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Seigniorage in the United States: How Much Does the U.S. Government Make from Money Production?

MONEY IS CERTAINLY one of the greatest inventions of mankind. As Brunner and Meltzer (1971) have noted, its vast social productivity arises from the enormous reduction in transactions and information costs that it provides by serving as a standardized medium of exchange.¹ Of course, these benefits, like those of any other good or service, are not provided at zero cost. The revenue received from producing and maintaining a nation's money stock covers its production costs and, perhaps, some profit as well for its producers.

In monetary economics, the revenue from money creation is called "seigniorage." Unfortunately, this term has been subject to a variety of interpretations in the literature. After reviewing several traditional definitions, this article develops a new seigniorage measure, extended monetary seigniorage, and shows how it is distributed between the Federal Reserve, member banks and the U.S. Treasury during the 1951-90

period. Then, it examines the relationship between inflation and seigniorage during this period and shows that this relationship is analogous to the well-known "Laffer curve" that relates tax rates and tax revenues: seigniorage increases as inflation rises until the inflation rate reaches about 7 percent; thereafter, inflation and seigniorage are inversely related. Indeed, for each percentage point rise in inflation above 7 percent, the U.S. Treasury's share of seigniorage fell, on average, by \$1.4 billion (measured at 1982/84 consumer prices).

REVENUE FROM MONEY CREATION: SOME ANALYTICAL CONCEPTS

The term "seigniorage" dates back to the early Middle Ages, when it was common for sovereigns of many countries to finance some of their expenditures from the profits they earned

¹See Brunner and Meltzer (1971).

from the coinage of money. In the money literature, seigniorage has often been used interchangeably for either the total revenue or the profit derived from money production and maintenance. Of course, revenues and profits are identical only if costs are zero. Although theoretical analysis can be simplified by assuming that costs are zero, this assumption cannot be maintained in empirical applications. Since this article focuses on the empirical issues associated with seigniorage, the total revenue, cost and profits associated with money production must be carefully distinguished and the relevant notion of seigniorage must be clearly defined.

In the analysis that follows, seigniorage is defined as the revenue associated with money production and maintenance, rather than the resulting profit. Also, the focus is on the revenue accruing to the government and, therefore, on the creation of monetary base rather than the creation of deposits by private depository institutions.

Monetary theorists have used two main concepts of seigniorage in analyzing its relationship to inflation. These concepts are termed "opportunity cost seigniorage" and "monetary seigniorage."

Opportunity Cost Seigniorage

As its name indicates, opportunity cost seigniorage defines seigniorage as the total "opportunity costs" of money holders. It asks the question, What additional real income would individuals have earned if they had held interest-earning assets instead of non-interest-earning money? The real interest earnings foregone by holding money are called its opportunity cost.

Real opportunity cost seigniorage (s_o) is:

$$(1) s_o = rB/P,$$

where B denotes total base money holdings, r is the representative nominal rate of return on assets other than base money and P is the consumer price level.

This concept of seigniorage has been used as an elegant tool of theoretical analysis.² Its analytical attraction is that it derives the value of

seigniorage from the individuals' valuation of the services of money. It does this by identifying seigniorage with the interest income that individuals voluntarily forego by holding some of their wealth as money instead of as earning assets. This concept, however, presents some problems when it is used for empirical studies of seigniorage.

To make the concept of opportunity cost seigniorage operational for empirical analysis, some actual nominal rate of return must be chosen as the measure of the representative rate of return (r) in equation 1. Estimates of seigniorage will differ widely depending on which rate of return — for example, the federal funds rate, the average yield on government bonds or the rate of return on stocks of, say, the computer industry — is used. Thus, the problem is to determine a weighted average of observable asset returns that meaningfully approximates the true opportunity cost of money holders.

There is also a conceptual problem with using this definition of seigniorage: opportunity cost seigniorage does not equal the monetary authority's actual revenue from money creation.³ Because the structure of the monetary authority's portfolio differs markedly from the asset structure preferred by private investors, opportunity cost seigniorage does not provide a measure of the gains to the monetary authority from money creation and maintenance.

Monetary Seigniorage

The concept of monetary seigniorage permits a more straightforward and unambiguous empirical measurement. Monetary seigniorage (s_M^*) is defined as the net change in base money outstanding (ΔB), deflated by the consumer price level (P):

$$(2) s_M^* = \Delta B/P.$$

Monetary seigniorage measures the transaction value of non-monetary assets that money holders trade in to the monetary authority to obtain the desired increase in their base money balances (ΔB). Because the data necessary to calculate this measure are easily available, the concept of

²See Bailey (1956), Johnson (1969), Auernheimer (1974) and Barro (1982).

³For a different view, see Gros (1989), p. 2. He interprets equation 1 to represent "the interest savings the government obtains by being able to issue zero interest rate securities in the form of currency." This interpretation,

however, is valid only if the nominal rate of return (r) equals the effective yield on government debt and operating costs are zero.

monetary seigniorage has been widely used and measured by monetary economists.⁴

Extended Monetary Seigniorage

Unfortunately, the traditional concept of monetary seigniorage does not provide a complete account of the government's revenue from base money provision. It abstracts from the actual process of base money creation and, therefore, neglects the fact that the total flow of revenue in addition depends on the asset structure of the central bank.

The total flow of seigniorage to the government consists of two components. The first is the real value of the non-monetary assets that the central bank receives from the public in exchange for an increase in the monetary base. This is measured by the traditional concept of monetary seigniorage as defined above. The second component is the interest earnings the central bank receives on its stocks of non-government debt.

Since domestic private and foreign debtors have to service the debt held by the central bank, there is a flow of seigniorage to government even if the public does not desire to increase its cash balances. It is important to note, however, that only the interest earnings on non-government debt qualify. The Treasury's payment of interest on its debt held by the central bank is an inside transaction between government institutions that does not affect the resource transfer from the private money holders to government. Finally note that the central bank occasionally realizes capital gains (losses) by subsequently selling assets in the open market at higher (lower) prices than it had purchased them.

To take these additional components of the revenue from base money production and maintenance into account, let the interest rates on the monetary authority's holdings of private domestic debt (D) and official foreign debt (F) be denoted by d and f , respectively, and unrealized capital gains by G_R . Then, the extended monetary seigniorage, s_M is:

$$(3) s_M = s_M^* + (dD + fF + G_R)/P.$$

Extended monetary seigniorage encompasses the traditional measure of monetary seigniorage. The new concept provides the seigniorage measure best suited for this study for two reasons. First, it directly measures the total real net flow of assets that the Federal Reserve System and U.S. Treasury receive from their monopoly over base money production; second, it can readily be computed from available data.

EXTENDED MONETARY SEIGNIORAGE IN THE UNITED STATES: A DETAILED FRAMEWORK FOR ANALYSIS

An analysis of extended monetary seigniorage in the United States can begin at either of two points: the "sources" side shows us how the gains were achieved, while the "uses" side tells us who received the gains.

Sources of U.S. Extended Monetary Seigniorage

From the sources side, the extended monetary seigniorage is shown by equation 3. In more detail, it can be written as:

$$(4) s_M = (\Delta B + dD + fF + G_R)/P,$$

$$\text{where } B = C + R_B + R_F.$$

It is important to note that, in this analysis, the monetary base (B) is defined more broadly than is usually the case. Here, official foreign deposits at the Federal Reserve System (R_F) are added to the usual monetary base components of currency in circulation (C) and reserves of depository institutions (R_B).⁵ This expanded definition is appropriate because the Federal Reserve obtains seigniorage from producing foreign deposits in precisely the same way it does from producing deposits for domestic depository institutions.

Uses of U.S. Extended Monetary Seigniorage

To develop the uses side of extended monetary seigniorage, two financial accounts are utilized: (1) the combined Federal Reserve-Treasury "monetary" balance sheet and (2) the income statement of the Federal Reserve System.

⁴See Friedman (1971), Calvo (1978), Fischer (1982), Dornbusch (1988), Grilli (1989) and Klein and Neumann (1990).

⁵"Foreign deposits" include the demand balances of foreign central banks, the Bank of International Settlements,

foreign governments, and international organizations, like IMF and World Bank; it excludes the Treasury's Exchange Stabilization Fund.

The U.S. monetary authorities' combined balance sheet can be written in first-difference form to show the changes that have occurred over some specific time period as follows:

$$(5) \Delta A_{FR} + \Delta D + \Delta F + \Delta C_C + \Delta OA \\ = \Delta B + \Delta R_G + \Delta K.$$

The left-hand side of equation 5 describes the *changes* in the Federal Reserve's assets that supply funds: outright purchases of U.S. Treasury and federal agency obligations (ΔA_{FR}), loans to depository institutions via the discount window and government securities bought under repurchase agreements (ΔD), the acquisition of gold, special drawing rights, and foreign exchange (ΔF), issuance of coin by the Treasury (ΔC_C) and other Federal Reserve net assets (ΔOA).⁶

The right-hand side of equation 5 describes the *changes* in the factors that absorb these funds: the monetary base (ΔB), deposits of the Treasury (ΔR_G) and the Federal Reserve System's capital accounts (ΔK).⁷ Again, note that the monetary base definition used in this analysis includes foreign deposits (R_F) held at the Federal Reserve.

The Fed's income statement is summarized in equation 6. The left-hand side describes the Fed's current income and expenses that give rise to its net revenue; the right-hand side of equation 6 shows how the Fed's net revenue is distributed.

$$(6) dD + fF + aA_{FR} + G_R + G_U - OC_{FR} \\ = Y_B + Y_{FR} + Y_{G,N}.$$

As noted earlier, *d* and *f* represent the interest rates that the Federal Reserve receives on its loans to the domestic private sector and its international assets, respectively; similarly, "a"

denotes the average interest return it receives on its portfolio of government securities bought outright.⁸

The next two terms are the "realized" profits (G_R) that the Fed receives from sales of its bonds and foreign assets at prices above those that it paid for them, and the "unrealized" profits (G_U) that result from the Fed's practice of marking the prices of its foreign exchange holdings to their market value. This accounting practice was introduced in 1978; before foreign exchange holdings were valued at historical rates.⁹

The term (OC_{FR}) measures the current operating costs or expenses of the Reserve Banks and the Federal Reserve Board minus the fees and reimbursements that the System collects for the services it sells to the banking industry, the Treasury and other government agencies. These service fees and reimbursements are "netted out" to remove receipts and expenses that are presumably unrelated to the Federal Reserve System's monetary authority role.

The right-hand side of equation 6 shows how the Federal Reserve's net revenue (Y) is distributed. The Fed pays its member banks statutory dividends (Y_B) on their paid-in capital and uses an amount Y_{FR} , which is equal to $.5\Delta K$, to raise the Reserve Banks' surplus capital to the level of its member banks' paid-in capital. The remainder of the System's net income is transferred to the U.S. Treasury under the heading of "Interest on Federal Reserve notes" ($Y_{G,N}$).¹⁰

Subtracting equation 6 from 5 and using the identity that the current issuance of coin (ΔC_C) equals the operating cost of the U.S. Mint (OC_M) plus the profit to the Treasury on the issuance of coin ($Y_{G,C}$) yields:

⁶In contrast to their practice of valuing the domestic assets at the original purchase price, the Federal Reserve Banks mark their foreign exchange holdings to the market. As a consequence, reported changes in the stock of the Federal Reserve System's international assets include net purchases at the actual transaction values (ΔF) and valuation gains (or losses) on the previous stock of these assets if foreign currency prices have changed. Because these valuation changes do not directly increase or absorb reserves, they are not included in equation 5. Incorporating them explicitly would simply introduce the same value on both sides of equation 5 and, hence, they would be "netted out" of the analysis.

⁷ R_G includes Treasury cash holdings.

⁸The Federal Reserve's international assets include the nation's gold stock on which it receives no interest earnings.

⁹Most European central banks do not mark their foreign exchange holdings to market values; instead, they evaluate their holdings at the lowest market price that occurred since they were acquired. As a result, their income statements never show unrealized profits from their foreign exchange holdings; however, they show unrealized losses whenever the prices of foreign currencies fall below their acquisition values.

¹⁰As an historical aside, prior to 1933, the income transfer to the U.S. Treasury was effected as a franchise tax based on a provision of Section 7 of the Federal Reserve Act. This provision was repealed in 1933 to permit Reserve Banks to restore their surplus accounts, after they had been cut to one-half by the enforced subscription to the Federal Deposit Insurance Corporation, founded in 1933.

$$\begin{aligned}
 (7) \Delta B + dD + fF + G_R \\
 &= (OC_{FR} + OC_M) + Y_{FR} + Y_B \\
 &+ (Y_{G,N} + Y_{G,C} - aA_{FR} - \Delta R_C) \\
 &+ \Delta(A_{FR} + D + F + OA - K) \\
 &- G_U,
 \end{aligned}$$

where: $B = C + R_B + R_F$, and

$$Y_{G,C} = \Delta C_C - OC_M,$$

$$Y_{FR} = .5\Delta K.$$

Dividing equation 7 through by the consumer price level (P) and using the definition of extended monetary seigniorage shown in equation 4 yields:

$$(8) s_M = s_C + s_B + s_G + s_I + s_L,$$

where: $s_C = (OC_{FR} + OC_M)/P$

$$s_B = Y_B/P$$

$$s_G = (Y_{G,C} + Y_{G,N} + \Delta A_{FR} - aA_{FR} - \Delta R_C)/P,$$

$$s_I = \Delta(D + F + OA - .5K)/P \text{ and}$$

$$s_L = (-G_U)/P.$$

THE USES OF EXTENDED MONETARY SEIGNIORAGE

Equation 8 shows how the extended monetary seigniorage in each period is used: (1) s_C is the cost of providing the public's desired real base money balances, including the costs associated with monetary policy and the Federal Reserve's contribution to bank supervision, (2) member banks receive s_B , the statutory dividends, (3) the government receives s_G for spending purposes, (4) the Federal Reserve uses s_I to increase its portfolio of assets other than government debt and (5) the Fed uses s_L to make up for book-losses resulting from adverse changes in asset prices.

It is useful to consider in detail the seigniorage distributed to the U.S. government, which may be termed "fiscal seigniorage."¹¹ Fiscal seigniorage can be written in two different ways.

The first way, using the government's budget constraint, is

$$(9a) s_C = (G - T + aA_o - \Delta A_o)/P,$$

where $(G - T)$ is the government's primary budget deficit or surplus and aA_o is the government's interest expenditure on its debt held outside the System (A_o). Equation 9a shows that fiscal seigniorage is the portion of the government's deficit that is not financed by borrowing from the public (ΔA_o). This means that fiscal seigniorage contributes to the finance of the primary budget deficit and of the interest expenditures on debt held by the public (outside the Federal Reserve System).

The second way of writing fiscal seigniorage, as shown in equation 8 above, is

$$(9b) s_C = [Y_{G,C} + (Y_{G,N} - aA_{FR}) + \Delta(A_{FR} - R_C)]/P.$$

Equation 9b breaks down fiscal seigniorage into three source components: the net revenue from issuing coin ($Y_{G,C}$), the net revenue received from the Federal Reserve ($Y_{G,N} - aA_{FR}$), and the net borrowing from Reserve Banks ($\Delta A_{FR} - \Delta R_C$).¹²

The treatment of net borrowing as a source of fiscal seigniorage is not an obvious one, since the Fed does not lend directly to the Treasury; instead it purchases Treasury securities in the open market. From a purely technical point of view, the Treasury receives the borrowed funds from the public on the date of security issue, not from the Fed at the later date when the public resells the securities to the Federal Reserve.

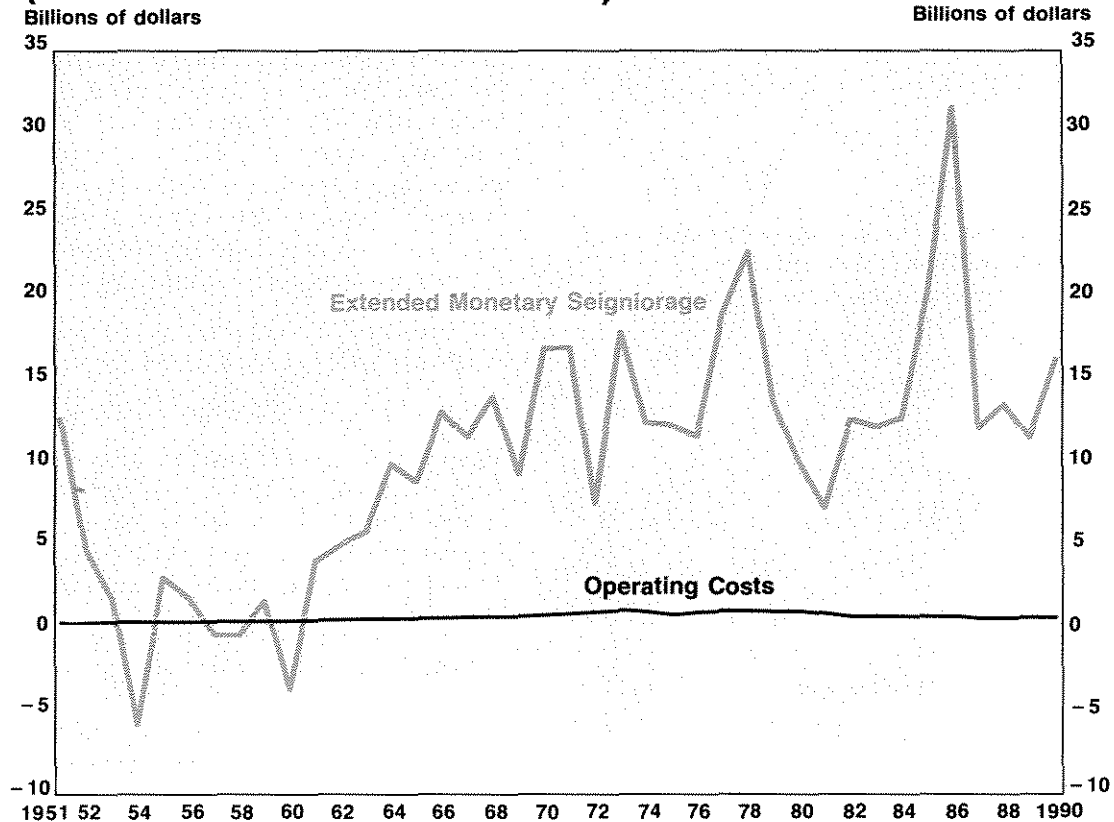
The above treatment of borrowing can be justified by the following considerations: First, from the economic point of view, what counts is not the first but the final placement of the Treasury securities. Thus, if the security dealers do not hold but resell the Treasury securities to Reserve Banks after a short duration, it is, in fact, the Fed that supplies the borrowed funds to the Treasury. At the same time, these transactions permit the security dealers to buy another load of new debt from the Treasury. Second, the bulk of the Federal Reserve's pur-

¹¹See Klein and Neumann (1990)

¹²In the theoretical literature, it is usually taken for granted that the net revenue received from the Federal Reserve ($Y_{G,N} - aA_{FR}$) cannot be negative since the government receives back as part of the transfer ($Y_{G,N}$) the interest paid on its debt to the central bank (aA_{FR}). This conclu-

sion, however, holds only if the costs of the monetary authority are assumed away. In the United States, for example, the Treasury's interest payments to the Fed typically exceed the Treasury's income received as "interest on Federal Reserve notes."

Figure 1
Extended Monetary Seigniorage and Operating Cost
(in 1982/84 Consumer Prices)



chases of Treasury securities is at the short-term end of the maturity spectrum. During the 1980s, for example, 83 percent of the securities purchased had maturities of less than one year. For this large portion of newly acquired debt, the time difference between the public's buying and reselling plays no significant role in the empirical analysis below based on annual observations. Third, some portion of new Treasury debt issued with maturities exceeding one year is also purchased by the Federal Reserve during the year of its issue. Finally, any approximation error with respect to the annual time unit ceases to play a role when annual average data for decades are examined below.

EMPIRICAL ANALYSIS

Figure 1 shows the magnitudes of the extended monetary seigniorage (s_M) and the monetary authorities' operating costs (s_C) as measured in 1982/84 dollars, from 1951 to 1990. During the

past four decades, the annual real value of extended monetary seigniorage has generally risen, while ranging over that period from -\$6 billion in 1954 to \$31 billion in 1986. As figure 1 indicates, a comparatively small portion of this amount—only about 7 percent on average—was used to cover the costs of producing the monetary base by the monetary authorities. Consequently, the government's production of base money has resulted in sizable and rising net profits, which are equal to the difference between the two curves in figure 1.

This result is shown in somewhat different form in table 1, which provides annual average data for each of the past four decades. During the 1980s, the annual real net profit from base money production and maintenance averaged more than \$14 billion, while, during the 1950s, it averaged \$1 billion per year. The steepest increase in extended monetary seigniorage occurred in the 1960s, when it jumped to almost \$10 billion annually, on average, up sharply

Table 1
The Uses of Extended Monetary Seigniorage¹

	1951-60	1961-70	1971-80	1981-90
Extended monetary seigniorage s_M	\$1,555	\$9,847	\$14,373	\$14,948
- Operating cost, s_C	454	695	1,039	746 ²
= Net profit	1,101	9,152	13,334	14,202
- Dividend payment to member banks, s_B	67	100	101	96
- Book-loss on foreign exchange, s_L	n.a.	n.a.	23 ³	-379
- Investment in loans and foreign assets, s_I	-1,397	-1,159	1,855	3,283
= Fiscal seigniorage, s_G	\$2,431	\$10,211	\$11,355	\$11,202
Memo:				
Traditional monetary seigniorage, s'_M	\$1,498	\$9,683	\$14,414	\$13,945
Fiscal seigniorage as percent of real federal on-budget spending	1.0%	2.8%	2.1%	1.6%

¹Annual averages in millions of dollars, 1982/84 consumer prices.

²Net of revenue from priced services (\$501 million).

³Starting in 1978.

from its 1950's level. About 80 percent of this rise resulted from drastic increases in average reserve requirements during the 1960s.

As table 1 shows, the average annual total operating costs of the monetary authorities increased by about 50 percent during the 1970s from its earlier levels. This rise primarily reflects the Federal Reserve's efforts to introduce a variety of services in the 1970s associated with the payments mechanism. The monetary seigniorage used for covering operating costs fell in the 1980s when the Fed began to charge explicitly for these services.¹³

Dividend payments to member banks on their paid-in capital (s_B), which run about \$.1 billion per year, and the System's accounting losses on its holdings of foreign exchange (s_L) represent

fairly negligible uses of the total monetary seigniorage. As table 1 indicates, these accounting adjustments began in 1978, when the Fed started valuing its foreign exchange holdings at current market prices.¹⁴

During the 1980s, the Federal Reserve System accounted an annual valuation gain on its foreign exchange holdings averaging \$380 million. This gain reflects the appreciation of the Deutschmark and yen against the dollar from 1985 to 1987 and again in 1989/90. Occasionally, the Fed also realized profits on foreign exchange holdings; they averaged \$151 million per year during the 1980s.

As in all countries, the bulk of the extended monetary seigniorage went to the government. The average annual flow of fiscal seigniorage

¹³For example, if the cost of priced services was added to the operating costs for the 1980s, it would raise the figure shown by almost 75 percent.

¹⁴During the 1970s, the Fed's realized (as opposed to accounting) losses on foreign exchange amounted to about \$148 million per year in real terms. These losses resulted from foreign exchange intervention attempts to stem the

sharp decline in the value of the dollar during the 1970s. They appear, of course, on the sources side of the seigniorage equation and, hence, reduce the total monetary seigniorage collected; see equation 4.

Table 2
The Components of Fiscal Seigniorage¹

	1951-60	1961-70	1971-80	1981-90
U.S. government debt bought outright by Fed	\$2,295	\$10,525	\$12,117	\$10,462
+ Interest received on FR-notes net of interest paid to Fed	- 529	- 541	- 1,233	455
+ Coin issued net of outlays of U.S. Mint	591	428	1,092	587
- Change in Treasury's deposits with Fed	74	- 201	- 621	- 302
= Fiscal seigniorage	\$2,431	\$10,211	\$11,355	\$11,202
Memo:				
Interest received on FR-notes	\$1,671	\$5,214	\$10,489	\$15,954
Interest paid to Federal Reserve	\$2,200	\$ 5,755	\$11,722	\$15,499

¹Annual averages in millions of dollars, 1982/84 consumer prices.

rose from \$2.4 billion during the 1950s to \$11.2 billion in the 1980s. The dominating source component of fiscal seigniorage is the outright acquisition of government securities by the Fed. Just how important it is can be seen in table 2; for all practical purposes, it matches the total.

This observation underscores the fact that the seigniorage flow to government must not be identified with the Fed's payment to the Treasury of "interest on Federal Reserve notes." In servicing the debt held by the Fed, the Treasury makes interest payments of roughly the same order of magnitude as the Fed pays to the Treasury (see the bottom lines in table 2).¹⁵ Indeed, the Fed's portfolio of U.S. government securities can be interpreted as an interest-free loan to the Treasury.

While during the 1970s and the 1980s fiscal seigniorage amounted to 80 percent of monetary seigniorage collected, it even exceeded the

total flow during the 1950s and the 1960s. How was it possible that the government consumed more seigniorage than was collected? The answer to that question is asset substitution in favor of U.S. government debt: for a given base money stock, the Fed can reduce its loans to the banking sector or sell foreign assets and use the proceeds for buying outright government debt. For example, if the Fed replaces foreign assets worth \$100 million with Treasury bills of the same amount, it foregoes foreign interest earnings of, say, \$5 million. As a result, the current flow of fiscal seigniorage is increased by \$95 million (see equation 9b).¹⁶ To be sure, this is a one-time effect. During subsequent periods, the flow of fiscal seigniorage will be smaller than otherwise, because of the lost stream of foreign interest earnings.

As table 1 indicates, the observed differences between the annual flows of monetary and fiscal seigniorage are largely due to asset substitution. During the 1950s and the 1960s, the Fed

¹⁵Barro (1982) was not aware of this, when he identified the interest on Federal Reserve notes as the revenue from money creation. But note that Barro would be correct if the Fed, like the Deutsche Bundesbank, would mainly hold earning assets other than government debt.

¹⁶While the discussed transaction reduces the Fed's interest earnings on foreign assets, it raises the interest earnings on the portfolio of Treasury securities. But, as noted above, this does not affect the net flow of fiscal seigniorage.

raised the annual flow of fiscal seigniorage above the flow of extended monetary seigniorage by replacing non-government debt worth more than \$1 billion each year, on average, with U.S. government securities. The reverse policy was chosen thereafter so that the annual flow of fiscal seigniorage fell behind monetary seigniorage by an average of almost \$4 billion during the 1980s.

While the continuous flow of fiscal seigniorage helps to finance the federal budget, it is a fairly small source of funds. On average, it contributed about 2 percent to the finance of federal expenditures over the past 40 years.

Seigniorage and Inflation

In the monetary economics literature, seigniorage is often discussed and analyzed in terms of an "inflation tax," a term that was coined by Milton Friedman (1953). This association reflects the fact that, other things the same, a nation's monetary authorities can increase monetary seigniorage by increasing the supply of base money relative to its demand. Because the resulting rising price level reduces the real value of the public's base money holdings, the public will demand more nominal base money balances to make up for the price-level-induced decline in its real cash balances. As a result, the price rise produces an increase in monetary seigniorage.

Extended monetary seigniorage, however, will not rise in some fixed proportion to inflation; the demand for real cash balances is inversely related to the rate of inflation. Hence, the increase in seigniorage associated with higher and higher inflation becomes smaller and smaller; eventually, some inflation rate is reached at which monetary seigniorage is maximized. Thereafter, higher inflation will reduce the level of seigniorage as the inflation-induced effect dominates the price-level effect on the public's demand for real cash balances.

In sum, monetary theory predicts that seigniorage rises with inflation but falls once the in-

flation rate has passed a certain threshold. Thus, the predicted relation resembles the shape of the Laffer curve in public finance where the revenue from the income tax first rises with the effective tax rate but begins to decline once the disincentive effect of too high a tax rate becomes dominant.

Monetary theorists have applied profit-maximizing conditions for a monetary authority to generate the seigniorage-maximizing rate of inflation.¹⁷ This concept, however, is unlikely to yield much insight in the actual behavior of monetary authorities. While, in history, monetary authorities of several countries have repeatedly produced larger inflations in the attempt to accommodate fiscal problems, central banks, in general, are not profit-oriented organizations, and ascribing profit-maximizing motives to them is misleading.¹⁸

Thus, instead of looking for some theoretically justified story about inflation and the motives of the Federal Reserve System, we are better off by simply looking at the "stylized facts" about the relationship between inflation and the extended monetary seigniorage in the United States. Figure 2 provides one way of assessing this relationship. The points in the diagram show the rate of inflation and the associated monetary seigniorage in each year from 1951 to 1990. As expected, the data reveal an initial positive relationship between inflation and extended monetary seigniorage. As also expected, however, this positive association slowly disappears, then becomes negative for sufficiently high rates of inflation. Thus, the empirical relationship resembles the shape of a Laffer curve.

The curve drawn in figure 2 shows the results of estimating extended monetary seigniorage (s_M) as a quadratic function of the rate of inflation (π):

$$(10) s_M = a_0 + a_1\pi - a_2\pi^2 + \epsilon,$$

where ϵ is a white-noise residual. The estimated parameters imply that monetary seigniorage be-

¹⁷Consider the traditional concept of monetary seigniorage, as defined above by equation 2. It can be rewritten as:

$$(a) s_M = (\Delta B/B)(B/p).$$

Next, assume a standard money demand function:

$$(b) B/p = y \exp[-\lambda(r + \pi)],$$

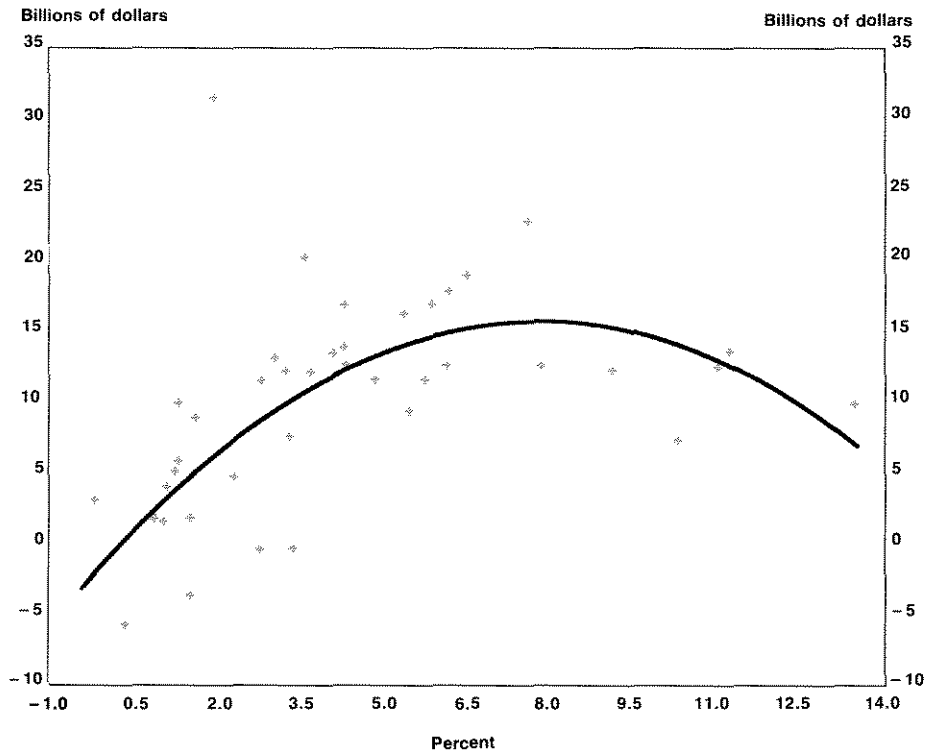
where (y) is real income, (r) is the real rate of interest and π the inflation rate. Finally, assume a steady-state equilibri-

um in which y and r are constant. This implies: $\pi = \Delta B/B$. Maximizing equation a subject to equation b yields the seigniorage-maximizing rate of inflation:

$$(c) \pi^{opt} = 1/\lambda.$$

¹⁸For a different view, see Toma (1982).

Figure 2
Extended Monetary Seigniorage and Inflation
(1982/84 Consumer Prices)



gins to decline once inflation exceeds a rate of 7.9 percent.¹⁹

From the point of view of the U.S. government, fiscal seigniorage is more interesting than monetary seigniorage because the former measures what the government actually receives for budget finance. As figure 3 shows, fiscal seigniorage is quite similarly related to the level of inflation, except that it reaches a maximum at an inflation rate of 7.2 percent.²⁰

These estimates suggest that high inflation, at least more than 7 percent or 8 percent per year, has been less profitable for the U.S.

government when monetary or fiscal seigniorage alone are considered. This is demonstrated in table 3, where average annual seigniorage flows are compared over different inflation ranges. During the high inflation years, when inflation exceeded 9 percent annually, fiscal seigniorage averaged 7.7 billion per year. This is about 5 percent lower than it averaged during the low inflation years and even 45 percent lower than during the medium inflation years.²¹

CONCLUSION

The government's monopoly in issuing base money yields profits that facilitate its fiscal

¹⁹Estimating equation 10 with a dummy for 1986 yields: $a_0 = -979$ (-0.55), $a_1 = 4,325$ (5.94), and $a_2 = 269$ (4.73), numbers in parentheses are t-values. $\bar{R}^2 = .62$, DW = 1.52.

²⁰The respective curve is computed from estimating equation 10 with fiscal seigniorage as the dependent variable. Denoting the estimated parameters by b yields: $b_0 = 1,233$ (0.56), $b_1 = 3,123$ (3.51), $b_2 = 217$ (3.07), $\bar{R}^2 = .28$, DW = 1.88.

²¹While it may be tempting, given the evidence presented in table 3, to conclude that the U.S. government should prefer inflation in the 4.6 percent to 9 percent annual range, it would be a mistake to do so. First, there are other social (and governmental) gains from lower inflation that are not examined here. Second, and perhaps more relevant, the U.S. rate of inflation has been below 4.5 percent for 25 of the 40 years between 1951 and 1990.

Figure 3
Estimated Seigniorage and Inflation
(in 1982/84 Consumer Prices)

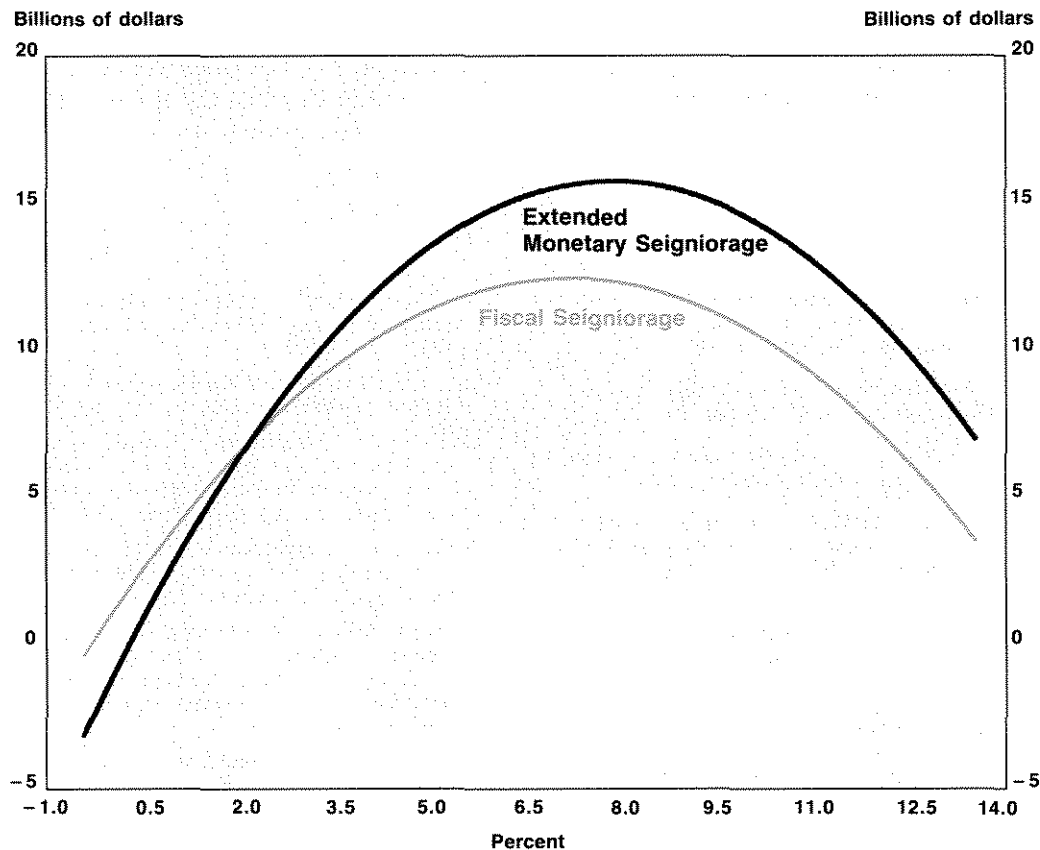


Table 3
Seigniorage and Inflation¹

	Inflation range		
	- 0.3 to 4.5%	4.6 to 9.0%	9.1 to 13.6%
Monetary seigniorage, s_M	\$8,056	\$15,030	\$11,106
Fiscal seigniorage, s_G	\$8,096	\$11,117	\$ 7,685
Number of years	25	10	5
Average inflation rate	2.3%	6.2%	11.1%

¹Annual averages in millions of dollars, 1982/84 consumer prices.

finance. This paper developed a new measure of monetary seigniorage and presented a framework for analyzing and measuring the total seigniorage flow from base money production and its allocation to various uses, including fiscal finance, in the United States.

In addition, the paper analyzed the relationship between monetary and fiscal seigniorage and inflation in the United States from 1951 to 1990. While it is well-known that, within certain

limits, governments are able to increase their seigniorage flows through higher inflation, the limits to such actions are not as well-known. The evidence presented here suggests that the U.S. government's fiscal seigniorage declines when the rate of inflation exceeds 7 percent. Indeed, in those years when inflation exceeded 9 percent, the U.S. government's fiscal seigniorage fell short of the levels achieved when U.S. inflation rates were less than 4.5 percent.

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