Properties of Monetary Systems

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Properties of Monetary Systems

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A constant theme in Keynes's analytic work is the design of monetary and non-monetary arrangements. Economic Consequences of the Peace is a strong critique of the arrangements proposed at the Versailles peace conference. A Tract on Monetary Reform, as the title suggests, proposes an alternative to the return to the classical gold standard. A Treatise on Money takes a deeper look at fundamental properties of money and ends with proposals for world monetary reform to reduce price variability. The General Theory tries to show why an economy remains at less than full employment, as Britain's economy had in the twenties, and proposes institutional reform, principally non-monetary reform, to remedy the problem of underemployment. Keynes last major effort, the proposal for Bretton Woods, though not written as an analytic work, was a

*I am grateful to Karl Brunner and to Alex Cukierman for helping me to work my way through parts of the problem, but they are not responsible for what emerged.
major effort to redesign the world monetary system.

In a world of costless transactions, certainty and costless acquisition of information, the comparison of monetary standards is uninteresting. Many methods of making payments and expressing values have the same costs and benefits. For economic analyses of differences in monetary standards, the reasons for using money, the way society chooses to denominate assets and express values or the role of government in the monetary system there must be costs and benefits that change with the monetary standard and the monetary system. Principal differences in cost to individuals or societies arise from three sources. Costs of producing and storing the unit used as money vary with the choice of fiat paper or commodity standards and with the choice of the commodities used as a commodity standard. Costs of organizing, administering and policing the system vary with the resources used to coordinate decisions, nationally and internationally, and the resources used to prevent fraud and counterfeiting or to monitor debasement of the currency units. Costs vary also with the type and degree of uncertainty that individuals and society bear. No monetary system can provide complete price, exchange rate and interest rate stability. There are differences in cost and in the distribution of the cost burden that depend on the properties of the monetary and economic systems and on the nature of shocks or disturbances. Keynes (1936, p. 170) reaches a similar conclusion about the effect of uncertainty on liquidity preference.

The choice of monetary arrangements and a monetary standard has elements found in many collective decisions. Each person's net benefit depends upon the actions that others take. The fact that the choice has elements of collective choice does not mean that the choice of monetary arrangements and the monetary standard must be made by governments. There is considerable
historical evidence that the evolution of monetary systems began as a private solution to a local problem and only later governments assumed certain functions. The role of government in the monetary system changed many times in the centuries that followed. The design of monetary arrangements has been drawn and redrawn in the marketplace and in the parliaments as a response to prevailing conditions, beliefs, hopes and fears about future conditions, technology, and the tastes expressed in the market place and in the voting booth or by the dictator or sovereign.

The twentieth century provides a rich and diverse history of choices and a lively discussion about the merits of various alternatives. The rest of this section briefly surveys the history and its background. Keynes is a central figure -- probably the central figure -- structuring the choices and comparing the alternatives during the first half of the century. The ideas associated with his work, or based on it, dominated monetary and non-monetary arrangements in the quarter century following his death in 1946. The international monetary agreement, known as the Bretton Woods system, was the product of many minds, but Keynes's blueprint provided the structure around which discussion occurred and from which the international monetary arrangements of the postwar years evolved. The monetary and non-monetary policies of many countries are -- properly or improperly -- called Keynesian, testifying to the belief that these policies are based on theories propounded by Keynes.

Keynes was born in 1883, at a time when the classical international gold

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1The use of cigarettes as a medium of exchange in the prisoner of war camps during World War II and the use of stone money among the Yapese are well-known examples of private solutions. Toynbee (1954, p. 309) claims that government assumed responsibility for production of coins in the 7th century B.C. by establishing a monopoly and fixing the sizes and weights of coins.
standard was firmly established. Britain's commitment to the standard, about one hundred fifty years earlier, fixed the value of the pound sterling at 113 grains of fine gold and sustained the commitment by offering to buy and sell gold at that price. Since the Bank of England kept its notes convertible into gold at the fixed price, other banks could maintain convertibility of their notes either by buying and selling gold at the price fixed by the issuing government or by maintaining convertibility of their note issue, and later their deposits, into Bank of England notes. Exchange rates were determined by the relative gold content of a currency for countries on the gold standard. As an example the U.S. dollar was reset in 1900 at 23.22 grains of fine gold, so £1 was the equivalent of $4.8665. The fixed exchange rate between the two currencies was maintained by both countries' commitment to maintain the gold content of its currency.

The British commitment to buy and sell gold was suspended from 1793 to 1821 and from 1914 to 1925. In 1821, Britain restored the commitment at the former price and returned to the gold standard. The return to gold was accompanied by a fifty percent deflation from 1814 to 1824 to restore convertibility at the former exchange rate of gold for notes. Viner (1937, p. 174). The 1821 resumption, and a number of temporary suspensions and resumptions of convertibility of notes into gold at the Bank of England later in the century, reinforced anticipations about the long-run fixity of the price of gold in pounds sterling but left no doubt that there was uncertainty
about convertibility on any specific future date.\textsuperscript{2} The commitment to gold was not as fixed as the constant of gravity. It seems proper, however, to regard the public's belief in the commitment to the gold price at the end of the century as being as firm as any political or economic arrangement is likely to be.

During the last quarter of the nineteenth century, social decisions suggest that belief in the social and private benefits of the gold standard was high. Many countries formally committed their monetary authorities to buy and sell gold, and by extension to buy and sell other currencies on the standard, at fixed prices.\textsuperscript{3}

The commitment to gold at its historic price was widely accepted as a norm in Britain and the United States. After the first World War, the Governor of the Bank of England, Montagu Norman, and Benjamin Strong, Governor of the Federal Reserve Bank of New York agreed to work for the restoration of the prewar exchange rate between the British pound and the U.S. dollar. Both countries had inflated during the war, so the Governors agreed that both would have to deflate to restore the former exchange rate, $4.86 to the pound. Mutual deflation imposed excess burdens on both countries, including the relatively severe recession of 1920-21. The return to gold at the prewar price is usually offered as a principal reason for persistent unemployment in

\textsuperscript{2}See Viner (1937) for details of the controversy about resumption and devaluation. Ricardo favored resumption but predicted that prices would fall only 8 to 13 percent. The additional decline, he claimed, was largely the result of mismanagement. See Viner (1937, pp. 176-179).

\textsuperscript{3}Bloomfield (1959) and Bordo and Schwartz (1984) discuss the extent to which countries followed the rules of the gold standard without intervention. The verdict appears to be that they did not, but they maintained multi-lateral fixed parties and gold exchange rates until 1914.
Britain's export industries during the twenties. Money wages had increased in
the export industries, relative to foreign wages, so the prewar parity
required a reduction in money wages or a reallocation of resources. In either
case, the return to the prewar price of gold imposed a burden. Some of the
burden would have been avoided by devaluing the pound in terms of gold, but
that option was dismissed.

Keynes actively opposed the return to the prewar gold standard in 1925.
He believed that the social costs of returning to gold were larger than the
benefits and, from a broader perspective, he opposed the gold standard as a
vestige of laissez faire. Keynes favored greater intervention in the economy
and, at the time, worked to change the position of the Liberal Party toward
greater activism in economic affairs. Harrod (1951, pp. 331-4). He was not a
socialist, but "he was not a great friend of the profit motive"
(Ibid. p. 333), or of the pre-war liberal order. He saw the gold standard as
part of that order and, although he changed his opinions on many issues during
the next twenty years, he always opposed the classical gold standard and
worked actively to develop alternatives.

Although the return to the gold standard was brief, its effect was long
lasting in Britain and elsewhere. The return to gold did not restore the
competitive position of the export industries and was not followed by a
reduction in unemployment. Belief in the standard as a means to prosperity
seems to have been eroded by the experience and its aftermath. The tide of
opinion shifted away from the commitment to gold and toward greater
experimentation and management of monetary affairs.

Britain once again left the gold standard in September 1931 after the
start of the depression of the thirties. During the years until the start of
the war, most of the world's currencies devalued against gold and against each
other. Countries imposed exchange controls and trade restrictions seeking relative advantage or to increase the government's control of interest rates and resource use. Monetary and trade arrangements, and the growing threat of war at the end of the decade, heightened uncertainty about future values. Many countries continued to use gold to settle international payments. They paid the resource costs of a commodity reserve currency without obtaining the benefits that come from the avoidance of exchange controls and a credible commitment to domestic and international convertibility at a fixed exchange rate.

At the end of World War II, the governments of both Britain and the United States hoped to avoid a return to the instability of the interwar period. Planning of postwar monetary arrangements began as an effort by the two governments to establish a more stable international economic order. The Bretton Woods agreement and the General Agreement on Tariffs and Trade set up institutions that imposed restrictions on member countries' freedom to restrict trade or to change relative values or currency parities. Countries did not entirely avoid the cost of holding gold, but the stock of dollars and convertible currencies increased relative to the gold stock, and most countries held reserves in dollars. Eventually, the increase in dollars relative to the U.S. gold stock, and the failure of the U.S. to slow the rate of increase, raised doubts about the future values under the standard. Uncertainty about future values rose. Efforts to restrict de facto convertibility into gold added to the uncertainty and the cost of the system.

In 1971, the Bretton Woods system formally ended when President Nixon ended de jure convertibility of dollars into gold. Exchange rates became market determined, and countries were free to choose fixed or fluctuating rates.
Milton Friedman had argued earlier (1953, pp. 157-250) that the gold standard and other commodity standards with fixed exchange rates are more costly than a system of fluctuating exchange rates with a rule fixing the rate of money growth. Friedman calculated the resource cost of a commodity standard for the United States but neglected costs arising from uncertainty about future values. He claimed that, in addition to lower resource costs, a system of freely fluctuating exchange rates can benefit countries by encouraging trade and allowing government to pursue policies that keep exchange rates and domestic prices relatively stable (Ibid., p. 158).

A decade or more of fluctuating exchange rates has not borne out Friedman's hope or prediction. Governments have not chosen to reduce barriers to trade but have, instead, imposed quotas and trade restrictions. Although inflation was reduced in the early eighties, governments have not used monetary policy to stabilize either domestic prices or exchange rates, and they have not refrained from intervention in currency markets in their attempts to alter the outcome of private decisions.4

The brief sketch of monetary arrangements conveys some of the diversity of arrangements during the past century. The sketch also suggests the way in which costs change under different systems and brings out several issues that must be resolved in the design of domestic and international arrangements. First is the division between public and private functions. Monetary systems and arrangements are social institutions, but they may arise or change either through private action or by law. Second is the level and type of risk that society bears under different monetary arrangements. The choice between fixed

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4Friedman (1984) continues to favor fluctuating rates. He now proposes to fix the level of the monetary base -- currency and bank reserves instead of fixing the growth rate of money.
and fluctuating exchange rates, or between rules and discretionary monetary management, impose different types of risk on society and call forth different arrangements for pooling, diversifying and reducing risk. Third is the level of consumption, output or welfare achieved. Some arrangements may increase or reduce efficiency by introducing or removing uncertainty, by facilitating or hampering trade expansion, by increasing resource costs and in other ways.

A monetary system cannot provide high employment at rising real wages if other institutions inhibit efficiency or shift resources toward present consumption. But it is also true that society's opportunity set is not independent of monetary institutions or arrangements. If the monetary system increases risk and uncertainty, investment is likely to be smaller or a smaller fraction of wealth will be invested within the country. If the financial system is highly regulated, resources will be used to circumvent controls instead of searching for opportunities that increase aggregate wealth. If the financial system does not develop, opportunities for trade and exchange are restricted. For these reasons, among others, the opportunity set depends on the type of monetary system. See Brunner and Meltzer (1971).

Opportunities, Risks and the Role of Government

The changing role of governmental and private institutions, and their coexistence, suggests that no single arrangement has been found to dominate all others. Money is produced by privately owned banks and by government central banks. While many central banks began as private banks, today most
central banks are owned by governments or operate as government agencies. Even where equity in the central bank is owned privately, as in the United States, government has the power to appoint the managing directors and to restrict their policies and operations. Where governments have nationalized ownership of the central bank and placed the central bank under the control of the Treasury, as in Britain, the central bank retains some independence within the government. The bank has, at times, resisted the government's proposals for changes in monetary arrangements and operating procedures.

Different monetary arrangements introduce different explicit or implicit norms for government and devolve different responsibilities on the public and private sectors, on governments, private institutions and individuals. Each choice distributes risks and opportunities in different ways. This section discusses the role of government and the distribution of risks and opportunities arising from four choices: the medium of exchange, the standard of value, private or public production of money, the international standard -- fixed or floating exchange rates.

The Medium of Exchange

Social choice of a medium of exchange has elements found in all collective decisions. Each person's net benefit from using a small number of assets to make payments depends on the information, knowledge or beliefs that others have about the units or commodities offered. A main item of

5 Responsibility for U.S. international monetary policy, for example decisions to devalue or revalue, to intervene in foreign exchange markets and to operate the Exchange Stabilization Fund have not been given to the central bank.
information about a medium of exchange is the knowledge that third parties accept the unit in exchange for a wide range of goods and services and in diverse locations.

The collective aspect is widely recognized. The term "general acceptability" is typically used to define "medium of exchange". "General acceptability" conveys that the cost of using a particular asset decreases as the frequency of use within a social group increases.

Collective choice of the assets used as mediums of exchange does not require that the choice be made by government. Monetary theory offers many examples of market practice moving ahead of law or treaty to establish trading and exchange arrangements. Traveller's checks issued by privately owned banks and non-banks are modern examples of privately developed means of payment that are used internationally. But these means of payment, though widely used, are used mainly for current transactions. They are not much used to settle deferred obligations or contractual agreements. And they are denominated in units previously established by law or agreement within a group.

The use of a medium of exchange reduces costs of transacting and reduces uncertainty about the quality of the objects received in payment for goods and services. The knowledge that objects received in payment will be accepted in payment by others reduces time spent, or resources used, in many exchanges. Reduction of the risk that the objects received will not be acceptable to others increases the utility of risk averse transactors. Both the reduction in resources and the reduction in risk permit the market system to expand. Expansion of the market opens opportunities by permitting increased

6Recent work by Fama (1980) on the theory of banking ignores this collective aspect and misses one of the main services that a monetary system provides -- the services of a medium of exchange.

Collective choice of a medium of exchange does not require government action or law. The history of money shows that the choice of a medium of exchange within social groups often preceded the development of governments with the power to specify the means of payment used by all parties to the exchange. Then, as now, trade extends beyond the hegemony of particular governments. To find reasons for government's role in monetary affairs, we must look beyond the role of money as a medium of exchange.

Standard of Value

Payment of obligations raises an issue about what constitutes payment or discharge of debt. Conventions about payments may start by summarizing practice, but eventually laws restrict practice. When laws specifying methods of payment are embodied in statutes, as they have been for centuries, the choice of the standard of value becomes a governmental function.\(^7\)

Keynes regarded the money of account -- the use of money to express prices -- as the primary concept of money. \textit{JMK} (5, p. 3). He saw the choice as a governmental function, part of its function of enforcing contracts. (5, p. 4) Money is held, according to Keynes, because it is a standard. He repeated this view in the \textit{General Theory} (1936, pp. 236-7) where he emphasized the difference between the premium paid for "liquidity" and the carrying cost of money as a principal determinant of the assets used as money.

\(^7\)Specification of legal tender for payment of taxes gives government an interest in the choice.
Choice of a unit of account and a standard of value has some elements in common with the choice of standards of weight and measure. Specification of weights and measures, like value, requires the choice of an arbitrary unit in which measurement is expressed. Governments can lower the cost of achieving consensus about these units by legislating or imposing the choice. Both monetary units and weights and measures remain fixed for long periods of time, although monetary units are susceptible to destruction by high inflation. Cheating may occur in setting weights and measures, as in the weight of coins or in counterfeiting, but these departures from the norm are correctable in principle where standards have been defined.

There are important differences between "money" and units of weight or measure. Monetary units differ from other standardized units in comparisons across space or time. A contract to deliver an acre of land or a meter of cloth can be converted into hectares of land or inches of cloth by arithmetic. Whenever the conversion is properly made, the result is the same. Whether a contract for future delivery is written in one unit or another is unimportant for this purpose.

Contracts expressed in different units of value can be equivalent on one date and different on another. Relative prices of units change with changes in taste and technology or because one is produced under conditions of increasing and another under conditions of decreasing cost. This is a principal problem faced by those who have tried to define an "ideal" commodity standard.

The history of monetary units provides many instances of changing relative values. Attempts to maintain bimetallism at a fixed exchange rate between gold and silver, or to maintain any two units with different costs of production, often gave rise to the problems made familiar as Gresham's law:
Bad money drives good money out of circulation at a fixed exchange rate. People pay using money of lower current or anticipated market value and hold the unit that is expected to appreciate.

Monetary history also provides examples of failed efforts to measure value by specifying commodity baskets or by developing index numbers or formulas as a means of comparing values intertemporally. Keynes considered the problem in the Treatise, where he emphasized effects of price change on the distribution of real income and concluded that "the right way to compare the purchasing powers of money in two positions is to compare the total money incomes of two 'similar' persons in the two positions." (5, p. 89) He acknowledged a difficulty in finding persons for comparison, and he was careful to note at several places that tastes must be constant, but he did not see the general nature of the problem.®

The impossibility of defining an ideal or exact index number is the reason that there is an irreducible uncertainty about value in intertemporal comparisons and in comparisons across regions or locations at a given time. Whenever tastes or technology change, relative prices, relative product demands and the utility of any standardized basket change. No index number or weighted commodity standard can be devised to keep a measure of value stable in the sense in which a standard of weight or measure is stable.

Standards of value differ in the degree to which they reduce uncertainty. If people are risk averse, they prefer lower risk and uncertainty. Other things equal, they will choose the unit of value -- and the monetary system -- with lowest risk.

®Keynes's discussion of Fisher's ideal index number, or of earlier work by Marshall and Edgeworth, suggests that there cannot be any precise comparison. See (5, pp. 100-103)
There are three restrictions on the public's ability to make the choice, however. First, there must be broad agreement on the standard or it will not be widely used in contracts. The costs of acquiring and disseminating information about alternative standards is large relative to the benefit that any individual, or small group can obtain. For this reason, people may continue to use less stable, established standards for long periods rather than incur the costs of shifting to a more stable standard. Second, there is no agreement on the ideal standard or on the best way to minimize instability of value. Stability of value is a main point of contention between those who favor gold or commodity money, or private production of money, or some type of monetary rule. Third, enforcement costs are high and may become infinite. Governments often have little incentive to either maintain the value of nominal contracts or to pursue policies that reduce variability and uncertainty.

The benefits of a common unit of value are not fixed. They depend on the rules or arrangements for producing money and the degree to which the rules increase or reduce uncertainty about value.

Production of Money

The choice of a unit of account, a standard of value, and a medium of exchange or the enforcement of deferred payment obligations does not require that governments produce money. Governments specify systems of weights and

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9Courts upheld the right of the U.S. government to abrogate the gold clause in private contracts. The British government required people to sell their foreign assets to the government during the war thereby preventing them from limiting the loss of value.
measure and enforce these standards without engaging in the production of scales or yardsticks. Governments have a greater incentive to produce money than to produce yardsticks if the public accepts paper money in place of full-bodied money. The government collects revenue, seigniorage, and society saves resources when paper replaces gold, silver or other metals as money. It costs no more to produce a ten dollar bill than to produce a one dollar bill, but the same cannot be said about the cost of producing ten ounces rather than one ounce of metal.

In a fractional reserve system, paper substitutes for metal as money. Confidence in the ability of the issuer to convert paper into metallic money is established and maintained by a record of payment. Default and counterfeiting lower the confidence that people place in paper money and raise the cost of using paper money. Small changes in the gold stock are amplified. The social saving arising from the substitution of paper for metallic money is, therefore, not a net gain to society. Where governments have broad discretion to increase or reduce money, significant resources are used to conduct, monitor and predict the actions of central banks and governments. Costs of acquiring information and costs of monitoring are part of the social cost of uncertainty about future prices, output and the real value of nominal assets.

Private production of money can reduce these monitoring costs if there are sufficient private incentives to produce money that has greater stability of value. Other costs increase, however. Money produced by government can be

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10 The saving of resources refers only to the cost of production. The net social benefit need not be positive. The choice of optimal monetary arrangements depends on the latter. The government can collect the seigniorage by taxing private producers of money.
made free of default in nominal value. The government, or the central bank, has the power to print money and to suspend convertibility into specie when the public chooses to increase its holdings of government money. Bagehot (1873), Schwartz (1984) and many others have described the financial crises of the past. These authors show that prompt action by a lender of last resort reduced the severity of crises and brought each crisis to an end. Failure of the lender to lend, or otherwise expand the monetary base, as in 1931-1933, made the recession in the United States deeper and longer, bankrupt large numbers of banks and firms and sharply reduced wealth and welfare.

A private bank can suspend convertibility and offer to lend to the market at a penalty rate during financial crises also, but its ability to act as lender of last resort is limited. A private lending institution can only be kept free of default risk during a financial panic if it holds relatively few risky assets. If the lender makes loans to households or firms, holders of its liabilities bear the risk of failure in a financial crisis. To reduce risks of this kind, the lender must sacrifice return by holding relatively riskless assets like Treasury bills. This reduces the profitability of the lender or requires a user fee to be paid by the public.\(^\text{11}\) Government can reduce costs of this kind by authorizing a lender to issue obligations that are free of the risk of default on nominal value. The reduction in risk is not costless. Unless the power to issue money is restricted, granting the government power to issue money raises the risk of inflation or deflation and increases uncertainty about future values.

Again, there are different combinations of resource cost and uncertainty

\(^{11}\)Private producer's of travellers checks charge a fee, even though they do not function as lenders of last resort.
and different types of uncertainty under different monetary arrangements. Any monetary system based on commodity reserves uses resources to produce money or to control its production. Strict commodity reserve systems make the value of money depend on the relative price of the commodity. Uncertainty about future relative prices and costs of production affects asset allocation. Any effect on the allocation of assets between money and real capital or between long-term and short-term capital affects output and consumption. If, instead, government produces fiat money and controls the quantity, resource costs of producing money are lower, but monitoring costs are likely to be higher, and the risk that government will tax the real value of nominal assets by inflating is higher. A central bank permits the government, or its agent, to function as lender of last resort and to reduce risk of default by private banks. These risks, too, affect asset allocation.

Fixed or Fluctuating Exchange Rates

Systems of fixed and fluctuating exchange rates are most easily discussed by treating polar positions and neglecting mixed systems. In a regime of freely fluctuating exchange rates, the monetary authority controls a particular quantity. The price level of domestic goods and services and the exchange value of domestic for foreign money adjust to that quantity. The relevant quantity of money is the monetary base -- the net liabilities issued by the monetary authority for use as reserves of other issuers or as a means of payment. In a fixed exchange rate regime, the authority fixes a particular relative price and accepts the quantity of money and the general price level resulting from the choice. The pre-set price is usually the price of a particular commodity, such as gold, or of some basket of commodities. The
monetary authority agrees to issue and withdraw money in exchange for the commodity at the pre-set price.

The operating characteristics of each system depend on other institutional arrangements, including the fiscal system, the types of shocks to demand or supply that people experience and the relative frequency and durability of the different shocks. Characteristics of a fixed exchange rate system vary, also, with the conditions under which the commodity reserve is produced, on changes in the demand for the commodity in alternative uses and on the extent to which the system is based on a unilateral commitment by a single country or a multilateral agreement.

A rule setting a growth rate for the quantity of money reduces the resource cost of operating the monetary system. Commodities do not have to be stored as a monetary reserve, and monetary growth does not require additional storage. Friedman (1953) A credible monetary rule can also reduce the variability and uncertainty that people experience. By fixing the growth rate of money, the monetary authority eliminates the variability of money growth and any covariance between money growth and velocity growth. The variability of aggregate output is, then, equal to the variance of velocity growth. This latter variance differs under a monetary rule from the measured variance under existing standards.

A rule for money growth cannot maintain domestic price stability on average unless the difference between the average growth rate of real output and average velocity growth is constant. Prices of foreign goods and services consumed domestically will reflect influences abroad mediated by the adjustment of exchange rates of domestic for foreign moneys. Further, the variability of velocity growth is not independent of the choice of monetary regime. If the variability of velocity growth is sufficiently lower under
fixed than fluctuating exchange rates, or if the covariance of money growth and velocity growth is negative, fixed exchange rates can reduce the variability of nominal income growth and the risks that people face.

Keynes apparently believed that fixed exchange rates would increase stability if temporary payment imbalances gave rise to lending and borrowing instead of expansion by creditors and contraction by debtors. His plan for Bretton Woods fixed exchange rates internationally but permitted central banks to pursue domestic objectives. If domestic policy produced sustained inflation (or deflation), the country could devalue (or revalue). Neither the exchange rate of a country's currency nor its domestic price level was fixed permanently under the Bretton Woods system, but the presumption was that principal countries would achieve approximate price stability on average and would borrow and lend to stabilize output and prices. Nothing enforced stability or prevented inflation however, and the lack of enforcement was a major reason that the system did not endure.

Earlier, in the Tract, Keynes favored discretionary control of money to achieve domestic price stability, but he recognized that the system would provide greater benefits if other countries, particularly the U.S., stabilized prices also. In the Treatise, he proposed a type of commodity reserve standard based on prices of internationally traded raw materials. He did not, then or later, claim that the proposed system was ideal, but he believed it was an improvement over the classical gold standard. Meltzer (1984)

Keynes' objective in each of his proposals was to reduce uncertainty by reducing the variability of prices or incomes. He presumed that governments or central banks would share his objective and work to achieve it. Early in his career, he rejected the classical gold standard, and what he described as laissez faire. Throughout his life, he remained a proponent of activist
policies. Activism was limited, however, by the rules of the monetary standard. Each of his proposals permitted discretion, within rules that limited discretion. He never proposed a system of freely fluctuating exchange rates with determination of money growth left to the judgment of the central bank or government or determined by a rule that reduced or removed the role of government.

An activist system has as one of its main objectives reducing fluctuations in prices and, if prices and anticipations are less than fully flexible, reducing fluctuations in employment and real income as well. If fluctuations can be predicted with sufficient accuracy to make smoothing profitable, private speculators enter to capture the gain. The fluctuations that remain can be reduced by collective action only if governments or central banks have superior information or if there is some gain from pooling across individuals and over time that private speculators cannot (or do not) capture.

Without risk and uncertainty about future outcomes, the design of monetary (and other) institutions would be a simpler task. All outcomes would reflect any gain from using money and having an established medium of exchange and standard of value. Differences in outcome would reflect the excess burden imposed by institutions that are less than optimal arrangements from the standpoint of efficiency. Risk and uncertainty change the size of the burden by changing costs and benefits faced by a risk averse public. Institutional arrangements may absorb or augment the risks that the public bears and, thus, raise or lower the burden.

An important difference between monetary arrangements determining the medium of exchange, standard of value, production of money and choice of international regime is the degree to which these arrangements reduce risk toward the minimum level inherent in nature and trade. Unfortunately, there
is no obvious way to compare alternative monetary systems on a priori grounds. I turn, therefore, to consider some evidence.\textsuperscript{12}

**Some Empirical Differences Between Standards**

U.S. monetary experience in the twentieth century includes six different policy regimes. None of the regimes lasted less than ten years. Gordon (1982) developed a set of quarterly data for several variables of interest -- prices and real and nominal income -- beginning in 1890. Friedman and Schwartz (1970) constructed quarterly data for the stock of money ($M_2$) -- currency and total deposits -- beginning in 1907 and for currency and demand deposits ($M_1$) beginning in 1915. The series on nominal GNP and money are raw material for the construction of quarterly series on monetary velocity starting in 1907 and 1915. In this section, I use these data to draw some tentative conclusions about monetary regimes.

The tentative nature of any inferences must be emphasized. The quarterly GNP series is interpolated from data that has been constructed long after the event. See Gordon (1982) Although interpolation most likely reduces the variability of the data for the earlier years, this is far from certain, and data for nominal GNP remain relatively variable in some periods. No less

\textsuperscript{12}Evidence for shorter periods and particular policies is given in Mascaro and Meltzer (1983) and Evans (1984). See Brunner (1983) for a related discussion of the issue.
Table 1

Description of Six Monetary Regimes

<table>
<thead>
<tr>
<th>Period</th>
<th>Starting Date</th>
<th>Ending Date</th>
<th>Number of Observations</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1890-1</td>
<td>1914-4</td>
<td>100</td>
<td>gold standard, no central bank</td>
</tr>
<tr>
<td>1B</td>
<td>1907-3</td>
<td>1914-4</td>
<td>30</td>
<td>gold standard, no central bank quarterly monetary data available</td>
</tr>
<tr>
<td>2</td>
<td>1915-1</td>
<td>1931-3</td>
<td>67</td>
<td>gold exchange standard, central bank</td>
</tr>
<tr>
<td>3</td>
<td>1931-4</td>
<td>1941-4</td>
<td>41</td>
<td>managed exchange rates, discretionary policy</td>
</tr>
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<td>4</td>
<td>1942-1</td>
<td>1951-1</td>
<td>37</td>
<td>interest rate pegging</td>
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<td>1951-2</td>
<td>1971-3</td>
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<td>Bretton Woods</td>
</tr>
<tr>
<td>6</td>
<td>1971-4</td>
<td>1980-4*</td>
<td>37</td>
<td>floating rates and discretionary policy</td>
</tr>
</tbody>
</table>

*M₂ data end with change of series in 1979-4.
important is the inability to separate real shocks, including weather and wars, from monetary shocks. Data for war years are included. Agriculture had a much larger role at the turn of the century and in the twenties, so variability of real and nominal GNP may have been larger for that reason alone.

The data are divided into six periods corresponding to six monetary regimes in the U.S. The starting and ending dates and brief descriptions of each regime are shown in Table 1. All data are quarterly rates of change computed from first differences of logarithms.

These data can be used to compare the variability of GNP, money and velocity growth under the six monetary regimes. The comparison is a first step, since no attempt is made to distinguish types of change. Some of the variability reflects anticipated changes, while some changes are unanticipated. The costs of anticipated and unanticipated changes differ. Further, part of the variability arises from transitory changes in growth rates that promptly reverse, while some reflects permanent changes in the growth rate. The costs of bearing variability arising from transitory and permanent changes differ, and the proper responses differ. An unanticipated, transitory change cannot be offset and requires no adjustment. The proper response to a permanent change is to adjust once the change is expected to persist.

The computed values for the variances of nominal GNP growth, money growth and velocity growth can be used to compute the covariance of money growth and velocity growth for periods 1B through 6 using the standard formula.

\[ \text{CovMV} = \frac{1}{2} (\text{vGNP} - \text{vM} - \text{vV}) \]
with \( v \) denoting the variance of the growth rate. Table 2 shows these data for the variances of \( M_1 \) and \( M_2 \) growth.

The principal differences between periods reflect the changing contributions of the variance of \( M \) and the covariance of money and velocity growth. There is no apparent systematic relation between monetary regimes in the distribution of the variance of GNP growth between the three components. The covariance is always positive, however, suggesting that in each monetary regime, the variabilities of money growth and velocity growth are positively related.

Under a stabilizing monetary regime, money growth offsets changes in velocity growth. Relatively high variability of money growth can have a stabilizing influence on nominal GNP growth if the covariance of money and

### Table 2

<table>
<thead>
<tr>
<th>Period</th>
<th>Variance</th>
<th>( v_{M_2} )</th>
<th>( v_{V_2} )</th>
<th>( 2\text{Cov } M_2 V_2 )</th>
<th>( v_{M_1} )</th>
<th>( v_{V_1} )</th>
<th>( 2\text{Cov } M_1 V_1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNP Growth</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>1B</td>
<td>0.76</td>
<td>25.9</td>
<td>5.3</td>
<td>68.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.07</td>
<td>21.9</td>
<td>5.3</td>
<td>72.8</td>
<td>26.0</td>
<td>7.0</td>
<td>67.0</td>
</tr>
<tr>
<td>3</td>
<td>3.73</td>
<td>40.1</td>
<td>6.5</td>
<td>53.4</td>
<td>24.1</td>
<td>7.2</td>
<td>68.7</td>
</tr>
<tr>
<td>4</td>
<td>1.02</td>
<td>53.8</td>
<td>5.7</td>
<td>40.5</td>
<td>68.5</td>
<td>6.2</td>
<td>25.3</td>
</tr>
<tr>
<td>5</td>
<td>0.12</td>
<td>53.8</td>
<td>3.4</td>
<td>42.7</td>
<td>46.2</td>
<td>4.3</td>
<td>47.9</td>
</tr>
<tr>
<td>6</td>
<td>0.10</td>
<td>28.0</td>
<td>2.0</td>
<td>70.0</td>
<td>52.0</td>
<td>2.0</td>
<td>46.0</td>
</tr>
</tbody>
</table>
velocity growth is negative. That negative values of the covariance are not found in any sample period suggests that a rule that kept money growth constant would lower the variability of nominal GNP growth in two ways: the variability of money growth would be zero, and the covariance would be zero also. The data in Table 2 suggest that the arithmetic effect of constant money growth is a reduction of 93% to 98% of the variance of GNP growth.

The arithmetic effect is not the final effect. Most likely the variability of velocity growth is not invariant to a regime change of this kind. The variance of velocity growth would have to rise by a factor ranging from more than 14 to more than 50 to increase the variability of nominal income growth following the institution of a rule fixing the rate of money growth according to the estimates in Table 2.

Additional evidence on this issue is found by Benjamin Friedman (1984, Table 7). Friedman computed the variances and covariances of money growth, velocity growth and nominal GNP growth for postwar expansions and contractions in the U.S. from 1948 to 1982. He found that the comparable percentages to those in Table 2 for $vM_1$, $vV_1$ and twice the covariance are, respectively, 36%, 38% and 26%.\(^{13}\)

An earlier study by Brunner and Meltzer (1983) computed the variances and covariances of deviations of money growth and velocity growth from the values estimated using time series models on quarterly data for 1953 to 1980. The deviations are a measure of unanticipated growth of money and velocity. They found (1983, Table 1) that the variability of unanticipated velocity growth never dominated the variability of unanticipated GNP growth, but constant

\(^{13}\)The covariance is positive for the expansions and negative in the contractions, but the negative value is less than 1/4 the variance of money growth.
money growth reduces the variance of GNP growth much less than is shown by the data in Table 2. This suggests the importance of separating anticipated and unanticipated changes before drawing firm conclusions.

None of these data provides evidence on the direction of causation. The data show that the substantial postwar reduction in the variance of GNP growth is distributed over all components. Each is substantially smaller in the postwar, periods 5 and 6, than in earlier periods. Prewar variability is smallest in period 1B, the classical gold standard without a central bank, and largest in period 3, the era of managed exchange rates and discretionary central bank policy. Period 3 includes part of the depression of the thirties and the recovery from the depression, but the depression does not explain why the variances of \( M_1 \) and \( M_2 \) growth or the covariances of money with velocity are as much as two or three times the variances or covariances in other prewar periods.

The remarkable decline in the variability of real and nominal GNP growth, money growth and velocity growth under the Bretton Woods agreement appears to confirm Keynes' belief that variability can be reduced by changing monetary arrangements. Keynes believed that, with lower variability, risk averse individuals hold smaller money balances. The demand for money falls, and the demand for capital increases, lowering real rates of interest. The decline in interest rates encourages investment raising the equilibrium stock of capital and the level of real income. Meltzer (1981, 1984) Variability of real income growth remained relatively low in period 6, the post-Bretton Woods era, so we cannot conclude that the Bretton Woods agreement was the principal cause of the postwar reduction in variability.

Keynes believed that the principal way to lower variability was to reduce the variability of the demand for money. The data for the six periods in
Table 2 suggests that the variability of velocity growth explains a relatively small part of the variability of GNP growth in all periods. The variability of money growth and the covariance of money and velocity growth appear to account for the largest part of the variability of GNP growth.

A more direct test of Keynes' conjecture is provided by evidence that the demand for money per unit of income is lowest when variability is lowest. Rank correlations of money per unit of income for the six periods for which \( M_2 \) is available, and the five periods for which \( M_1 \) is available, do not support the hypothesis. A stronger test of the effect of monetary variability on interest rates and the demand for money produces some evidence rejecting the hypothesis. Mascaro and Meltzer (1983) test for the effect of increased variability of unanticipated money growth, unanticipated velocity growth and the covariance on interest rates. They conclude that increased variability of unanticipated money growth raises the rate of interest and the demand for money, but they fail to find a significant effect for the variability of unanticipated velocity growth on interest rates. This evidence suggests that the monetary regime may properly be described as the cause of an excess burden that would be reduced by changing monetary arrangements to reduce uncertainty, lower interest rates and increase real income but not for the reason Keynes suggested. The reduction in excess burden is more closely related to the reduction in the variability of the money stock.

Conclusion

A monetary system has four elements of choice. There is a medium of
exchange, a standard of value, an arrangement for producing money and a
decision about the international monetary arrangement, fixed or fluctuating
exchange rates. Each choice has some collective elements, but not all the
collective elements involve government.

The choice between private and governmental responsibility changes the
nature of risks or uncertainty borne in the society. Some risks are
unavoidable; they can be reduced but not eliminated. The choice of a standard
of value is an example. There is no way to eliminate risk of fluctuations in
value or uncertainty about future values. Other risks can be eliminated, or
nearly so, by monetary arrangements. The creation of a lender of last resort
to prevent the spread of defaults on nominal values is an example.

Monetary experience in the twentieth century includes very different
arrangements for specifying value and producing money. An examination of this
experience shows that the variability of real and nominal income growth
differed markedly under different arrangements. The social choice of monetary
arrangements appears to be associated with differences in variability. If
variability of income is a measure of risk or uncertainty, the choice of
monetary arrangements has been associated with large differences in
uncertainty.

Decomposition of the variance of nominal income growth into the variance
of money growth, velocity growth and their covariance shows that the variance
of velocity growth -- or growth in the demand for money per unit of output --
makes a relatively small contribution to the variance of nominal income
growth. Further, the covariance of money growth and velocity growth is
positive in each of the six monetary regimes considered.

The use of an identity, the quantity equation, precludes the assignment
of any causal significance to particular factors. But the use of the identity
assures that all factors affecting the variability of nominal GNP growth have been considered. The relative small contribution of the variance of velocity growth, and the much larger contribution of the variance of money growth, suggests the fruitful direction for research on the sources of variability.

The findings suggest that risk or uncertainty in the growth of real and nominal income is more likely to be reduced by arrangements that reduce the variability of money growth than by policies that attempt to offset fluctuations in the demand for money or velocity. A monetary rule that held money growth constant eliminates the covariance with velocity growth and the variance of money growth. The data suggest that a rule of this kind would reduce risk below the level observed under any of the standards. This conclusion differs, of course, from any of the conclusions reached by Keynes.
Bibliography


