physical assets of these authorities (silver stock of the Treasury [from 1860] and premises of the central bank).

The negative components of RCON are lost gold certificates, Treasury net and central-bank specie, and central-bank net foreign assets other than foreign-held currency. Unlike in the net-liabilities composition, lost gold certificates are deducted from RCON rather than from the specie stock. With the specie stock rather than specie in circulation a component of the monetary base, Treasury net and central-bank specie must be subtracted from RCON. Central-bank net foreign assets other than foreign-held currency are deducted for inclusion in NFA, but foreign-held Treasury and central-bank currency are negative components of NFA rather than of RCON. These groupings are preparatory for balance-of-payments derivation in Sect. 22.1.7. The asset breakdowns of the historical base provided by previous authors—FS (1963, pp. 210–212, 796–798), Cagan (1965, pp. 333–339), and Bordo (1975, p. 511)—do not separate NFA and therefore do not link to the balance of payments.[22]

Period averages for the assets composition of the monetary base are shown in Table 22.3. The relative unimportance of NFA is noteworthy. The pattern of the specie contribution versus the two other components is the same as for Table 22.2, with the relative contribution of the specie stock a maximum under the Independent Treasury System and a minimum during the greenback period. In absolute terms, the specie stock expands more than six-fold during 1879–1913 over the greenback period and again four-fold during 1914–1932 over 1879–1913. The residual contribution of the authorities is only 19 and 22% under the First and Second Banks, respectively. Certainly, the First Bank was always a conservative institution, and the Second Bank could be described as such for a good part of its federally chartered existence. Even during the Federal Reserve period, the authorities' residual contribution is outweighed by the specie stock.

Table 22.3 Contributions to monetary base: assets breakdown (period means—end of year)

Period	*Millions of Gold Dollars*			*Percentage of Monetary Base*		
	Specie	*Treasury and Central Bank*		*Specie*	*Treasury and Central Bank*	
		Net Foreign Assets	*Residual Contribution*		*Net Foreign Assets*	*Residual Contribution*
1791–1810	18	0	4	82	−1	19
1811–1816	25	–	7	82	–	18
1817–1838	38	−1	11	80	−2	22
1839–1846	76	–	5	94	–	6
1847–1861	185	–	0	101	–	−1
1862–1878	149	–	364	31	–	69
1879–1913	936	−5	983	47	0	53
1914–1932	3726	−355	2665	62	−6	44

22.1.6 The New Monetary Base Versus Predecessors

Comparison of the new monetary base with predecessor series is instructive. The Temin (1820–1857), Rutner (1833–1859), and FS (1867–1932) series are obtained on a uniform year-end basis, compatible with the new base, via linear interpolation between adjacent figures closest to year end.[23] Temin's monetary base is the specie stock. So both the new monetary base and the new specie stock are compared to it, with the three series graphed in Fig. 22.1. For 1820–1857, the new specie stock averages 24% *below* the Temin series. The new base averages 12% *above* the Temin series during the period of the Second Bank (1820–1838) but 35% *below* it thereafter. The Temin series is smoother than the new base, but after 1838 it diverges sharply upward.

The new monetary base is graphed against the Rutner series in Fig. 22.2. The new base averages 10% *below* the Rutner series during 1833–1850, 13% *above* it during 1851–1854 (the only years when the new base exceeds Rutner), and 17% *below* it during 1855–1859. The two series have a broadly similar pattern until 1850.

The new monetary base is uniformly less than the FS base, as shown in Figs. 22.3–22.5. It averages 46.7% below the FS base during 1867–1873 (principally due to the exclusion of national bank notes), 2.5% below

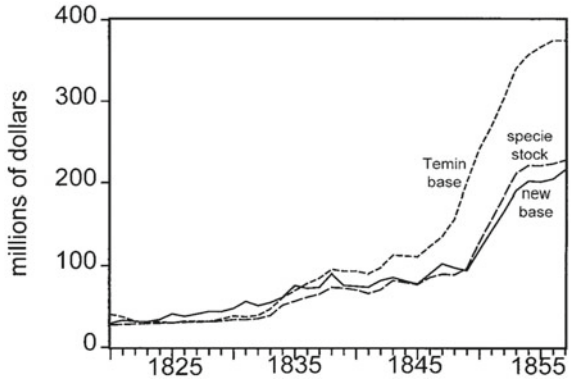

Fig. 22.1 New monetary base and specie stock versus Temin monetary base, 1820–1857

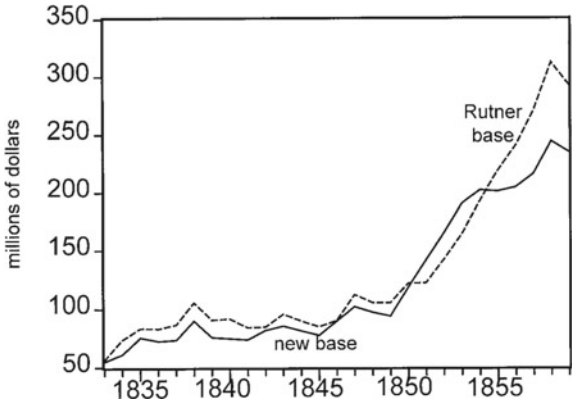

Fig. 22.2 New monetary base versus Rutner monetary base, 1833–1859

it during 1874–1897, 1.8% below it during 1898–1917 (when non-European foreign-held dollars are deducted), and 7.5% below it during 1918 1932 (when European-held dollars also are excluded). Only during 1867–1878 do the series diverge sharply. Afterward, they track each other very closely.

The new base suggests amendments to historical investigations of the determinants of the money stock. First, the new series is always below the

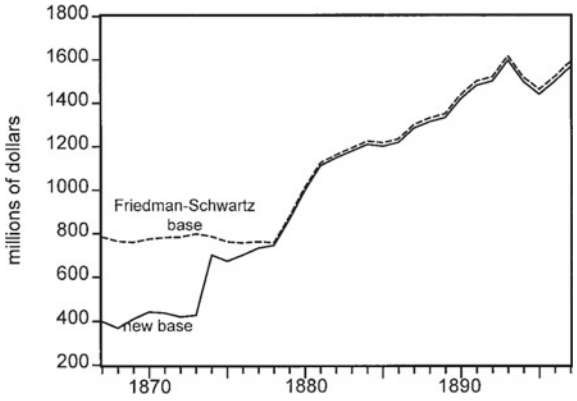

Fig. 22.3 New monetary base versus Friedman-Schwartz monetary base, 1867–1897

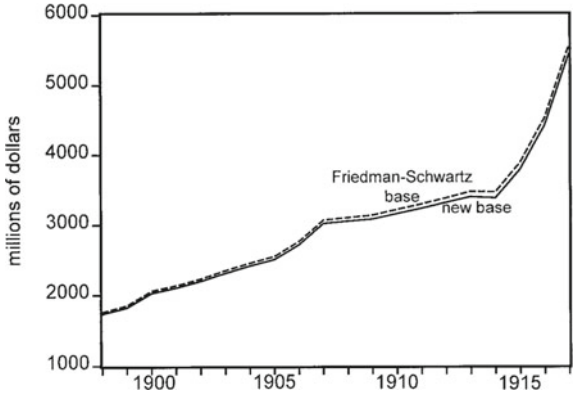

Fig. 22.4 New monetary base versus Friedman-Schwartz monetary base, 1898–1917

FS base. The implication is that, for a given period or point in time, the FS series would overestimate the role of the monetary base relative to the reserve/deposit and currency/deposit ratios, compared to results using the new base. In this respect, the *level* of the monetary base matters—pertinent because (except for 1867–1878) in percentage changes the new series is broadly similar to its predecessors. However, researchers typically

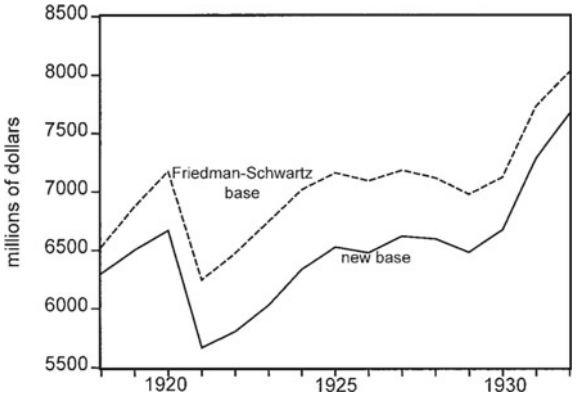

Fig. 22.5 New monetary base versus Friedman-Schwartz monetary base, 1918–1932

are concerned instead with *changes* in the money stock and in determinants of the money stock. Even here, the new base can make a difference. Some examples follow.

Temin (1969) observes, "The factor leading to an expansion of the monetary stock, then, was the rise in the stock of specie. The amount of specie in the country more than doubled in the quinquennium following 1832" (p. 77). Temin shows an official specie-stock series for this discussion, and the 1832–1837 increase is 184%, compared to a money-supply growth of 55%. His own specie series increases by 114% (116% on an end-of-year basis). By contrast, the new monetary base increases by only 44%—*less than the money supply expansion*.

FS (1963, p. 53) note "the mild and almost horizontal movement in high-powered money" from January 1867 to February 1879, with their monetary base changing at an annual average rate of −1.03% compared to 1.33% for the money supply. The new monetary base increases at an annual average rate of 4.18%, and *dominates* the other two determinants of the money supply rather than, as FS found, the reverse.[24] For July 1921 to August 1929, FS (1963, p. 275) describe the "change in high-powered money…[as of] minor importance for the period as a whole." Their figures show annual average percentage increases of 4.6% for the money supply and only 1.3% for their monetary base. The latter figure

compares to 0.7% for the new base (from average 1920–1921 to average 1928–1929). In this case, using the new base *strengthens* the FS finding.

22.1.7 The Monetary Balance of Payments, 1790–1932

The methodology for the monetary balance of payments was developed by Kemp: "Compute the net impact of [international] transactions on the U.S. money stock…Of all international transactions, the only ones that affect the money stock are those that affect some component of the monetary base"(Kemp 1976, p. 10; see also , 1975a, 1975b). In this light, the existing historical balance-of-payments series—North (1960, pp. 600, 605) for 1791–1860, Simon (1960, pp. 699–705) for 1861–1900, and Bureau of the Census (hereafter "Census" 1975, pp. 867–868) for 1874–1932—fall far short.

First, these series ignore net foreign assets of the Treasury and central bank, confining attention to specie transactions alone. Second, there are specific conceptual errors. The Bureau of the Census defines the balance of payments as the entire change in the gold stock, intermixing net production of gold—a purely domestic transaction—with net imports. Simon includes silver as well as gold in specie, thereby creating an inconsistency not only with official monetary data but also with the FS and new monetary bases. Third, North and Simon use official data, that measure net specie imports directly, whereas it is indicated below that an indirect computation provides the more-reliable series. Fourth, North uses inconsistent data from various sources to estimate the series for 1790–1819, and his interpolation method is opaque.

Let IMP denote annual *net* specie imports and PROD annual *net* specie production, the difference between gross production and nonmonetary consumption (import of coin or bullion, production of bullion, or melting of coin that is retained as bullion or used in arts and industry *minus* nonmonetary metal melted down and recoined). Consider the equation.

$$\Delta \text{SPST} = \text{IMP} + \text{PROD} \tag{22.2}$$

With SPST, and therefore ΔSPST, known and of a higher order of accuracy than IMP and PROD (see Appendix), Eq. (22.2) will necessarily hold only if either IMP or PROD is estimated residually. Suppose rather that *both* variables are constructed directly, with notation IMP^{dir} and PROD^{dir}, and let the residual $\text{RES} = \Delta\text{SPST} - (\text{IMP}^{\text{dir}} + \text{PROD}^{\text{dir}})$.

Then the indirectly estimated variables are (a) $IMP^{ind} = \Delta SPST - PROD^{dir} = IMP^{dir} + RES$ and (b) $PROD^{ind} = \Delta SPST - IMP^{dir} = PROD^{dir} + RES$.

The monetary balance of payments (BP) is net specie imports *plus* the change in nonspecie net foreign assets of the authorities:

$$BP = IMP + \Delta NFA \tag{22.3}$$

With the alternative measures of IMP, (a) $BP^{dir} = IMP^{dir} + \Delta NFA$ and (b) $BP^{ind} = IMP^{ind} + \Delta NFA = BP^{dir} + RES$. The two balance-of-payments series are shown in Table 22.1, with BP^{dir} available only from 1820. While both IMP^{dir} and $PROD^{dir}$ (whence IMP^{ind}) are subject to imperfect measurement, $PROD^{ind}$ is a much more volatile series than $PROD^{dir}$, a statement not true for IMP^{ind} versus IMP^{dir}. With $PROD^{ind}$ associated with IMP^{dir}, this finding suggests that IMP^{ind} is a superior measure to IMP^{dir} (whereas no previous work has even considered using the indirect measure of specie flow) and therefore that the "true" BP is closer to BP^{ind} than to BP^{dir}. Empirical results are shown for both BP^{ind} and BP^{dir}.

22.1.8 Comparative Economic Performance of Subperiods

The eight delimited periods of 1792–1932 are compared using three sets of performance principles: monetary-oriented criteria from a generalized exchange-market-pressure model, monetary pyramiding ratios, and measures of price and income growth and stability.

22.1.8.1 Exchange-Market-Pressure Model

The annual change in monetary-base supply ($\Delta BASE_S$) is the monetary balance of payments (BP) *plus* the change in the domestic-origin component of the monetary base (ΔDOB), with the latter being the sum of net specie production (PROD) and the change in the authorities' residual contribution to the base ($\Delta RCON$).[25] The proportionate change in $BASE_S$ is

$$\frac{\Delta BASE_S}{BASE_S} = \frac{BP}{BASE_S} + \frac{\Delta DOB}{BASE_S}.$$

The most-general demand-for-base function allows only for no money illusion: $BASE_D = P \bullet base_d$, where $BASE_D$ ($base_d$) is the nominal (real)

demand for base money and P is the price level in specie (prior to 1860) or gold (from 1860) prices.[26] Taking the proportionate change in BASE_D and imposing money-market equilibrium,

$$\frac{\text{BP}}{\text{BASE}} = \frac{\Delta P}{P} + \frac{\Delta \text{base}_d}{\text{base}_d} - \frac{\Delta \text{DOB}}{\text{BASE}} \tag{22.4}$$

Foreign (f) money-market equilibrium:

$$\frac{\Delta \text{BASE}^f}{\text{BASE}^f} = \frac{\Delta P^{\text{f}}}{P^{\text{f}}} + \frac{\Delta \text{base}_d^f}{\text{base}_d^f} \tag{22.5}$$

where the foreign price level (P^{f}) is in gold currency. Taking Eq. (22.4) *minus* Eq. (22.5), rearranging terms, and adding to each side the proportionate change in the exchange rate (E, the number of units of foreign currency per dollar),

$$\text{EMP} = \text{DPP} + \text{SB} + \text{DB} \tag{22.6}$$

where

$$\text{EMP} = \frac{\text{BP}}{\text{BASE}} + \frac{\Delta E}{E}$$

$$\text{DPP} = \frac{\Delta P}{P} - \frac{\Delta P^{\text{f}}}{P^{\text{f}}} + \frac{\Delta E}{E}$$

$$\text{SB} = \frac{\Delta \text{BASE}^f}{\text{BASE}^f} - \frac{\Delta \text{DOB}}{\text{BASE}}$$

$$\text{DB} = \frac{\Delta \text{base}_d}{\text{base}_d} - \frac{\Delta \text{base}_d^f}{\text{base}_d^f}$$

Equation (22.6) divides EMP (exchange market pressure in favor of the dollar) into three components: DPP (deviation from purchasing power parity in favor of the dollar), SB (monetary supply-side nominal contribution to EMP), and DB (monetary demand-side real contribution to EMP).[27] EMP has alternatives EMP^{dir} (EMP^{ind}), resulting from BP^{dir} (BP^{Ind}) in its construction; similarly, it has SB^{dir} (SB^{ind}) from PROD^{dir} (PROD^{ind}) (via ΔDOB). In Eq. (22.6), SB^{ind} (SB^{dir}) is associated with

Table 22.4 Exchange market pressure (period means—percentages)

Period	*Net specie imports (period means, percent)*			
	Algebraic value		*Absolute value*	
	Direct	*Indirect*	*Direct*	*Indirect*
1792–1810		0.83		7.09
1811–1816		7.04		8.20
1817–1838	2.06[a]	2.74	9.29[a]	6.51
1839–1846	5.26	4.89	8.69	7.76
1847–1861	−14.88	−17.00	15.93	17.89
1862–1878	−8.76	−10.26	8.86	10.27
1879–1913	0.45	0.63	1.95	2.69
1914–1932	2.08	2.07	4.42	4.87
1920–1932[b]	1.31	1.41	3.70	3.78

[a]Specie-flow calculation indirect for 1817–1819
[b]Excludes years during which London gold market was nonoperational

EMP^{dir} (EMP^{ind}). DB is computed from Eq. (22.6) residually, whence $DB^{dir} = DB^{ind}$.

Considering the left-hand side of Eq. (22.6), the magnitude of EMP measures external disturbance to the domestic economy, involving a change in the monetary base and/or the exchange rate, with adjustment and possibly associated costs to follow. Table 22.4 shows the period means of both algebraic and absolute values of EMP (in percentages).[28] Period efficiency varies inversely with the magnitude of either measure of EMP, but the tougher test is absolute value, as positive and negative figures reinforce rather than offset one another. Irrespective of the criterion and of whether EMP^{dir} or EMP^{ind} is considered, the classic gold standard (1879–1913) exhibits the greatest efficiency, with the Federal Reserve period being second (absolute-value measure).[29] Removing the years during which the London gold market was nonoperational (wherefore correction for paper-currency depreciation could not be made) enhances performance of the Federal Reserve period but insufficiently for displacement of the primacy of 1879–1913.

From the right-hand side of Eq. (22.6), $|SB + DB| = MC$ is the absolute "monetary component," or the magnitude of that part of EMP contributed by the monetary supply side and demand side offsetting or reinforcing each other. The smaller the MC (as a period mean), the more

Table 22.5 Monetary component of exchange market pressure (period means)

Period	*Net Specie Imports*			
	Absolute		*Relative*	
	Direct	*Indirect*	*Direct*	*Indirect*
1792–1810		11		64
1811–1816		6		28
1817–1838	9[a]	7	56[a]	55
1839–1846	8	8	44	47
1847–1861	18	19	69	64
1862–1878	10	11	51	55
1879–1913	2	3	36	44
1914–1932	7	7	66	66

[a]Specie-flow calculation indirect for 1817–1819

efficient the period. For MC = 0 (SB = −DB), there is perfect efficiency (complete offsetting of supply and demand), but there is no maximum value of MC. For a relative measure, suppose that |SB| and |DB| are given to the monetary standard. Then their sum is the level against which MC is measured, whence the relative monetary component RMC = 100 · MC/(|SB| + |DB|), computed as a period mean. Maximum efficiency, RMC = 0, occurs again for MC = 0, but now maximum RMC = 100 (for SB · DB > 0), involving reinforcement (or non-offsetting) of supply and demand contributions.

Table 22.5 shows the MC and RMC measures. The classic gold standard has maximum efficiency for MC and shares it with the 1811–1816 interregnum for RMC. The uniform superiority of 1879–1913 over central-banking periods is especially noteworthy.

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22.1.8.2 Monetary Pyramiding Ratios

The ratio BASE/SPST measures discipline, from a specie-standard viewpoint, in restricting the monetary base. Under a pure specie standard, the ratio is unity. The Independent Treasury (1847–1861) and the preceding interregnum come closest to the ideal ratio (zero coefficient of variation around a unitary mean), with results in Table 22.6 for the mean and coefficient of variation. As would be expected, the greenback period is least

Table 22.6 Pyramiding ratios

Period	*Monetary Base to Specie Stock*[a]		*Money Income to Monetary Base*[b]	
	Mean	*Coefficient of Variation (percentage)*	*Mean*	*Coefficient of Variation (percentage)*
1792-1810[c]	1.22	6.86	21.89	21.43
1811–1816	1.25	17.80	27.01	13.40
1817–1838	1.27	11.45	23.08	13.53
1839–1846	1.06	4.69	18.72	7.84
1847–1861	1.00	10.81	15.88	11.81
1862–1878	3.72	42.77	13.48	24.06
1879–1913	2.17	14.80	10.08	6.61
1914–1932	1.65	15.31	12.64	16.60

[a]Monetary base and specie stock: end of year
[b]Monetary base average of current and previous end-of-year
[c]1791–1810 for monetary base to specie stock

disciplined, followed by the classic gold standard (for mean ratio). Paradoxically, the flexibility of the ratio may help to explain the latter-period's remarkable efficiency, in both the external economy (discussed above) and the internal economy (considered below).

Consider the further ratio $(P \cdot Y)/\overline{\text{BASE}}$, where Y is real GNP and $\overline{\text{BASE}} = (\text{BASE}_{-1} + \text{BASE})/2$. The numerator of this ratio is nominal GNP denominated in gold dollars, consistent with the expression of BASE. Then the ratio is income velocity with reference to the monetary base.[30] Period efficiency involves a low and stable velocity. Therefore, measured efficiency varies inversely with the mean and coefficient of variation of velocity. Table 22.6 shows that 1879–1913 prevails over all periods as having maximum discipline (lowest mean velocity and lowest coefficient of variation).

22.1.8.3 Price and Income Behavior

Period efficiency varies inversely with price instability and price volatility. Two price concepts are used: (1) "gold-price level," the price concept (P) in the exchange-market-pressure model, which corrects for depreciation of paper currency against gold or specie, thus placing paper standards on an equal footing with effective specie standards; and (2) "paper price

level," the conventional concept, in which prices are undeflated. The indicator of price instability is mean inflation (percentage per year), computed as $100 \cdot \Delta \ln P$, while the measure of volatility is the standard deviation of trend-corrected P, $100 \cdot [\ln P - F(\ln P)]$, where F is the Hodrick-Prescott filter (smoothing parameter 100). Adjustment for trend eliminates bias in period comparisons, and for each statistic perfect efficiency involves a zero value. Results are exhibited in Table 22.7. The classic gold standard has the best performance by either criterion and for each price concept. The Federal Reserve period exhibits maximum volatility for each price level and, if truncated at 1929, maximum instability for the gold price. The 1811–1816 period has the most unstable, and the second most volatile, paper prices.

Income growth and cyclical stability are the final efficiency criteria. A fair comparison of monetary standards is enhanced by expressing growth (percentage per year) in per-capita terms: $100 \cdot \Delta \ln(YC)$, where YC is per-capita real income, but cyclical income is in overall terms and trend corrected, $100 \cdot [\ln(Y) - F(\ln Y)]$. Monetary-standard performance increases with mean growth and decreases with the standard deviation of cyclical income. As shown in Table 22.7, 1879–1913 is trivially behind the greenback period in highest mean growth but substantially superior to it in income stability. Truncating the Federal Reserve period to end

Table 22.7 Monetary-standard performance: price and income

Period	*Mean rate of growth (percentage)*			*Standard deviation*[a] *(detrended logarithm)*		
	Gold Price	*Paper Price*	*Per-Capita Income*	*Gold Price*	*Paper Price*	*Income*
1792–1810	1.26	1.26	1.04	5.09	5.24	3.46
1811–1816	2.62	4.06	0.30	6.86	9.34	3.20
1817–1838	−1.48	−1.80	0.94	6.45	6.44	3.32
1839–1846	−2.63	−2.82	0.32	5.60	5.81	3.67
1847–1861	1.19	1.19	1.50	4.15	7.73	4.18
1862–1878	0.46	0.50	1.94	7.94	8.56	4.50
1879–1913	0.21	0.19	1.93	2.66	2.77	3.44
1914–1932	1.65	1.65	−0.50	9.73	9.73	7.50
1914-1929[b]	3.47	3.47	1.65	10.08	10.08	6.60

[a]Multiplied by 100
[b]Truncated period ending with year of peak income

in 1929, the year of peak income, transforms its negative growth to only third highest, and the other central-bank periods exhibit growth below even that of the Independent Treasury System.

The classic gold standard also performs well in cyclical stability, third to the 1811–1816 and Second Bank periods. Even with the 1929 truncation, the Federal Reserve period shows maximum instability, followed by the greenback period.

22.1.8.4 Comparison with Existing Literature

The existing literature on economic performance of historical periods is quite different from the current study.[31] The usual objective is multi-country comparison of the classic gold standard and/or comparison of that era with later periods, whereas the current study is strictly concerned with the United States and over a long time span. Previous studies ignore the greenback period, rarely consider the antebellum experience, and do not delineate pre-1914 subperiods by monetary authority. Also, the existing literature disregards exchange market pressure and monetary pyramiding, considering only price and income behavior. The only findings at all comparable to the current study are Meltzer (1986) and Miron (1989), and for truncated classic gold standard and Federal Reserve periods. Meltzer's results are unfavorable to the classic gold standard, which has greater "risk" and "uncertainty" for real output, whereas Miron's findings are consistent with the current study.

22.1.9 Conclusions

Friedman and Schwartz's (1963) book is properly judged as "surely one of the most important books in economic history, and indeed, in all of economics, written in the twentieth century" (Rockoff, 2000, p. 1). The current study builds on the FS fundamental data contribution, their monetary-base series, and extends it back to 1789. The result serves as the foundation for a monetary balance-of-payments series (in two versions) over 1790–1932—a time span during which the United States was actually or potentially on a specie standard.

The years 1792–1932 are divided into eight periods (including three central-banking episodes, the Independent Treasury System, the greenback period, and the classic gold standard), and their economic performances are compared. A generalized exchange-market-pressure model naturally evolves from the data development, with the balance of

payments deflated by the monetary base. Criteria of monetary-standard efficiency, developed from this model and also from monetary-pyramiding considerations, are used in addition to the usual price and income behavior. The main empirical result is the undeniable superiority of the classic gold standard (1879–1913) over central-banking episodes and all other periods.

Appendix

Data Sources and Construction of Variables

Specie Stock

1789–1859. Existing specie-stock series for the antebellum period all are generated by adding a net specie-flow series cumulatively to a base Fig.[32] The principal problem with this technique is the incomplete nature of the official specie trade series, due to (1) smuggling, (2) unavailability of a reliable return on silver imports from Mexico, (3) absence of the requirement that overland exports to Canada and Mexico be declared, and (4) lack of data on gold and silver brought in by immigrants (until the mid-1850s).[33] It follows that a superior method involves *benchmark specie-stock estimates emanating from data on specie held by the banks (including the central bank), Treasury, and public*, without the use of flow data. An annual specie-flow series then serves to interpolate between benchmark dates, with resort to linear interpolation where the series is inadequate or unavailable. The underlying assumption is that the benchmark figures are better estimates than those obtained by cumulating specie flows.

For end-of-year 1789–1806, Blodget (in *Treasury Report*, 1855, p. 51) is the specie-stock (SPST) source.[34] Using only stock data, Blodget in effect counts specie held by the banks and public (FS 1970, p. 233). Gallatin (1831, pp. 45, 49, 53–54), who was well aware of Blodget's work, provides figures for specie in banks for end-of-year 1810, 1814, 1815, 1819, and 1829. He generates the (end-of-year) 1829 specie stock explicitly as the sum of specie in banks and in the public. His technique for estimating public holdings of specie is applied here to his data for the other years, resulting in corresponding benchmark specie-stock figures.

Woodbury provides specie held by banks and by the public for various dates; his basic figure is for the end of 1833, providing another benchmark estimate.[35] The final benchmark figure is for end-of-year 1860 and is the gross specie stock, constructed as the sum of the gold stock (computed below) and subsidiary silver stock (the latter "midyear-averaged" [the average of the current and subsequent midyear] figures for 1860 and 1861, in Treasury *Report*, 1928, p. 552).

Specie-stock figures between the benchmark dates remain to be determined. The interpolative flow series (F) for 1820–1860 is constructed as the sum of net specie imports and net specie production, where net specie production is domestic production *minus* nonmonetary consumption. This consumption involves gold or silver obtained via import of coin or bullion, domestic production of bullion, or melting of coin (but not via reworking of existing nonmonetary metal) that is retained as bullion or used in arts and industry *minus* nonmonetary metal (in jewelry or other manufacture) melted down and recoined.

Net imports of gold and silver are official data, available from 1820 and customarily used by researchers.[36] However, better production and consumption series have become available since earlier research or were ignored in previous work on the specie stock. Annual gold production for 1820–1847 is the "middle" estimate of Martin (1976, pp. 446–447), with the total for 1792–1823 divided equally among the years. For 1848–1860, the source is Berry (1984, pp. 74, 76). Silver production is from Herfindahl (1966, pp. 323, 328–329).[37] Seaman (1852, pp. 258–260) is the source of nonmonetary consumption for 1820–1850.[38] Figures for 1851–1860 are obtained via linear interpolation between 1850 and 1880 (new gold and silver used in manufacturing and the arts, in *Mint Report*, 1921, pp. 62–63).[39] Gold consumption in 1880 is gold used in manufactures and the arts, total new material (Mint *Report*, 1921, p. 62). Silver consumption in 1880 is the product of ounces of silver used in manufactures and the arts, total new material (Mint *Report*, 1921, p. 63), and the price of silver (Census 1975, p. 606).

To interpolate between successive benchmark estimates, years 0 and n, let $\Delta_0^n \text{SPST} = \text{SPST}_n - \text{SPST}_0$ (with the gross specie stock used in place of SPST_{1860}, which is purely gold), and note that Δ_0^n SPST is uniformly positive. Linear interpolation is applied where F is unavailable (1807–1809, 1811–1813, 1816–1818) or $\sum_{i=1}^{n} F_i$ is

negative (1820–1828). This leaves $(n, 0) = (1833, 1829)$ and (1860, 1833). Intervening years $j = 1, \ldots, n-1$ are obtained as.

$$\mathrm{SPST_j} = \mathrm{SPST_0} + \left(\frac{\sum_{i=1}^{j} F_\mathrm{i}}{\sum_{i=1}^{n} F_\mathrm{i}} \right) \cdot \Delta_0^\mathrm{n}\,\mathrm{SPST}^{40}$$

1860–1932. The gold-stock series constructed by FS (1963, p. 723; 1970, pp. 353–354) for 1867–1932 is replicated and extended back to 1860, with some different data sources. Published figures for 1860–1877 are only for midyear (June 30). Except for 1873–1879 in Mint *Report* (1941, p. 84), pre-1879 figures are not corrected for gold presumed lost by the Director of the Mint. Unrevised data for midyear 1860–1872 and end-of-year 1878 are in Treasury *Report* (1898, p. 109; 1928, p. 552).

The FS gold-loss series for midyear 1867–1873 is the difference between uncorrected (Treasury *Report*, 1928, p. 554) and corrected (Kindahl, 1961, p. 40) gold plus gold certificates in circulation. Rounded to the nearest million, the figure equals that shown by FS (1963, p. 17) for 1867 and is readily extended to 1860 via FS's linear interpolation. Subtracting gold loss from the unrevised stock, the corrected stock series is obtained for midyear 1860–1872. End-of-year specie stock for 1860–1877 is computed via midyear averaging. For 1878, it is the difference between the uncorrected stock and the average of the midyear 1878 and 1879 gold loss. For end-of-year 1879–1932, the source is Mint *Report* (1941, p. 84).

Net Specie Imports and Production

Net specie imports ($\mathrm{IMP^{dir}}$) are from Sect. 22.1.10.1 for 1820–1859, calendar-year annualized net gold imports (same source) for 1860–1932, *minus* calendar-year annualized addition to gold exports to Canada (Simon, 1960, p. 645) for 1860–1893, *plus* change in earmarked gold (Board of Governors of the Federal Reserve System [hereafter "Governors"], 1943, p. 536) for 1916–1932. Net specie production ($\mathrm{PROD^{dir}}$) is production *minus* nonmonetary consumption, where production is from Sect. 22.1.10.1 for 1820–1859, computed as described in Sect. 22.1.10.1 for 1792–1819, the 1792–1823 annual value repeated for 1789–1791, and gold production for 1860. For 1861–1900, the source for gold production is Berry (1984, p. 78); for 1901–1932, production in fine ounces (Census 1975, p. 606) is multiplied by price ($20.67 per fine ounce).

Nonmonetary consumption is from Sect. 22.1.10.1 for 1820–1859 and computed as described in Sect. 22.1.10.1 for 1811–1819. The percentage decline 1831–1821 is applied to 1801–1791 and 1811–1801 (as for 1821–1811), and linear interpolation is used for intervening values. Consumption for 1860–1932 is of gold alone. For 1860, gold consumption is estimated as the product of 1860 specie consumption and the 1880 ratio of gold consumption to gold plus silver consumption (from Sect. 22.1.10.1). Linear interpolation between 1860 and 1880 is used for the intervening years. Gold consumption for 1881–1932 is gold used in manufactures and the arts, total new material (Mint *Report*, 1921, p. 62; 1933, p. 30).

Lost and Foreign-Held Currency

Lost currency. Lost Treasury currency (including gold certificates) and Federal Reserve currency, midyear 1862–1933, is obtained as the difference between listed and loss-adjusted circulation of currency denominated up to $1000.[41] Estimated lost national bank notes are excluded during 1862–1874, via subtraction of the product of the computed lost currency and the official circulation ratio of national bank notes to the sum of national bank notes, old demand notes, U.S. notes, and gold certificates (data from Treasury *Report*, 1928, p. 554, and for old demand notes, from Treasury *Reports*, 1862–1874; the ratio is zero during 1862–1863). Midyear averaging of the resulting series yields end-of-year figures for lost currency 1862–1932.

Foreign-held currency. Countries for which dollar holdings are available are those in Europe (including Britain), Cuba, the Dominican Republic, and Honduras. The initial European stock of dollars at end-of-April 1923 (Governors 1943, p. 417) is assumed to derive from equal annual flows, beginning with a zero stock at the end of 1917.[42] The April 1923 stock is assumed to equal the measured cumulative net outflow May 1923 to June 1938; with the May-December flow included to yield end-of-year 1923 and subsequent annual net flows added to provide end-of-year 1924–1932 figures; this is Garber's (1986, pp. S150–S151) methodology.

The stock of dollars in Cuba is from Wallich (1950, pp. 320, 324–325). He provides an end-of-year series for 1920–1932. For 1912, the stock of dollars is taken as the midpoint of Wallich's range for coin plus dollar bills *minus* the midpoint of the range for coin. The dollar stock in 1912 is interpolated linearly to zero in 1897, on the assumption

that dollars in Cuba reached a measurable level only with the Spanish-American War.[43] For 1918, Wallich adds a range of $10 million to $15 million to the contemporary estimate of coin plus dollar bills and interprets the contemporary-author's method as dollars constituting two-thirds of the total. Taking the midpoint of Wallich's range, the arithmetic is clear for the 1918 estimate. Linear interpolation yields figures for 1913–1917 and 1919.

The data source for dollars held in the Dominican Republic and Honduras is Mint *Reports* (1917–1931). It is assumed that an April 1917 figure for the Dominican Republic applies to end-of-year 1916. In 1905, President Theodore Roosevelt imposed a customs receivership on the country, and the dollar was adopted as the standard of value. Therefore, the dollar stock of the Dominican Republic is deemed to have increased linearly from zero in 1904 to the 1916 figure. Existing end-of-year figures are 1917, 1919–1920, 1922–1923, and 1925–1930 for the Dominican Republic and 1920–1921 and 1924 for Honduras.[44] Linear interpolation between adjacent years is applied to obtain 1918, 1921, and 1924 for the Dominican Republic and 1922–1923 for Honduras. It is assumed that 1931–1932 values for the Dominican Republic are the same as the 1930 value.

As a consequence of a rise in the price of silver above 70 cents per ounce (1917–1920 according to Census 1975, p. 606), $3 million in U.S. currency was imported into Honduras by end-of-year 1920 (Mint *Report*, 1921, pp. 154–155). This amount is allocated equally over these 4 years. The residual stock at end-of-year 1916 is an end point for linear interpolation to 1904, as for the Dominican Republic. In 1926, the government of Honduras took steps to discourage dollar circulation (Mint *Report*, 1927, p. 127). Therefore, the 1925 figure, assumed to be the same as the 1924 figure, is halved for 1926 and halved again for 1927–1932.

First Bank Variables

Specie. Specie holdings for 1792–1800 are from the Bank's (closest to) end-of-year balance sheets prepared by Wettereau (1985); for 1791, with no branches, the figure is for the Philadelphia main office alone. For 1801, 1808, and 1810, Wettereau's presentation of the November 26, 1801; February 1809; and January 15, 1811, balance sheets of Gallatin are used. For 1802, the figure of $9 million is taken, based on Gallatin's statement in November that specie holdings were more than $8 million and still

increasing (Wettereau, 1937). The "alarmingly low figure" in May 1804 and February 1805 suggests an amount of $2 million for (end of) 1804, exceeded only from 1797. By May 1806, with note circulation about $5 million, "the specie problem was no longer acute, the supply on hand exceeding the total note circulation" (Wettereau 1985, p. 283), implying holdings of $6 million for end-of-year 1806. Linear interpolation between adjacent figures is used for the remaining years.

Currency. The same sources as for specie provide circulation for 1791–1801, 1808, and 1810. Figures for 1803 and 1807 are taken from House Document 27, 23rd Congress, 2nd session (hereafter "HD27 23C 2s"). Linear interpolation between adjacent figures is used for the remaining years.

Non-Treasury deposits. The same sources as for specie are used for 1791–1801, 1808, and 1810, but only total deposits are given for 1791 and 1808. To estimate non-Treasury deposits for 1791, the proportion of non-Treasury deposits for March 9, 1792, is applied. Treasury deposits at the Bank, available for 1791–1801 and 1810, are obtained for 1803–1806 from Holdsworth and Dewey (1910, p. 60) and estimated via linear interpolation of adjacent years for 1802 and 1807–1809. This permits computation of non-Treasury deposits for 1808 as a residual and for 1809 as the average of 1808 and 1810.

Assume that the modern reserve ratio, defined by the equation "reserve ratio *equals* specie holdings *divided by* the sum of currency in circulation, non-Treasury deposits, and Treasury deposits," was a meaningful statistic for this conservatively operated bank.[45] In 1802, specie holdings, at their highest level to that date, are in the same order of magnitude as in 1809; in 1803, they are very close to the 1800 and 1801 values; and in 1804, they are extremely low, taken as $2 million. Therefore, it is assumed that (1) the reserve ratio for 1802 is the same as that for 1809, (2) the reserve ratio for 1803 is the average of the 1800 and 1801 values, and (3) the reserve ratio for 1804 is the average for 1792–1796, the previous years when specie holdings were less than $2 million. For 1805–1807, the reserve ratio is linearly interpolated between 1804 and 1808. Non-Treasury deposits for 1802–1807 are then obtained via the reserve ratio-equation.

Net foreign assets. These are net assets on "foreign transactions" account *plus* holdings of foreign bills of exchange *minus* Amsterdam loan

outstanding. The source is the same as for specie.[46] Except for the Amsterdam loan, foreign assets and liabilities are listed in the Bank's balance sheets only for 1792–1795. Using information in Wettereau (1937, p. 269, n. 27), a complete series of the outstanding amount of the Amsterdam loan—a relatively large item—is constructed. It is unknown whether there were other foreign items during the years for which balance sheets are not extant.

Second Bank Variables

Regarding Second Bank data, Smith (1953, p. 276) is suspicious of the much-used Tyler Report (Senate Document 17, 23rd Congress, 2nd session [hereafter "SD17 23C 2 s"]) and recommends using the Bank's actual returns whenever possible, the procedure followed here.

Specie. Consulting the end-of-year returns printed in various congressional documents, Bank specie is obtained for 1821–1823 and 1825–1838.[47] For the remaining years, resort must be had to Tyler's data (in SD128 25C 2 s). There are no data for end-of-year 1817, so linear interpolation is applied to the figures for September 1817 and February 1818.

Currency. Circulation for 1817–1820, 1824, and 1832–1838 is from the same sources as for specie. For the remaining years, SD128 25C 2 s is used; because the pre-1832 returns show only notes issued, notes on hand and in transit must be deducted to derive circulation.

Non-Treasury deposits. Same sources as specie are used.

Net foreign assets. Holdings of foreign bills (or net foreign exchange) *plus* amount due from European bankers *minus* amount due to European bankers are used. The sources are the same as for specie, except for 1837. For that year, linear interpolation is applied to the figures for December 1, 1837, and February 1, 1838 (from actual returns in SD128 25C 2 s).

Federal Reserve Variables

Specie. Gold in Federal Reserve banks is from Mint *Report* (1941, p. 84).

Currency. Federal Reserve notes and Federal Reserve banknotes in official circulation are from Governors (1943, pp. 409–412), the FS source.

Domestic non-Treasury deposits. Domestic bank deposits at Federal Reserve Banks (FS 1963, pp. 737–740) are used.

Net foreign assets (other than foreign-held currency). Holdings of foreign bills *plus* amount due from foreign banks *minus* foreign deposits at Federal Reserve banks (Governors 1943, pp. 330–332) are used.

Lost and foreign-held currency. Consider the FS monetary-base series for end-of-November 1874–1906, end-of-February 1874–1907, and end-of-year 1907–1932. For comparability with the new monetary base, state bank notes are excluded. The FS source for state bank notes is Governors (1943, p. 408), which shows $1 million in circulation June 1873 to June 1878 and then zero. So $1 million is deducted from the November figures 1874–1877 and February figures 1874–1878. Linear interpolation, as in note 23, is applied to obtain an end-of-year series 1874–1932 (hereafter "the adjusted FS series"). Estimated Treasury and Federal Reserve currency in official circulation 1914–1932 is obtained by subtracting (1) specie in circulation (specie stock [from Sect. 22.1.10.1] *minus* Federal Reserve gold *minus* Treasury gross specie [from Sect. 22.1.10.7]), (2) nongold coin in circulation (from Sect. 22.1.10.7), and (3) domestic bank deposits at Federal Reserve banks. For 1914–1932, one computes the annual ratio of Federal Reserve currency to the estimated sum of Treasury and Federal Reserve currency in official circulation. This ratio multiplies "lost currency net of lost currency in 1913" (Sect. 22.1.10.3) to yield lost Federal Reserve currency. It multiplies "foreign-held currency net of foreign-held currency in 1913" to estimate foreign-held Federal Reserve currency.

Treasury Variables

Specie. The position that Treasury specie is zero for 1789–1835 is irrefutable (Treasury *Report*, 1915, p. 374; FS 1970, pp. 245–246). It is the sense of FS (1970, p. 248) that this is true also for 1836–1846, which appears to be the position of Taus (1943, pp. 222–224), except for the period of the first Independent Treasury. Therefore, through 1846, Treasury specie is taken as zero except for end-of-year 1840, where gold is assumed to constitute half of the balances in Treasury offices (from Treasury *Report*, 1915, p. 374). For end-of-year 1847–1859, the Macesich data published in FS (1970, pp. 222–224) are used.

For 1860–1861 and 1864–1872, midyear data are computed as the (uncorrected) stock of gold coin and bullion *minus* circulation of gold

coin from Treasury *Report* (1928, pp. 552–554). The ratio of Treasury gold to the corrected gold stock for midyear 1861 and 1864 is interpolated linearly to obtain midyear ratios for 1862–1863, which in turn multiply the corrected stock to estimate midyear Treasury gold for these years. For 1873–1878, midyear Treasury gold is from Mint *Report* (1941, p. 84). Midyear averaging yields Treasury gold end-of-year 1860–1877. The figure for end-of-year 1878 is in Treasury *Report* (1898, p. 59). Treasury gold for end-of-year 1879–1932 is from Mint *Report* (1941, p. 84).

Gold certificates. Gold certificates were first issued in 1865, but in a trivial amount (Bayley, 1881, p. 162). For 1866–1877, midyear averaging is performed on official circulation data in Treasury *Report* (1928, p. 554). End-of-year data 1878–1932 are from Governors (1943, pp. 409–412) and Treasury *Report* (1898, pp. 131–132; 1903, pp. 219–220; 1909, pp. 204–208; 1915, pp. 351–354).

Nongold coin in circulation. The sum of silver dollars, subsidiary silver coin, and minor coin is used. Silver dollars were not in circulation during 1860–1877. However, following FS (1963, pp. 113–114, n. 37; 723), the 1877 figure is taken as $6 million, representing circulation of trade dollars. Standard silver dollars in circulation are available end-of-year 1878–1932 (Governors 1943, pp. 409–412; Treasury *Report*, 1898, pp. 124–126; 1903, pp. 215–216; 1909, pp. 194–198; 1915, pp. 343–346).

Considering subsidiary silver coin, for 1860–1873 midyear averaging is applied to data from the ultimate source: Treasury *Report* (1928, pp. 552, 554). For midyear 1860–1863, only the stock figure is available, and the 1864 circulation/stock figure is used to estimate circulation. For 1874–1877, midyear averaging is applied to figures in Governors (1943, p. 408), the FS data source (containing fewer significant digits than Treasury *Report*, 1928). For 1878–1932, the sources are the same as for silver dollars. Following FS (1963, p. 723; 1970, p. 355), the overestimate deducted in mid-1910 by the Director of the Mint is apportioned linearly over 1881–1909.

Minor coin in circulation is available midyear 1900–1914 and end-of-year 1914–1932 (Governors 1943, pp. 408–412). Midyear averaging is applied to the former.

Currency, 1812–1873. For Treasury notes (1812–1873), outstanding issues are taken from public-debt statements: end-of-year 1812–1843

from Elliot (1845, pp. 906–917) and various end-of-quarter dates 1844–1874 from Treasury *Reports*. The latter figures are converted to end of year via (1) addition of quarterly issues *minus* redemptions from Bayley (1881) or (2) linear interpolation, used where the two adjacent known figures both are below $1 million (in fact, below $0.65 million) *and* issues are zero during the interpolation period.[48] For old demand notes, Treasury notes of 1863, compound-interest notes, and 3% certificates (1861–1873), end-of-year figures for the initial year are the issues (with redemptions again zero) (Bayley, 1881, pp. 153, 161–163, 169). Then midyear-averaged figures in outstanding public-debt statements (Treasury *Reports*, 1862–1874) are taken.[49] For U.S. notes (greenbacks, 1862–1873), official circulation is obtained via midyear averaging of data in Treasury *Report* (1928, p. 554). For fractional currency (1862–1873), the same applies, with two amendments. First, following FS (1963, p. 724; 1970, pp. 354–355), all but $1 million of outstanding fractional currency in midyear 1878 is assumed lost, distributed linearly over 1863–1878, and deducted from the official data. Second, the initial (end-of-1862) figure is total issues during 1862 (there were no redemptions [Bayley, 1881, pp. 159–160]) multiplied by the circulation/stock ratio of midyear 1863, with the estimated loss subtracted.

The sum of all the above components *plus* gold certificates in official circulation (from 1866) *minus* lost currency yields Treasury currency (with no gold certificates) in domestic circulation 1812–1865 but inclusive of gold certificates 1866–1873.

Currency, 1874–1932. The adjusted FS series *minus* specie in circulation *minus* lost currency and foreign-held currency *minus* nongold coin in circulation yields Treasury currency, inclusive of gold certificates, in domestic circulation 1874–1913. The series for 1914–1932 is obtained as this result *minus* Federal Reserve currency in official circulation *plus* lost Federal Reserve currency *plus* foreign-held Federal Reserve currency *minus* domestic bank deposits at Federal Reserve Banks.

Currency, exclusive of gold certificates, in domestic circulation, 1866–1932. This is obtained by *subtracting* gold certificates in official circulation and *adding* lost gold certificates. Lost certificates are the product of (1) the ratio of official circulation of gold certificates to that of old demand notes, U.S. notes, national bank notes (from 1874), silver certificates, Treasury notes of 1890, and gold certificates, and (2) lost Treasury currency inclusive of gold certificates, net of lost currency in 1865.

For 1866–1873, the denominator of the ratio consists of old demand notes, U.S. notes, and gold certificates. For 1874–1913, the denominator is estimated as the adjusted FS monetary base *minus* specie in circulation *minus* nongold coin in circulation. For 1914–1932, Federal Reserve currency in official circulation and domestic bank deposits at Federal Reserve Banks (Sect. 22.1.10.6) are also subtracted. Lost Treasury currency is total lost currency (Sect. 22.1.10.3) *minus* lost Federal Reserve currency (Sect. 22.1.10.6).

Prices

Specie price of currency. For the central bank, this variable is unity except for May 1837 to August 1838, when the Second Bank suspended specie payments. The percentage premium (PR) on American gold at Philadelphia for end-of-year 1837 is linearly interpolated between December 9, 1837, and January 6, 1838, observations (SD457 25C 2 s). The specie price of currency is then $1/(1 + \mathrm{PR}/100) = 0.9609$. Non-unity specie price of currency for the Treasury is the gold price of greenbacks for the last market day of the year, 1861–1878.[50]

Price level. The paper price level is measured by the GNP deflator. For 1792–1869, the source is Berry (1988, p. 21), ratio-linked in 1869 to the series for 1869–1932 in Balke and Gordon (1989, pp. 84–85) and Department of Commerce (1986, pp. 1, 6). The gold price level (P) is the product of the paper price level and the specie price of currency (for the full year rather than end of year), with par equaling unity.

The annual specie price of currency for the antebellum period is derived as follows. The Berry deflator is based on the Hoover and Taylor (1959) composite index of wholesale price indexes in various cities. Let PCUR^i denote the specie price of currency in city i. The weighting pattern of the Hoover-Taylor index (differing for 1800–1815 from 1816–1861) is applied to the data-available PCUR^i for periods during which at least one city is on a paper standard ($\mathrm{PCUR}^i < 1$), based on information in Officer (1996, pp. 16–17) and Berry (1943). Thus, the specie price of currency is a weighted average of PCUR^i for New York and Philadelphia (1814–1817); Cincinnati and the other cities (for which $\mathrm{PCUR}^i = 1$) (1818–1820); New York, Philadelphia, and Cincinnati (1837–1842—but $\mathrm{PCUR}^i = 1$ for New York 1839–1842); and New York, Cincinnati, and New Orleans (for which $\mathrm{PCUR}^i = 1$) (1857).[51] For 1862–1878, the specie price of currency is the gold price of greenbacks (Mitchell, 1908, p. 4).

Income

The logical source for income (Υ) 1792–1869 is the real-GNP series of Berry (1988, pp. 18–20), consistent with construction of the price level. However, Berry's technique is subject to legitimate criticism for the antebellum period.[52] Fortunately, the limitations of Berry's series are overcome via the broad-concept real-GDP data of Weiss (1992, pp. 31–32). The Weiss figures, developed for nine antebellum benchmark years (1793, 1800, 1807, 1810, 1820, … ,1860), are on a per-capita basis. Multiplication by population (Census 1975, p. 8) yields YW, the Weiss GDP series.

Denoting the Berry series as YB, a revised series (YR) is derived as follows: (1) For 1860–1869, YR = YB. (2) Running t from 1850 back in time over the benchmark years (with successive such years separated by m calendar years),

$$\mathrm{YR}_t = \frac{\mathrm{YW}_t}{\mathrm{YW}_{t+m}} \cdot \mathrm{YR}_{t+m}$$

$$\mathrm{YR}_{1792} = \frac{\mathrm{YR}_{1793}}{\mathrm{YB}_{1793}} \cdot \mathrm{YB}_{1792}. \tag{3}$$

$$\text{Let } f = \frac{\left(\frac{\mathrm{YR}_{t+m}}{\mathrm{YB}_{t+m}} - \frac{\mathrm{YR}_t}{\mathrm{YB}_t}\right)}{m}. \tag{4}$$

Then $\mathrm{YR}_{t+n} = ((\mathrm{YR}_t/\mathrm{YB}_t) + n \cdot f) \cdot \mathrm{YB}_{t+n}$, $t = 1850, 1840, \ldots,$ $1 \leq n < m$. The source of income 1869–1932 is the same as for the paper price level. Balke and Gordon (1989) take care to express real GNP consistent with the national accounts (Department of Commerce 1986) denomination in 1982 constant dollars, whence the price level equals 100 for that year.[53] The revised series for 1792–1869 is ratio-linked to the Balke-Gordon series in 1869. Per-capita income is the ratio of real income to population.

Foreign Variables

The foreign variables are index numbers: Britain (converted to 1913 = 1) 1791–1913, an index of Britain (0.5778 weight) and Canada (0.4222 weight) (both converted to 1913 = 1) 1913–1932. Weights are proportional to share of U.S. exports and imports during 1913–1932 (Census 1975, pp. 903–906).

Exchange rate (E). For 1791–1913, the exchange rate is based on the annual average of the quarterly sight-bill equivalent exchange rate (dollars per pound) corrected for paper-currency depreciation (obtained by reversing the procedures in Officer 1996, pp. 54–55, 64–97). The inverse of this series (whence pounds per dollar) is taken and expressed as 1913 = 1.

For 1913–1932, annual cable exchange rates (DP = dollars per pound and DC = dollars per Canadian dollar) are from Governors (1943, pp. 665, 681). The United Kingdom was on a paper standard from August 1914 to April 27, 1925, and again from September 20, 1931, as was Canada to June 30, 1926, and from January 1929. It may be noted that dollar/sterling and Canadian-dollar/sterling parity was 4.8665635, with Canadian-dollar/U.S.-dollar parity at unity. The London gold market was closed during the paper standard until September 1919. So the exchange rates are corrected for paper-currency depreciation 1919–1925 and 1931–1932 as follows.

Letting PGL denote the currency price of gold in London (the ratio of the market price of gold [from Shrigley 1935, p. 92] to the mint-parity price of gold), PRP = (1/PGL − 1) is the proportionate premium of the pound over gold (with the pound at a discount, PRP is negative). The corrected dollar/pound exchange rate is DPC = DP − 4.8665635 · PRP. Letting CP denote the Canadian-dollar/pound cable exchange rate (from Leacy 1983, series J563), the proportionate premium of the Canadian dollar with respect to gold is PRC = (4.8665635/CP) · (1/PGL) − 1, and the corrected dollar/Canadian-dollar exchange rate is DCC = DC − PRC. The inverses of DPC and DCC are then expressed in index-number form.

Price level (P^f). Considering Britain for 1790–1830, the Gayer, Rostow, and Schwartz price index (in Mitchell 1988, p. 721) is ratio-linked to the GDP deflator for 1830–1932. The latter is constructed as the ratio of current-price to constant-price GDP, with the numerator and denominator each obtained by ratio-linking earlier to the first year of later component series: Feinstein (in Mitchell 1988, pp. 831–838) expenditure (1830–1854) and "compromise" (1855–1869, 1913–1919) estimates of GDP at factor cost, Solomou and Weale (1991, p. 60; 1996, pp. 110–113) "balanced" estimate of GDP (1870–1912 and 1920–1932). The Canadian GNP deflator is from Urquhart (1993, p. 25) 1913–1926, ratio-linked to Statistics Canada (Leacy 1983, series K172) 1926–1932.

For each country, the gold price level is the product of the paper price level and the gold price of currency. The currency price of gold in London (PGL) must be extended to 1797–1821, the Bank Restriction Period of the paper pound. Quarterly averages of the price of bar gold are computed from weekly observations in *Report* ([1819] 1968, pp. 335–354) for 1797–1818 and *Report* ([1832] 1968, pp. 98–100) for 1819–1821. Annual averages of the available quarterly observations are taken, and linear interpolation is applied for missing years (1800–1803 and 1806–1809).[54] The gold price of currency for Britain is 1/PGL, while for Canada it is (PRC + 1).

Monetary base (BASE^f). The Canadian monetary base (1913–1932), from Metcalf, Redish, and Shearer (1996), is conceptually equivalent to the FS base and the new monetary base. The British series (BASE^B), developed here, differs in including only domestic bank deposits (hereafter "bankers' balances") at the Bank of England, excluding other non-central-government deposits, because the latter cannot be separated from foreign deposits.

For 1791–1869, BASE^B is the sum of coin in circulation (CC), Bank of England notes in circulation (BN), Scottish and Irish banks notes in circulation *less* coin held (SIN) (from 1845, pursuant to the Bankers' Acts [Scotland and Ireland] of that year), and bankers' balances (BB). The sources for SIN are Report ([1857] 1969) for (last date in year) 1845–1856 and *The Economist* (4-week average ending date closest to year-end) 1857–1869. For 1791–1867, CC = SP − BAC, where SP is the specie stock and BAC is the Bank of England coin and bullion. CC 1868–1869 is midyear-averaged figures of Capie and Webber (1985, p. 198). For 1844–1869, BAC and BN (constructed as notes issued *minus* notes in Banking Department) are from *The Economist*, closest return to end of year. Prior to 1844, the preferred source of any Bank series is Bank of England *Quarterly Bulletin* (June 1967, Appendix [hereafter QB]). Other series for BAC and BN are in *Reports* ([1840, 1841, 1848] 1968).

Let QBF denote the QB end-of-February series, (RF, RN, RD) the corresponding *Report* series for end of (February, November, December), and the subscript 1 the series forwarded one year. Formula A is $(QBF_1/RF_1) \cdot RD$, formula B differs in linearly interpolating RD as $(2 \cdot RN + RF_1)/3$, and formula C is $(2 \cdot QBF + 10 \cdot QBF_1)/12$. Formula A is used to estimate BN 1792–1797, BN 1815–1843, and BAC

1832–1843; formula B to estimate BN 1791, BN 1798–1814, and BAC 1816–1831; formula C to estimate BAC 1791–1815.

Benchmark year-end dates for SP are 1790 (the 1800 figure *minus* 10 times average annual net imports of specie 1791–1800 [from Brezis 1995, p. 51]); 1800, 1830, and 1860 (from Feinstein 1988, p. 397); and 1868 (composed as CC + BAC). Net imports of specie (F^{B}) are from Brezis 1791–1800, computed as $\left(\mathrm{SP}_{1830} - \mathrm{SP}_{1800} - \sum_{1816}^{1830} F^{\mathrm{B}}\right)/15$ for 1801–1815, and from Imlah (1958, pp. 70–72), changing sign of his net-exports series, for 1816–1868. The interpolative technique for SPST is then applied to SP, with F^{B} the interpolative series.[55]

For 1791–1818, BB is constructed as $U \cdot V \cdot \mathrm{TD}$, where TD is total deposits, V is the estimated ratio of private (non-central government) deposits to total deposits, and U is the estimated ratio of bankers' balances to private deposits. Data are from QB and *Report* ([1832] 1968). TD is obtained by applying formula (C and B) to (1790–1814 and 1815–1818). Considering the numerator and denominator of V: for 1791–1806, they are the annual average of 1807; for 1807–1813, they are the annual average of the current year plus the annual average of the subsequent year; for 1814, they pertain to February 1815; for 1815–1818, they are linearly interpolated as for RD in formula B. For 1791–1818, $U = \mathrm{BB}_{1819}/(V_{1819} \cdot \mathrm{TD}_{1819})$.

For 1819–1869, BB is estimated as $(\mathrm{BB}_{1870}/\mathrm{BBH}_{1870}) \cdot \mathrm{BBH}$, where BBH is bankers' balances at the Bank head office (from QB) and BB (from Capie and Webber, 1985, p. 409) also includes balances at branches.[56]

For 1870–1932, BASE^{B} is obtained from the Capie and Webber (1985, pp. 54–57) end-of-year series by *adding* Bank of England Banking Department coin (last reporting date in December, from *The Economist*) and *subtracting* Banking Department notes and coin (Capie and Webber, 1985, pp. 409–420).[57]

Notes

1. Rutner, who has performed the most thorough investigation of the central-bank status of the Second Bank, states, "The ultimate criterion by which the BUS could be a central bank and which would make it unique is simply this: did other economic actors (i.e., banks and individuals) consider BUS monetary liabilities a form of reserve currency?" (Rutner 1974, p. 121). He answers strongly in the affirmative (see below).

2. See Hammond (1957, p. 403), Warburton (1962, p. 67), Fenstermaker (1965, p. 69), Rockoff (1971, p. 456), Rutner (1974, pp. 23, 27, 143–144), Timberlake (1993, p. 241), and Highfield, O'Hara, and Smith (1996, p. 483). However, Temin treats the Second Bank as a commercial bank, albeit an important one.
3. The fact that they were not uniformly so included is not a "puzzle" (Rutner's term), for (1) Bank notes were not a legal reserve and (2) there was no minimum reserve requirement.
4. By contrast, Fenstermaker and Filer (1986) find that the Banks of the United States did not affect the behavior of New England state banks, but they view this result as purely regional.
5. Rutner (1974) observes that even "in the Panic of 1837…there appears to be fairly strong evidence to suggest that the BUS monetary obligations were considered a form of reserve currency and hence in this sense the BUS was a central bank" (p. 145).
6. Within a few months of beginning operations at Philadelphia (the head office), each Bank established branches in Baltimore, Boston, Charleston, and New York (plus 13 other locations, on the part of the Second Bank). Ultimately, the First Bank had eight branches, and the Second Bank had a maximum of 26 at one time. After the Second Bank became a Pennsylvania state bank, it continued to operate nationally by converting its branches to agencies.
7. The monetary-control argument is best made for the First Bank by Hammond (1957, pp. 198–199) and Perkins (1994, p. 249), and for the Second Bank by Temin (1969, pp. 49–53) and Timberlake (1993, p. 241). Rockoff (1971, pp. 456–457) observes that the Second Bank continued this form of monetary regulation even after it became a Pennsylvania state bank.
8. This comparison, made by historians for the Second Bank (e.g., Shultz and Caine 1937, p. 211; Smith 1953, p. 236; Studenski and Krooss 1963, p. 87), again can be extended to the First Bank.
9. The Bordo-Kydland-Rockoff thesis suggests that it is a mistake to view the greenback period (or any suspension of specie payments) as uniformly involving the weakest adherence to a metallic standard and to view the classic gold standard as uniformly involving the strongest. In fact, for most of the last decade of the greenback period, there was strong expectation of a return to the former gold standard (Bordo and Kydland 1995, pp. 451–452), and for much of the early and mid-1890s, there was a high objective and subjective probability of U.S. abandonment of the gold standard (FS, 1963, pp. 104–113).
10. It is arguable that the First and Second Banks gained their central-bank status only gradually when the institution came into existence and lost it similarly when the Bank was on its way out. In this vein, Rutner

(1974, p. 125) asks, "Did BUS [Second Bank] monetary liabilities lose their 'high- poweredness' in a continuous or discontinuous manner?" He includes Second Bank notes and deposits in the monetary base until the very end of the Bank's existence in early 1842, but he also shows an alternative series excluding the Bank's liabilities from the base. The ideal solution might be to assign weights to the Banks' liabilities increasing from zero to unity at the beginning, decreasing from unity to zero at the end, if only the weighting patterns were known. The current study, in effect, allocates a weight of unity to Second Bank liabilities until the end of 1838 and a zero weight from the end of 1839.

11. Because the First and Second Banks did not generally behave as lenders of last resort, they were "outside" agents only in the sense of having their liabilities serve as components of the monetary base. However, it is also true that the performance of the Federal Reserve System as a lender of last resort during the early 1930s was "little more than lip service" (FS, 1963, p. 395).
12. Prior to 1860, nongold coin in circulation is included in the specie stock.
13. Currency is at par when measurable amounts are held by foreigners. So there is no conversion process for foreign-held currency.
14. Throughout this study, beginning-of-year data are considered end-of-previous-year data.
15. Yet there remains a conceptual problem. The greenback price of gold is highly correlated with the price level, and depreciated monies constitute 69% of the base during the greenback period (see Tables 22.2 and 22.3). So the gold-denominated base is roughly the real base for this period. Certainly, one would not apply this procedure after 1932, and especially after 1972, when the paper-dollar nominal monetary base (constituting the entire base) would be deflated by a volatile price of gold. So legitimate comparisons between the *greenback period* new monetary base and the post-1932 base could not be readily made. Also, in the long run, the resulting new base might approximate the real base, and a nominal base does not remain for analysis. I am indebted to an anonymous referee for raising several important issues, including this one.
16. In principle, as a compromise between the two positions, national bank notes could enter the monetary base prior to 1874 but with a weight below unity.
17. Notwithstanding the Mint Act of June 28, 1834, which undervalued silver relative to gold, there is evidence that "silver coins remained in common use in the United States until some time after the discovery of gold in California [in 1848]" (Berry, 1943, p. 488). In a similar vein, Martin (1973, p. 825) shows that "de facto bimetallism…persisted to mid-century." It appears that the turning point was the Subsidiary Coinage Act of February

21, 1853 (Officer 1996, p. 20), but Berry observes that as late as 1857, silver (along with gold) coin was advertised at a premium.

18. Smith (1953, p. 182) refers to "the post notes of ill repute" and observes that "the amount of these issues was a reliable index of the degree of financial emergency within the Bank."
19. The FS (1963, p. 25, n. 10) claim that their currency figures include 3% certificates is false; see note 49. However, FS are followed in their *exclusion* from the monetary base of other interest-bearing currency issued during the Civil War. Recent assessments of the "moneyness" of various forms of interest-bearing Civil War currency are in Gherity (1993) and Woodward (1995). The evidence is mixed and intertwined with the definition of moneyness.
20. Carothers (1930, pp. 170–185, 241–261) provides the best history of these remarkable currencies. He observes that "these glue-coated bits of paper [postage currency] were the worst form of currency ever used by a civilized people" and, quoting Knox, that fractional currency "wore out rapidly and became ragged and filthy."
21. See FS (1963, pp. 207, 257, n. 40), Rutner (1974, pp. 248–253), and Sylla (1982, pp. 31–33).
22. Also, none of the authors includes the Civil War years, and only Bordo includes the antebellum period. Furthermore, FS provide charts rather than figures; Bordo and Cagan deal only with *changes* in the base; and, like Temin, Bordo defines the antebellum monetary base as composed only of specie.
23. Temin's (1969, pp. 186–187) series is at end of fiscal year (September 30, 1820–1842, and June 30, 1843–1858). Rutner's series (not seasonally adjusted, with Second Bank a central bank) is selected for compatibility with the new base. It has year-end data points except for 1835, 1840, and 1843–1846. FS (1963, pp. 800–804; 1970, pp. 344–350) provide data for end-of-November 1867–1906, end-of-February 1867–1907, and end-of-year 1907–1932; the November–February figures serve as interpolative points for year-end Figs. 1867–1906.
24. The formula to calculate annual average percentage change in X is $100 \cdot \ln(X_{t+n}/X_t)/n$, where t is the initial year and $t + n$ is the final year.
25. Taking the first-difference of Eq. (22.1) and incorporating Eqs. (22.2) and (22.3) yields $\Delta \mathrm{BASE}_S = \mathrm{BP} + \Delta \mathrm{DOB}$.
26. Throughout the model, price levels and the exchange rate are corrected for paper-currency depreciation, in conformity with the monetary base expressed in gold dollars.
27. The exchange-market-pressure model, of which Eq. (22.6) is a generalization, has been criticized by Weymark (1995, 1997a, 1997b, 1998). She argues that EMP is the simple sum of the change in official reserves (here,

balance of payments) and exchange-rate components only under restrictive assumptions: (1) purely monetary model, (2) small open economy, (3) exogenous exchange-rate intervention, and (4) exogenous change in domestic credit (a component of ΔDOB in the current model). In response, first, Weymark extends the monetary model by incorporating aggregate demand and supply (and nontraded goods), but at the cost of complexity. The monetary approach is readily operational and melds well with the monetary balance of payments. Second, introducing foreign-country exchange-market intervention into EMP is unsuitable for the purpose at hand, in which EMP is constructed to impinge directly on the domestic economy. Therefore, the totality of the foreign-base term may be placed in SB. Third, under a specie standard, exchange rates are kept within the gold-point spread typically by passive specie-transactions behavior of the authorities. Fourth, providing that the authorities respond to EMP itself or that they sterilize gold flows, the definition of EMP remains valid even with endogenous change in domestic credit. In fact, the Second Bank under Biddle altered domestic credit in response to both specie-flow and exchange-rate change (Redlich, 1968, pp. 125, 134), and the Federal Reserve System sterilized gold flows for much of the 1920s and into the second half of 1931 (FS 1963, pp. 279–287, 297, 360–361, 396–399).

28. In the construction of variables, the proportionate change in X is $\Delta X/X_{-1}$.
29. It is also true that 1879–1913 has the smallest magnitude of the absolute value of every component of EMP, no matter how composed: BP^{dir}/BASE, BP^{ind}/BASE, ΔE/E, DPP, DB, SB^{dir}, and SB^{ind}.
30. This statement is valid only if P and Y are defined so that (1) $P = 1$ in the national-accounts base year and (2) the unit of measurement of Y is the same as that for BASE. Otherwise, the ratio is income velocity only up to a multiplicative constant. P and Y are constructed to make the statement true.
31. Nearly all of the studies are listed in Bordo and Schwartz (1999). See also Basu and Taylor (1999).
32. This is the technique of Temin (1969, pp. 185–189) and Rutner (1974, pp. 205–216) as well as that of Seaman (1852, pp. 257–260); Secretary of the Treasury, *Annual Report* (hereafter "Treasury *Report*") (1855, p. 71); and Warburton (reported in FS, 1970, p. 227).
33. See Treasury *Report* (1854, p. 281; 1855, p. 71) and Simon (1960, pp. 631–632, 644).
34. Blodget's series, for 1790–1807, is dated end-of-year by FS (1970, pp. 216–219), but it is interpreted as beginning-of-year (end of the previous year) by Temin (1969, p. 185), and by FS (1970, p. 244, n.

16) themselves, via the dating of the table in Treasury Department (1915, p. 45), which includes the Blodget figure for 1800.

35. Rutner (1974, pp. 205–207) believes that this is Woodbury's basic figure, and FS (1970, p. 227) provide evidence that it is indeed so, but it is uncertain whether the estimate is derived purely from stock data. Woodbury describes his numbers only as "prepared partly from actual returns, and partly from estimates" (Elliot, 1845, pp. 941–942).
36. The source is Census (1949, pp. 243–245), with "calendar-year annualization" of figures for other than calendar years. For example, data for years ending June 30 (September 30) are allocated 50% (75%) to the current (the remainder to the previous) year.
37. Linear interpolation is used between benchmark dates, and a half-year of operation is assumed for the initial year (1836) of the only significant silver mine. Data are converted from physical output to value via multiplication by the New York price of silver (1836–1849 from Director of the Mint, *Annual Report* [hereafter "Mint *Report*"], 1910, p. 99, with price computed as the ratio of value to output; 1850–1860 from Census, 1975, p. 606). Rutner uses Herfindahl's silver (and gold) data, but only for 1834–1849.
38. Calendar-year annualization is applied as warranted. Temin makes no allowance for nonmonetary consumption. Rutner (1974) and Shetler (1973) do not employ pre-1880 consumption data for their antebellum estimates (and Rutner errs in including reworked metal), but Seaman shows an appreciation of the concept of nonmonetary consumption that vindicates his numbers. Seaman's figures for 1821–1846 are net of domestic production and require restoration to gross level. From the text, it may be inferred that he takes production as (1) essentially zero for 1821–1823, (2) deposits of domestic gold production at the mints for 1824–1829, and (3) $500,000 for 1830–1846. The figure for 1820 is obtained by assuming that the percentage decline in consumption from 1821 to 1811 was the same as that from 1831 to 1821, and applying linear interpolation.
39. This is an important antebellum interpolation. It is prudent to check whether log-linear rather than linear interpolation makes a difference. The Theil inequality coefficient between the alternative interpolative series and the actual series F is 0.0086, with zero being a perfect fit.
40. Note that linear interpolation involves (j/n) in place of the bracketed term.
41. The source is Laurent (1974, p. 221). It is reasonable to assume that large-denomination notes would be guarded most carefully.
42. Garber (1986, pp. S140–S141, S150) provides evidence that "prior to World War I little U.S. currency was held in Europe." It is unlikely that this situation changed until some time after American Expeditionary Forces arrived in France in June 1917.

43. This is quantitatively the most important linear interpolation for foreign-held dollars. Log-linearity would change the monetary base in any year by less than $6 million, less than one-fourth of 1%.
44. A Honduras figure for 1922 is unreasonably low and so is disregarded.
45. This is the view of Perkins (1994, p. 248), who computes the ratio for various years.
46. The exchange rate to convert foreign bills in 1793 from guilders to dollars is in Wettereau (1985, p. 87).
47. The sources are HD52 17C 1 s (1821), HD78 18C 1 s (1822–1823), HD105 19C 1 s (1825), *American State Papers: Finance* 766 19C 2 s (1826), HD100 20C 1 s (1827), HD93 20C 2 s (1828), HD63 21C 2 s (1829–1830), HD523 23C 1 s (1831–1833), SD128 25C 2 s (actual returns) (1834, 1836), SD312 24C 1 s (1835), SD 471 25C 2 s (condensed return) (1837), and HD172 26C 1 s (1838). Smith did not locate returns prior to 1825.
48. There are discrepancies between Bayley's flow data and the change in amount outstanding obtained by first-differencing the public-debt series, but the divergence is of importance only for small changes in amount outstanding. For possible reasons for the discrepancy, see Treasury *Report* (1846, p. 29) and Rutner (1974, p. 253). Bayley's figures are probably superior to the Treasury flow data—the latter used by Rutner—because Bayley accounts for and corrects anomalies in the Treasury data. Also, Rutner obtains his outstanding-notes series by continuously cumulating sales *minus* retirements, a technique that fails to take advantage of the (presumed definitive) public-debt statements.
49. In using the "other U.S. currency" series rather than consulting the public-debt statements, FS commit actual or potential errors. First, "other U.S. currency," as found in Treasury *Report* (1928, p. 552), equals the sum of outstanding old demand notes, Treasury notes of 1863, and compound-interest notes; 3% certificates are excluded. Second, for midyear 1863, "other U.S. currency" is overstated by including (and thus double-counting) the stock of U.S. notes issued under the Act of March 3, 1863. At $89.879 million, the error is substantial—20% of the 1862–1863 average monetary base. By 1874, 3% certificates outstanding are nearly zero, and there is only a trivial difference between "other U.S. currency" and the sum of the components in the public-debt statement.
50. The average of the high and low price for the day is taken, from Mitchell (1908, pp. 288–338). For 1861, the January 1, 1862, figure is used.
51. Sources of $PCUR^i$ are Gallatin (1831, p. 106) for 1814–1817, Warren and Pearson (1935, p. 154) for New York 1837–1838 and 1857, Officer (1996, p. 78) for Philadelphia 1837–1842, and Berry (1943, pp. 386–389, 398, 462, 590–591) for Cincinnati. Averages of monthly or quarterly values, often of the percentage specie premium, are taken. (Where there is

a monthly range, the midpoint is used.) If the annual value of the specie premium is PR^i, then $PCUR^i = 1/(1 + PR^i)$. Berry provides no data for June 1839 to March 1840, but the specie premium is clearly zero for June–September. He notes that the specie premium increased to about 8% within 5 months of the October 1839 suspension. It is assumed that the premium increased linearly from zero just prior to that suspension to 8% in March 1840, and a suitable weighted average of zero and the interpolated value is computed for October 1839.

52. As noted by Engerman and Gallman (1982, pp. 5, 15–16), the extrapolator series are few in number, the GNP concept excludes home production, and the extrapolations are based on a statistical model devoid of economic content.
53. Balke and Gordon (1989, p. 40) argue convincingly for their own superiority over the competing Romer (1989, pp. 22–23) series. Dividing P by 100 and expressing Y in millions rather than billions of dollars satisfies (1) and (2) in note 30.
54. This technique results in a series superior to those of Tooke (in Arnon 1991, p. 159) and Hawtrey (1918, p. 64).
55. For 1791–1800 and 1801–1815, by construction, $\sum_{i=1}^{n} F_i^B = \Delta_0^n \mathrm{SP}$.
56. For 1819–1827, QB data are beginning of subsequent year.
57. Thus, the Capie-Webber series is corrected for, inconsistently, excluding Banking Department coin but including its notes.

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