Money, Inflation, and Output Under Fiat and Commodity Standards

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Abstract

This study examines the behavior of money, inflation, and output under fiat and commodity standards to better understand how changes in monetary policy affect economic activity. Using long-term historical data for 15 countries, the study finds that the growth rates of various monetary aggregates are more highly correlated with inflation and with each other under fiat standards than under commodity standards. Money growth, inflation, and output growth are also higher under fiat standards. In contrast, the study does not find that money growth is more highly correlated with output growth under one type of standard than under the other.

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Recently, Lucas (1996, p. 661) argued that the question of how "changes in the conduct of monetary policy can influence inflation, employment, and production . . . has not been given anything like a fully satisfactory answer." A shift in monetary standards from commodity to fiat by a country would seem to be one type of experiment that could provide some empirical evidence to help answer this question. Such shifts in monetary standards occurred beginning in the 1880s and continued through the 1930s. During that period, most countries changed their monetary standards: they permanently left a commodity standard (either gold or silver) and went to a fiat standard. Under commodity standards, governments minted coins and issued paper currency that represented promises to specified amounts of specie. After the change in standards, governments issued fiat money: token coins and paper currency that carried no promise of either present or future convertibility into gold, silver, or anything else of intrinsic value.

The purpose of this study is to examine whether the relationships between money and inflation and between money and output differ between economies operating under a commodity standard and economies operating under a fiat standard. The basis for our study is long-term historical money, price, and output data for 15 countries that have operated under both types of monetary standards. Using these data, we establish several facts about the differences in the relationships between money and inflation and between money and output when economies operate under a commodity standard and when they operate under a fiat standard. We find that under fiat standards, the growth rates of various monetary aggregates are more highly correlated with inflation and with each other than they are under commodity standards. We also find that money growth and inflation are higher. In contrast, we do not find that money growth is more highly correlated with output growth under one standard than under the other. However, we do find that under fiat standards, output growth is higher.

A study of relationships between money, inflation, and output is not, in itself, original. (See, for example, Cagan 1956, Friedman and Schwartz 1963, Schwartz 1973, Sargent 1982, Smith 1985, Barro 1987, Dwyer and Hafer 1988, and McCandless and Weber 1995.) What sets our study apart is that we document differences in the behavior of these variables under the two monetary standards over a long period in a large sample of countries. Previous studies that use a long period, such as Friedman and Schwartz 1963, have typically examined only a single country and have failed to distinguish between periods with different monetary standards. Others that use a large number of countries, such as Barro 1987, Dwyer and Hafer 1988, and McCandless and Weber 1995, have typically examined only a short period over which a single monetary standard prevailed. The study by Backus and Kehoe (1992) utilizes data on 10 countries over a period roughly comparable to that used here. However, that study focuses on whether the cyclical behavior of money, inflation, and output is the same across countries. The study does not consider how the behavior of these variables differs across monetary standards.

We focus on differences in the relationships between money and inflation and between money and output under the two monetary standards. When a difference is found, as is the case with the correlation between money and inflation, one might be tempted to conclude that the change in monetary standards caused the difference. Such an inference is not necessarily correct. Some other factor could have caused both the change in the monetary standard and the change in the money/inflation relationship. Before one can determine what caused an observed change in economic relationships under fiat and commodity standards, a model of monetary standard determination is needed that can confront the facts documented in this study. In other words, to establish causality, one needs a theory that both explains why governments decide to adopt a particular monetary standard and predicts the observed changes in the relationships between money, inflation, and output.

In the first section below, we take care of some preliminary issues concerning how we obtain our results. Specifically, we define commodity and fiat standards, discuss the various measures of money we use, and describe the data. In the next two sections, we present our findings about money/inflation relationships and money/output relationships. Then, at the end, we summarize these findings and present some suggestions for future research.

Preliminaries

Since our investigation is directed at uncovering differences in the relationships between money, inflation, and output under two monetary standards (commodity and fiat), we first carefully define what we mean by a *monetary standard.* Making this definition rigorous proves useful in classifying the periods we consider.

By a *monetary standard,* we mean the objects that serve as the unit of account and that back the objects that circulate as generally accepted means of payment (that is, the objects that back the objects that are money). Under a *commodity standard,* the unit of account is a fixed amount of the commodity. Government currency consists of coins made of the commodity and notes redeemable in the commodity; private monies, such as bank notes, are also redeemable in the commodity. Under a *fiat standard,* the unit of account is some abstract value, such as a dollar, pound, or peso. Government currency consists of irredeemable token coins and notes (fiat money), and private monies are redeemable in fiat money.

Identifying the monetary standard under which a country is operating is not always straightforward. The standard is unambiguous when people expect it to be permanent. Identification is less clear with temporary fiat standards, which are often the result of a need to finance a war. Bordo and Kydland (1993) argue that such standards are, in fact, commodity standards because people believe that there is a positive probability that the money will be convertible in the future. Bordo and Kydland argue that the gold standard should be thought of as a rule permitting such temporary suspensions. For this study, we adopt the Bordo-Kydland definition of the gold standard and consider those temporary fiat standards that are followed by a return to a commodity standard as being part of a commodity standard.

Assessing the relationships between money, inflation, and output under different monetary standards requires empirical counterparts to the concept of money. We use an eclectic approach. Following conventional studies of money and inflation, we use a broad measure of money (M2) that encompasses most objects that circulate as media of exchange or can quickly be converted into such objects.

Because some theories of money suggest that broad measures of money may fail to reveal important relationships between money and inflation, we also employ narrower measures of money.[1] These theories imply that money should be divided into two mutually exclusive categories: objects that represent a convertibility promise by, or claim on, the issuer and objects that represent no convertibility promise or claim. For convenience, we refer to the nonconvertible, unclaimable objects as *primary money* and the convertible, claimable objects as *secondary money*.[2] Gold and silver coins (specie) that used to circulate in the United States and Federal Reserve notes that circulate today are examples of primary money: the issuers of this money do not promise to convert it into anything of value. Bank notes that used to circulate in the United States and bank deposits that circulate today are examples of secondary money: the issuers of this money promise to convert it into something else, usually on demand.

We measure the quantity of primary money by the total monetary assets that remain after the balance sheets of all agents in the economy (the nonbank public, the banks, the central bank, and the government) are consolidated. In netting out assets and liabilities, we consider objects that conventionally appear on the balance sheet of central banks and governments as liabilities only when they actually represent convertibility promises on the part of the issuer.[3] Under a commodity standard, the quantity of primary money is the total specie held by all agents in the economy. Under a fiat standard, the quantity of primary money is the monetary base, the quantity of fiat money plus specie that is held by the bank and nonbank public.

To measure the quantity of secondary money, we add all the assets held by the nonbank public that are used as media of exchange and subtract the quantity of primary money. We take the assets that circulate as media of exchange to include those types included in the conventionally used monetary aggregate M2. Hence, our measure of secondary money is M2 less primary money.

We base our study on data for 15 countries that have operated under both commodity and fiat monetary standards. For each country, we computed the long-run geometric average growth rates of our three measures of money, prices, and output for the period during which the country operated under a commodity standard and the period during which it operated under a fiat standard. The countries in our sample and the periods during which they are considered to be operating under the two standards are given in the accompanying table. Because we were unable to obtain data on specie for Brazil and Sweden, those countries are not included in our sample for commodity money standards. Similarly, because we were unable to obtain data on the monetary base for Argentina, it is not included in our sample for fiat standards. However, we include two fiat periods for Spain: one prior to the Spanish Civil War and one from the beginning of World War II until 1980. This break occurs because the price and money series are not comparable between these two periods. We omit the hyperinflation period from the fiat period for Germany because money growth and inflation were so high during this period that if it were included, it would dominate all correlations for fiat standards. The data used are described in the appendix in Rolnick and Weber 1995.

Timing for when countries went from being on a commodity standard to being on a fiat standard is based on the last time a country was officially on a commodity standard. However, for four countries in our sample, different timings for when they were on the two types of standards are plausible. Specifically, Argentina can be considered to have gone on a fiat standard in 1914 rather than in 1930 because its return to the gold standard in the late 1920s was short-lived. Brazil can be considered to have gone on a fiat standard in 1864 because, even though it was nominally on a gold standard until 1929, it experienced numerous suspensions of convertibility up to that time. Chile can be considered to have gone on a fiat standard in 1878 because it returned to a commodity standard after this date for only short periods from 1895 to 1898 and from 1926 to 1931. Finally, Japan can be considered to have gone on a fiat standard in 1917 because its return to the gold standard in the early 1930s was short-lived. When we use these alternative timing assumptions, roughly half the countries in our sample have had commodity standard episodes end and fiat episodes begin at times other than the 1930s. We also performed all the calculations below using these alternative timing assumptions and found no substantive differences with the results reported below.

Money and Inflation

We begin by examining the relationship between the growth rate of money and the rate of inflation. We find that the growth rates of the various measures of money are more highly correlated with inflation under fiat standards than under commodity standards.

Under fiat standards, we find the same extremely high correlation between money growth and inflation that has been found by other researchers who have studied this relationship. In addition, we find that the strength of the relationship does not vary with the measure of money used: The correlation between money growth—measured by primary money, secondary money, or M2—and inflation is always 0.99.

The high correlation between money growth and inflation only suggests a linear relationship between the two variables. It does not determine the slope. Our finding, like that of other researchers, is that the slope is close to unity. We show this in Chart 1, where we plot the long-run primary and secondary money growth and inflation rates for the fiat standard sample observations. In that chart, the observations lie very close to a 45-degree line through the grand means.

Under commodity standards, in contrast, we find at best a moderate, positive correlation between money growth and inflation. Moreover, the correlation depends on the measure of money used. The highest correlation between money growth and inflation is 0.71, when M2 is the measure of money. A lower correlation of 0.49 is obtained when primary money is the measure. The correlation is only 0.41 when secondary money is the measure.[4] Charts 2 and 3 show the lower correlation between money growth and inflation and the differences in this correlation depending on which measure of money is used. In Chart 2, we plot the long-run primary money growth and inflation rates for the commodity standard observations. In Chart 3, we plot the long-run secondary money growth and inflation rates.

The finding that the correlation between money growth and inflation is the same for all measures of money under fiat standards but differs for different measures of money under commodity standards suggests that the growth rates of the various money measures are also highly correlated under fiat standards but less highly correlated under commodity standards. This is what we find.

There is a strong, positive correlation between the growth rates of primary and secondary money under fiat standards. The correlation is 0.99, suggesting, once again, a relationship that is close to linear. Further, because the observations lie close to the 45-degree line through the grand means, as shown in Chart 4, the slope of the relationship is close to unity.

In contrast, we find no evidence of a relationship between the growth rates of primary and secondary money during commodity standard episodes. The correlation is 0.10. This almost complete absence of a relationship is shown in Chart 5, where we display a plot of the growth rate of primary money against the growth rate of secondary money for commodity standard observations.

A comparison of Charts 1, 2, and 3 suggests two other points about money growth and inflation under fiat and commodity standards. One point is that, on average, rates of money growth are higher under fiat standards. The average rates of money growth are 13.0, 14.4, and 13.8 percent per year for primary money, secondary money, and M2, respectively, under fiat standards. The corresponding growth rates under commodity standards are 2.94, 7.86, and 5.35 percent per year. Further, every country in our sample experienced higher rates of money growth in the period during which it was operating under a fiat standard than in the period during which it was operating under a commodity standard.

The other point is that, on average, inflation rates are also higher under fiat standards. The average inflation rate for the fiat standard observations is 9.17 percent per year; the average inflation rate for the commodity standard observations is 1.75 percent per year. And, once again, every country in our sample experienced a higher rate of inflation in the period during which it was operating under a fiat standard than in the period during which it was operating under a commodity standard.[5]

The finding about money growth, at least primary money growth, is not surprising. Under a commodity standard, the rate at which primary money (specie) can grow is limited by technology. In the long run, we expect that the rate of growth of primary money would be approximately the same as that of real output. (This is what we find, as reported below.) This limitation does not apply to primary money under a fiat standard because under such a standard, money is virtually costless to produce. Nonetheless, the money growth results leave an unresolved issue. Governments can choose to have fiat money grow at the average rate that primary money grows under a commodity standard. The question is, Why do governments choose to have fiat money grow faster?

Money and Output

In this section, we examine the relationship between the growth rates of our various measures of money and the growth rate of output. We obtain mixed results. We find that under fiat standards, the correlation between primary money growth and output growth is lower than under a commodity standard. The correlation between primary money growth and output growth is 0.40 under fiat standards but 0.80 under commodity standards. This correlation is also lower when money is measured by M2: the correlations are 0.07 under fiat standards and 0.40 under commodity standards. However, for secondary money, the results are reversed: the correlation is 0.37 under fiat standards and −0.06 under commodity standards.

With respect to whether output growth is higher under one of the standards, we obtain unambiguous results. The output growth rate is higher under fiat standards. Specifically, the average output growth rate is 3.53 percent per year under fiat standards, whereas under commodity standards, it is only 2.55 percent per year. In addition, with the exception of Spain, every country in our sample had a higher long-run average output growth rate during its fiat standard period than during its commodity standard period. This is also the case for Spain when only the period from 1941 to 1980 is considered. Further, as suggested above, we find that the rates of output and primary money growth are very close under commodity standards.

Since both money growth and output growth are higher under fiat standards, one might conclude that there is a positive long-run relationship between money growth and output growth. Drawing such a conclusion is unwarranted, however. It confuses evidence from when countries switch to a different monetary standard with evidence from when countries operate under a given monetary standard. The evidence from the average levels of money growth and output growth of countries under commodity standards and countries under fiat standards only suggests a relationship between a country's level of output growth and its being on a given standard. The evidence does not suggest that if a country is already on a fiat standard, for example, increasing the rate of money growth will increase its rate of output growth. Indeed, as we have shown, there is only weak evidence for a positive relationship between money growth and output growth under fiat standards.

Summary and Concluding Remarks

In this study, we have uncovered several facts about differences in money, inflation, and output under two monetary standards. Our results are based on extensive historical money, price, and output data for 15 countries. We find that under fiat standards, the growth rates of various monetary aggregates are more highly correlated with inflation and with each other than they are under commodity standards. In contrast, we do not find that money growth is more highly correlated with output growth under one standard than under the other. We also find that under fiat standards, rates of money growth, inflation, and output growth are all higher than they are under commodity standards.

Some may interpret our findings as demonstrating some causal relationship between money and inflation or between money and output. Such a conclusion is unwarranted. Only with the development of models of monetary standards that confront findings like those we have presented can researchers be confident in drawing causality implications and ultimately designing better monetary policies and institutions. Our hope is that this study will stimulate research on models of monetary standards and encourage efforts to obtain better data on the experiences of countries under alternative monetary standards.

†Weber is also an adjunct professor of economics at the University of Minnesota.

[1]Examples of such theories are given in Tobin 1963 and Sargent and Wallace 1983. For example, Tobin (1963, p. 415) states that "*the fountain pens of commercial bankers are essentially different from the printing presses of governments.* Confusion results from concluding that because bank deposits are like currency in one respect—both serve as media of exchange—they are like currency in every respect. Unlike governments, bankers cannot create means of payment to finance their own purchases of goods and services. *Bank-created 'money' is a liability, which must be matched on the other side of the balance sheet. . . .* Once created, printing press money cannot be extinguished, except by reversal of the budget policies which led to its birth. . . . For bank-created money, however, there is an economic mechanism of extinction as well as creation, contraction as well as expansion" (italics added).

[2]We introduce new definitions of money because existing definitions, such as *outside money* or *base money,* do not distinguish monies by their convertibility property. *Outside money* is defined as any government-issued money that is used to purchase goods and services for the government (Gurley and Shaw 1960, p. 73). Thus outside money could be government-issued money that is convertible into gold. Similarly, *base money* is any type of money, convertible or nonconvertible, that can be used as bank reserves.

[3]For example, fiat money issued by a central bank conventionally appears on the liability side of its balance sheet, even though fiat money represents no convertibility promise on the part of the bank. Consequently, this money would not be considered a liability for the purposes of our consolidation.

[4]We also computed the same correlations using money growth less output growth instead of money growth. We found that both the qualitative and the quantitative results were unchanged.

[5]This conclusion does not appear to be sensitive to the fact that we have considered commodity standards only after 1800. Earlier data on inflation under commodity standards are somewhat sketchy. The data that are available, however, do not appear to overturn our conclusion. For example, consider the so-called Price Revolution of the 16th and 17th centuries in Europe caused by the large "increase in world silver production after the conquests of Mexico and Peru" (Hamilton 1960, p. 155). Hamilton (1960, p. 152) calculates that "when decennial prices in Spain reached their apogee during the Price Revolution, they were 3.4 times higher than a hundred years before. English prices reached their zenith during the Price Revolution in 1643–1652, when they were 3.5 times the 1501–1510 level." A 340 percent increase in the price level over 100 years, as in Spain, amounts to an average annual inflation rate of only 1.2 percent, lower than all but one of the inflation rates shown in Chart 1. A 350 percent increase in the price level over 133 years (the shortest interval for England) amounts to an even lower average annual inflation rate of only 0.94 percent.

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The Sample

Countries and Periods During Which They Had
Commodity and Fiat Money Standards*

Country	Period of Monetary Standard	
	Commodity	Fiat
Argentina	1884–1929	—
Brazil	—	1930–87
Canada	1871–1929	1935–93
Chile	1908–25	1940–80
France	1897–1936	1937–94
Germany**	1876–1913	1950–91
Italy	1862–1935	1947–93
Japan	1885–1931	1932–94
Netherlands	1900–1936	1936–92
Norway	1865–1931	1931–78
Portugal	1854–91	1932–89
Spain†	1874–83	1883–1935 1941–80
Sweden	—	1931–94
United Kingdom	1870–1931	1931–88
United States	1820–1932	1933–91

*The timing for changes from commodity to fiat standards is generally based on the last time a country was officially on a commodity standard.

**The period of hyperinflation in Germany between 1913 and 1950 is omitted.

†The fiat standard for Spain is broken because the money and price data in the two periods are not comparable. The first period represents the standard before the Spanish Civil War; the second, the standard after World War II began.
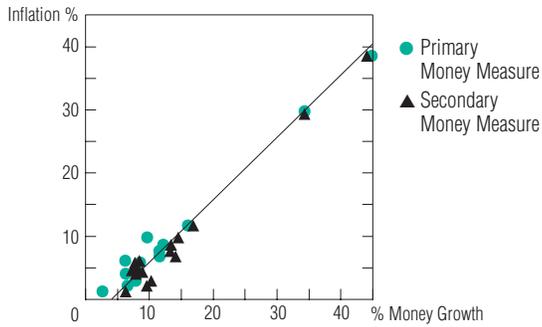
Sources: See Rolnick and Weber 1995, appendix.

Charts 1–3

Money Growth vs. Inflation

Long-Run Geometric Average Growth Rates
of Two Measures of Money and the Price Level
in Countries With Both Fiat and Commodity Money Standards

Chart 1 Under Fiat Money Standards . . .

Legend:
● Primary Money Measure
▲ Secondary Money Measure

Charts 2–3 . . . And Under Commodity Money Standards

Chart 2 Primary Money Measure
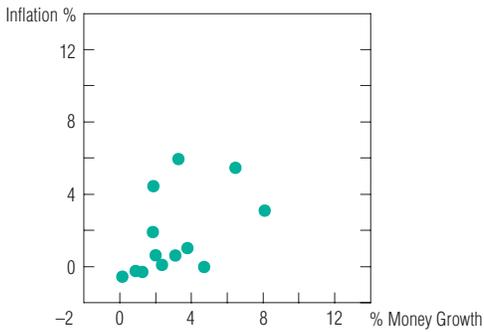
Chart 3 Secondary Money Measure
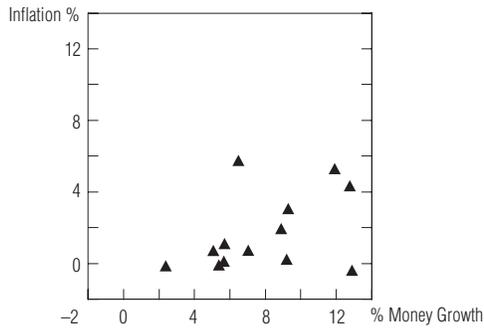
Sources: See Rolnick and Weber 1995, appendix.

Charts 4–5

Primary vs. Secondary Money Growth

Long-Run Geometric Average Growth Rates of Two Measures of Money
in Countries With Both Fiat and Commodity Money Standards
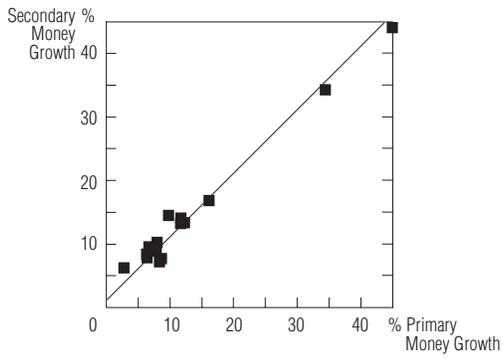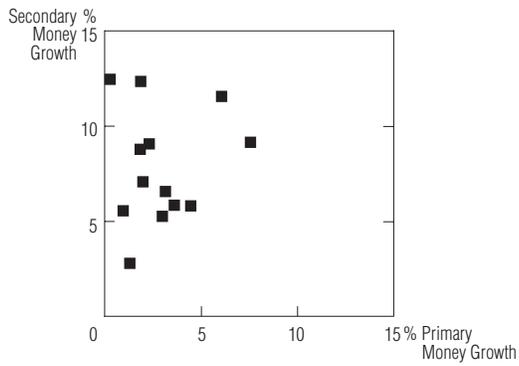
Chart 4 Under Fiat Money Standards . . .

Chart 5 . . . And Under Commodity Money Standards

Sources: See Rolnick and Weber 1995, appendix.