

On Monetary Regimes in General and in Brazil

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The topic I have been asked to address --- the principles guiding the choice of a monetary regime or constitution --- has remained an unresolved issue in the theories of money and economic policy. The student of money confronts four formidable obstacles when addressing this issue as an application of economic theory. First, money is not only neutral in monetary theory, but it is one of many, undifferentiated commodities without any particular properties that can affect the economy's equilibrium. Any commodity chosen at random provides money services as well as any other. Second, although the choice of monetary institutions or a monetary standard can have real effects in practice, these effects are excluded from formal economic theory by the assumption of continuous market clearing and by making the competitive equilibrium independent of real world institutions. Third, relevant aspects of uncertainty that give rise to costly information are missing. At most, individuals hold certain expectations about all possible future contingencies. Fourth, a representative agent makes all decisions, bears all costs, and receives all benefits. There are no effects of redistribution through inflation or deflation. In this framework the choice of a monetary constitution is uninteresting.

Analysis of monetary constitutions or regimes that is not subject to these restrictions also has not provided a clear guide to the welfare maximizing arrangement. The criteria for choosing between fixed and flexible exchange rates, at one level, include the relative importance of external trade, the type of shocks that occur, and the flexibility of real wages. These criteria are not complete. The criteria should include the excess burden that arises when a community is required to bear risk or uncertainty that would be reduced under an alternative arrangement. And the relative advantages of fixed and fluctuating rate regimes depend also on the choices that other countries make. For example, the social costs of participating in a gold or

¹Deirdre McCullough provided helpful assistance.

commodity standard are lower if many countries share the cost of stabilizing the commodity price level. And the costs of a fixed exchange rate system, such as the Bretton Woods system, depend on the behavior of the reserve currency country. The design of the Bretton Woods system did not put an effective limit on the supply of international reserves.

The choice of a fixed or flexible exchange rate is a choice between fixing a price or establishing a monopoly supplier of base money. General economic reasoning does not endorse fixed prices and does not generally support a grant of monopoly power. In the case of base money, however, the choice arises because society can reduce the resource cost of providing base money by substituting paper money for commodity money or by providing less than 100% reserve for issues of paper money. The community gains by holding smaller commodity reserves and a larger capital stock at the cost of permitting discretionary changes in the money stock and the price level or rate of inflation. This tradeoff between the resource cost of a commodity based monetary system and the risk of higher and more variable inflation is not the same for all countries. Political institutions affect the tradeoff; in some countries an independent central bank has been able to reduce the risk of inflation in a fiat money system. Cukierman (1992).

Lutz (1936) and Hayek (1978) proposed eliminating the state monopoly of the production of base money. They argue that competitive producers would have an incentive to offer units of money with stable purchasing power. If the public prefers stable money, stable money would drive unstable money out of use.

Competitive, or "free" banking is costly, however. Money holders incur three types of cost. Meltzer (1983) First, monitoring or information costs are relatively high as shown by the monitoring costs of deposit insurance arrangements. Second, since there is no central bank, there is no lender of last resort. A lender of last resort reduces systemic uncertainty and reduces the amount of commodity reserves that a prudent bank would hold. Bagehot (1873) Third, in addition to systemic risk, there are risks to individual banks arising from changes in relative prices, errors of judgment, or fraud.

If an efficient, free or competitive banking system could be established, it would

offer a useful alternative to, and restriction on, governmental systems. The existence of a parallel currency would lower the cost of avoiding the inflation tax and some of the costs of variable inflation. Some of the functions of a parallel currency have been taken by foreign currencies, notably the U.S. dollar, in countries with persistent high inflation. The dollar fulfills many of the standard functions of money in these countries even if it is not legal tender.

Although I do not see how a private, free banking system can overcome the combination of learning or information costs, resource costs and the absence of a lender of last resort, consumers gain if government allows entry of private producers of money. At best, entry may offer a useful way to restrict arbitrary governmental action, but much of that role has been taken by existing currencies that have lower information costs. I will, therefore, not further consider free banking.

Discussions of monetary constitutions typically analyze alternative regimes from the perspective of a world planner faced with a single choice for the world economy. In practice, countries now choose different arrangements -- varieties of fixed and flexible rates. Canada allowed its currency to fluctuate under the Bretton Woods system. Not all countries adopted the gold standard in the 19th century and, among those that did, not all followed the rules. Bordo and Schwartz (1984)

One explanation for the different choices that countries make is that there are significant differences in the relative cost of domestic and external price instability in different countries. Countries, or their citizens, want to minimize excess variability so as to reduce risk to the minimum inherent in nature and optimal trading arrangements. Since no country acting alone can maintain both internal and external price stability, the choice depends on the factors that are often mentioned -- size, openness, resource mobility, etc. -- and on the risks and opportunities that the external environment offers.

If all countries are to have the opportunity to stabilize domestic prices and their exchange rate, some country or group of countries must provide a stable price level (or expected price level). In a flexible exchange rate system, no single country may aim for price stability, so there may be no opportunity for third countries to fix their

exchange rates and import stable prices.¹ The same problem can arise under a fixed exchange rate system, as experience under the Bretton Woods system demonstrates. Under the classical gold standard, price levels fell until the 1890s then rose until World War I. The variance of actual and anticipated price levels in most member countries was higher under the classical gold standard than under the Bretton Woods or post-Bretton Woods regimes. Meltzer and Robinson (1989).

Countries whose currencies are used as a standard of value can provide a public good for third countries by maintaining actual or expected price stability. This public good is relevant for regimes in which third countries fix their exchange rates to currencies on flexible exchange rates or where there is no commodity base anchoring a fixed exchange rate system.

A second explanation of the different choices that countries make is the fiscal discipline that a country exercises. A country's choice of monetary arrangements is often dictated by its budget policies or fiscal regime.

Credibility is a third reason for choosing or maintaining a particular type of regime. Credibility acts like a capital stock that increases or decreases with experience. Rebuilding the stock is costly. In the standard formulation, the public knows that the central bank will not keep its commitment. Kydland and Prescott (1977). They act on that knowledge, so they prevent the central bank from achieving the optimal inflation rate. Of equal or greater relevance is the effect of credibility on the cost of reducing inflation. High credibility reduces this cost. Cukierman and Meltzer (1986). Britain's decisions to return to the gold standard after the Napoleonic Wars and World War I by deflating to achieve its traditional parity exchange rate of sterling for gold can be interpreted as an effort to regain the credibility that it had sacrificed during the wars. The Argentine government lowered the cost of reducing a long-standing inflation by establishing a quasi-currency board by act of the legislature and allowing U.S. dollars to be used as money.

¹ Average rates of inflation have been positive in all countries under Bretton Woods and in the post Bretton Woods regimes. For 1970-80, the average inflation for the world was 11.6%, and in 1980-92, the rate was 17.2%.

Regions within the United States are legally barred from issuing money, so they cannot devalue or adopt flexible exchange rates. Suppose, however, states had those options. Would it be in the interest of states or regions to let exchange rates adjust for differences in regional economic conditions? In the mid-1970s, Michigan or the U.S. middle west could have devalued against the oil producing states. When oil prices fell, the oil producing states could have devalued against the rest of the United States. In the 1990s, California and other states with relatively heavy concentrations of defense production could have devalued or floated their exchange rates. In each of these cases, the cost of keeping a fixed exchange rate include the costs incurred as labor and other resources move to new locations and the losses sustained by owners of fixed capital and land during the adjustment. The gains from maintaining a credible fixed exchange rate regime include the near-certainty that devaluations will not occur within the United States. A decision to devalue would have destroyed much of the credibility of the fixed exchange rate - single currency system developed over two hundred years. But, if population and resources are sufficiently immobile and the size of the adjustment is large, devaluation or floating can be the better choice. Credibility could be restored after a devaluation, but it would not return to its earlier value.

Several themes that will return in the following sections have been introduced. All countries may not prefer the same monetary regime; there is no unique optimum relevant for all countries. There is interdependence among countries. The choice set available to small countries depends on the regimes chosen by large countries. There are public goods to be provided so that individual countries can minimize risk for their citizens. Resource costs differ across regimes, and different regimes give rise to different types of uncertainty. Credibility of the regime facilitates adjustment. A country's choice of monetary regime depends on its fiscal arrangements. Adherence to budget balance or fiscal policies compatible with the monetary regime involves political decisions and, therefore, raises issues of political economy.

In the following sections, I consider first the choice of a quantity or price rule -- fixed or flexible rates -- from the perspective of the international economy or a large country that minimizes risks for its citizens. I discuss fixed exchange rate systems and

different kinds of monetary rules. Then I propose an adaptive rule for major currencies to provide price stability. Given that choice, smaller countries can import stable prices by fixing their exchange rates to a major currency on a flexible rate. They can “dollarize” by using foreign money, or they can adopt a currency board. I consider some risks and costs of different regimes. Next I discuss some recent work in political economy that considers some issues relevant to policy choices. Then I discuss Brazil’s monetary regime and what could be done to end inflation. A conclusion summarizes main points and recommendations.

Price and Quantity Rules Compared²

A central bank or monetary authority can control price or quantity. Although the choice is often described as a price or quantity rule, these names are misleading. A “price” rule refers to central bank control of an interest rate or exchange rate. A “quantity” rule permits the central bank to maintain a stable domestic price level. A so-called price rule cannot in general maintain a stable price level; this lesson was taught in the depression of the 1930s and in the inflations of the Bretton Woods era. The same lesson has been reaffirmed recently by the experience of the European Monetary System in 1992 and 1993.

A rule fixing the growth rate for the quantity of money has two potential advantages over a rule setting the exchange rate. First, a monetary rule, if properly designed and followed, can reduce variability. Second, the resource costs of the monetary rule are lower, as Friedman (1951) explained in detail. Less real output has to be stored as a monetary reserve. This section compares variability under a gold or commodity standard to variability under a Friedman-type rule. I then consider an alternative monetary rule that achieves price stability and reduces exchange rate variability.

Friedman (1951) estimated the annual resource cost of a commodity reserve currency to be as much as half of the average growth rate of annual output, using data

²Parts of this section are adapted from Meltzer (1983).

for the late 1940s and assuming that, on average, there is no inflation. A similar computation --- using the current ratio of money to income in the U.S. as a reference --- reduces the cost to about 16 percent of the average, annual growth rate of output. Unless there is a reason to anticipate a dramatic decline in average cash balances, the resource cost of a full commodity standard remains high.

Resource costs of an international standard are probably higher. The ratio of money to income in much of the world is above the U.S. ratio, so a larger fraction of world commodity stocks would have to be held as monetary stocks, and a larger fraction of the growth rate of output would be added to the stocks on average. If gold and other metals are exhaustible resources, their prices rise over time relative to the prices of reproducible commodities. The rise in price encourages private holding of gold (or commodity money) instead of productive capital, but also lowers the resource cost of increasing monetary gold stocks.³

A gold or commodity standard is extremely costly to operate unilaterally. All the real and monetary shocks in the world that change the relative demand for the commodity that is used as money affect prices and output in the country that maintains the standard. For example, under a unilateral gold standard, whenever wars, revolutions, increases in inflation abroad, or other unanticipated events increase foreigners' demand for gold, the domestic stock of money falls and the home price level falls until the rise in the relative price of gold restores equilibrium in the gold market. The agreement to supply gold at a fixed price means that every unanticipated event that affects the gold market leaves its mark on real income and prices in the gold standard country. The cost of providing the service is borne by the public in that country. Income and prices are more variable; uncertainty is higher; and the capital stock, income, and wealth are lower than under a multilateral standard. Hence, the perspective of this section is that of a multilateral or international standard.

Specifically, the price rule is assumed to be an international set of fixed

³With constant returns, all of the additional gold is provided by new production and with totally inelastic supply by a rise in the price of gold relative to commodities. Between these extremes the amount of additional resources used for gold production depends on the elasticity of supply.

exchange rates. Central banks and governments agree to buy and sell a specific commodity, gold, or a well-defined basket of commodities, at a fixed price. For the present, costs of maintaining the standard are ignored, and all money is subject to a 100 percent reserve requirement under either a price or a quantity rule. Budget policy is assumed to be compatible with either rule.

The first quantity, or monetary, rule considered is a unilateral rule set to keep constant base money growth -- Friedman's rule applied to the monetary base. A principal advantage of this rule arises from the constancy of money growth. Constant money growth implies that there is no correlation between money growth and velocity growth, so the variance of nominal output growth equals the variance of velocity growth. Let m , v , y , and p be the rates of change of money, velocity, real output and prices, and let V be a variance and C a covariance. Then,

$$V(m) + V(v) + 2C(m, v) = V(y) + V(p) + 2C(y, p).$$

The monetary rule sets $V(m)$ to zero, so $C(m, v)$ is zero also. The average expected rate of price change is zero, but prices change, so $V(p)$ is not zero.

With fixed exchange rates money growth is endogenous. The variance of the growth rate of nominal output in a fixed exchange rate regime is equal to

$$V(m) + V(v) + 2C(m, v)$$

The covariance can be positive or negative, depending on the type of shocks that occur, the frequency with which the various shocks occur, and the location at which they occur -- at home or abroad. I see no way to decide *a priori* whether money growth and velocity growth are positively or negatively correlated. In fact, the two typically have moved together cyclically but not always secularly. Positive cyclical covariance increases the variance of nominal output growth.

Either of two conditions is required for lower variability of nominal output or income growth under fixed exchange rates. The variance of velocity growth must decline by more than $V(m) + 2C(m, v)$. Or, a negative correlation between velocity growth and money growth must be large enough to compensate for the variance of

money growth.⁴ Neither condition is likely to be met, and the data suggest neither was achieved in the late 19th or early 20th century.

Empirical data for the U.S. under the gold standard and during the recent period of fluctuating rates (without a monetary rule) show (1) weak positive correlation between the money growth and velocity growth under the gold standard and (2) higher variability of velocity growth under the gold standard. These data suggest that the variability of nominal output is higher under a gold standard than under fluctuating rates. The absence of a monetary rule biases the result against fluctuating rates, since the variance of money growth was not zero, and the variability of inflation contributed to the variability of nominal output.

Bernholz (1982, Tables 2 and 3) computed the variance of output growth and the average rate of growth of output for five countries under the gold standard to 1913, and during selected periods after 1913. The variability of real growth is 1.5 to 4.5 times higher under the gold standard than during the period 1951-79. The growth rate of output under fluctuating exchange rates for 1967-79 is higher than under the gold standard to 1913 in Germany, Italy, and France. For Britain and the U.S., Bernholz shows two measures of real growth under the gold standard, one for a shorter and one for a longer span. In both countries, growth for the longer period is higher, and for the shorter period is lower, than in the years of fluctuating exchange rates. Despite the oil shocks in 1974 and 1979, which lowered real income in the 1970s, these data suggest that there is: (1) A negative relation between variability or uncertainty and the level of income; and (2) greater variability under a gold standard than under a regime of fluctuating exchange rates.

Bordo and Schwartz (1994) report similar results for a larger sample of countries. In general, output variability is higher under the gold standard than under the flexible rate regime in effect since 1973. Meltzer and Robinson (1989) report the same finding for the variance of unanticipated changes in output, and the rate of

⁴Using the notation in the text, the second condition restricts $C(m,v)$ to be negative and restricts $|C(m,v) - V(m)|$ in relation to the difference in $V(v)$ under the gold standard and the monetary rule.

inflation.⁵ Additional evidence on the costs of a gold standard is the relative size of expansions and contractions in the U.S. economy. One of the most regular features of U.S. peacetime cycles is that, on average, there are four years between peaks and four years between troughs, according to the dating of peaks and troughs by the National Bureau. The averages differ little for 24 peacetime cycles, 10 peacetime cycles under the gold standard (1879-1919), and 5 peacetime cycles between 1945 and 1980. In contrast, there is a notable difference in the lengths of expansions and contractions. The gold standard cycles are evenly divided between months of contraction and months of expansion. Since 1945, peacetime expansions are one-third longer,⁶ and peacetime contractions are less than one-half their average length under the gold standard.

The rates of change of base velocity and monetary velocity were considerably more variable under the gold standard than under the Bretton Woods system, or in the recent period of fluctuating exchange rates. Calculations reported in Brunner and Meltzer (1983) show that the variance of the quarterly rate of growth of base velocity during the decade of the 70s was about two percent at annual rates. This is less than half of the variance of base velocity under the gold standard and, as shown in Gould et al. (1978), a fraction of the variance of monetary velocity (M_2) for 1869-1949 or (M_1) for 1915-49.

One reason for the higher variability of income and output is that money growth is pro-cyclical under a gold or commodity standard. Gold flows toward expanding and away from contracting economies. The flows increase spending and output where incomes are rising and reduce spending and output where incomes are falling. This feature of the gold standard gave rise to frequent criticisms by classical writers and proposals for change.

A second potential reason for increased variability of nominal output under a

⁵Unanticipated changes are computed using a Kalman filter.

⁶The longest expansion, 106 months, includes the Vietnam war, so it is not a peacetime expansion and is excluded.

commodity money system is the increased variability of the price level. A commodity money system transmits foreign price and output changes and changes in world supply and demand for gold (or commodities) to the member countries. If domestic wages or production costs are less flexible than prices, price changes induce changes in production and employment, as implied by the Phillips curve.

Experience has shown that foreign influences are not avoided under flexible exchange rates. Flexible exchange rates permit prices and production costs to adjust to external changes but they do not assure that home country production and employment remain independent of foreign influences. Large unanticipated permanent shocks are sufficient to create interdependence under flexible exchange rates, if the exchange rate does not fully adjust rapidly to permanent changes.

When there are permanent and transitory changes that cannot be identified on impact, prices and costs of production can adjust at different rates. Differences in costs of production relative to prices are reflected in actual and anticipated rates of return to capital, hence in capital flows. Under flexible exchange rates, these flows are damped by the partial adjustment of the exchange rate, and they cease when the public adjusts fully to the permanence of the shocks. This source of variability is likely to be greater under a commodity or price rule than under a monetary rule.

A Friedman-type monetary rule does not remove all problems. The rule has three undesirable features. First, it does not maintain price stability if there are permanent changes in the rate of financial innovation or the rate of output growth. Both types of changes have occurred in developed and developing countries. Second, the rule does not use current information, so it is inefficient when there are changes in trend or persistent deviations from trend. If all changes are transitory, or if mean reversal is rapid and trends are constant, a fixed rule can have lower variance than an adaptive rule that uses current information. In a world of this kind, however, there is not much for monetary policy to do. Where there are persistent deviations or gradual mean reversal, new information can be used to reduce price level variability. Third, a monetary rule sacrifices exchange rate stability.

An Adaptive Rule

Several undesirable features of a Friedman-type rule are overcome by a multi-lateral, adaptive rule. An adaptive rule uses new information as it becomes available, so it adjusts gradually to persistent or permanent changes in real growth and intermediation. An adaptive rule can achieve price level stability, on average, by adjusting to past changes in growth and intermediation. If compatible rules are adopted for each of the principal currencies, the adaptive rule can also reduce fluctuations in exchange rates.

The adaptive rule I propose adjusts for changes in growth of velocity and output by setting

$$b_t = (y^*_{t-1} - V^*_{t-1}) \quad (1)$$

where y^* and V^* are the maintained average rates of growth of real output and base velocity. In Meltzer (1985) and elsewhere, I have suggested that y^* and V^* be defined as three year moving averages of past rates of growth and that b be defined as the one year growth rate.⁷ Lags on y^* and V^* recognize that information is available with a lag of at least one quarter.

By construction the rule in equation (1) maintains price stability. By recognizing that V^* is defined as the difference in the maintained growth rate of nominal GDP (or GNP) and the monetary base, eq. (1) can be reduced to

$$b_t = b^*_{t-1} - p^*_{t-1} \quad (2)$$

where p^*_{t-1} is the moving average of past inflation. The adaptive rule commits the central bank to keep the expected value of p at zero.

The rule does not hold the current inflation rate, p_t , to zero; p_t changes with changes in the trends, b^* and p^* (permanent changes), and with temporary deviations of money growth or inflation from trend, $b_t - b^*_{t-1}$ and $p_t - p^*_{t-1}$. If the central bank follows the rule consistently, b_t will be given by (2), so the principal reasons for deviations will be one-time changes in the price level and changes in trend growth of velocity and output that raise or lower p^* .

⁷McCallum (1987) independently proposed a similar (but not identical) rule.

The expected rate of inflation is zero if the central bank follows the rule in eq. (1).⁸ The actual rate of inflation would fluctuate around the expected rate. The rule would not stabilize the actual rate since transitory price changes cannot be predicted.

Stabilizing the expected inflation rate implies that the price level would follow a random walk. Looking ahead, individuals would expect the inflation rate to be zero at all times, so they would use this rate in planning their asset portfolios and lifetime consumption and bequests. The variance of the future price level that enters their planning would be high for distant observations.

An alternative would stabilize the price level by adjusting for one-time price changes. This could be done by subtracting actual price level changes from eq. (1) after they are known. It is not clear that price stability should be preferred to stability of expected inflation. A credible rule for price stability has the advantage of reducing information costs about the future price level by reducing the variance of the future price level. On the other side is the benefit from letting price level changes adjust real money balances to innovations in productivity. Moreover, there are costs of adjusting the price level when wages are inflexible or contracts are prevalent. If the price level truly follows a random walk, and the monetary rule is credible, the present value of such costs should not be large.⁹

Any credible monetary rule provides a public good by reducing uncertainty and reducing costs arising from time inconsistency. Any rule for domestic price stability, if adopted by reserve currency countries, provides two additional public goods. First, exchange rates are more stable if expected rates of inflation are the same in principal countries. Wealthowners in each country face lower exchange rate variability and lower domestic price variability. Second, third countries have the option of fixing their exchange rates and importing price stability. These countries also realize a benefit

⁸It could, of course, be set for any constant if there is a non-zero optimal rate of inflation. Empirical work suggests, not surprisingly, that the equation for the rule gives an unbiased prediction of inflation.

⁹With a random walk in the price level and zero expected inflation, the rule would stabilize the nominal wage, as some classical writers proposed. Productivity growth would adjust real wages by lowering the price level.

that they could not achieve alone. The cost of a fixed exchange rate can be large for a country that pegs its rate, if there are sudden changes in expected inflation abroad. A credible rule that reduces this risk is a valuable benefit. I return to this issue below.

Zero expected inflation and increased stability of nominal exchange rates also encourages trade and capital mobility. Costs of information and risks are lower, so the costs of hedging foreign exchange risks are lower also. Under the proposed adaptive rule, exchange rates between principal currencies would respond to real shocks. Exchange rate changes would damp the effects of productivity changes and contribute to adjustment. Hence, such changes would facilitate adjustment of the world economy to real shocks. Third countries that fixed to a revaluing currency, however, would be faced with costs of adjusting to a country specific productivity change abroad.

A rule for monetary base growth is more easily monitored, and the base is more readily controlled than other monetary or credit aggregates. A common argument against monetary base control is that the relation of the base to other monetary aggregates changes with intermediation. An adaptive rule adjusts for sustained changes in intermediation.

A bank run or currency drain poses a different problem. A well-designed monetary rule should not have to be suspended, as the gold standard was often suspended, if a bank run occurs. To reduce uncertainty, the rule should respond to short-run changes in the demand for base money. The most direct way that does not require suspension is to follow Bagehot's (1873) prescription to the central bank: lend freely at a penalty rate. A penalty rate eliminates borrowing from the central bank except in periods of market panic -- when the market fails to redistribute the existing stock of reserves in response to demand. During a panic, the central bank would match increased demand, so there would be no price level effect. When the panic ended, the penalty rate assures that the additions to reserves and base money are canceled at the central bank.

Options for Third Countries

A credible monetary rule for major currencies improves the choice set for other

countries. They can have a fixed exchange rate without paying the resource costs of a unilateral or multilateral commodity standard. They can earn interest on reserves by holding foreign securities. They can minimize price and exchange rate variability by fixing the exchange rate either to one of the major currencies or to a basket of currencies. They can choose one of the principal currencies as legal tender and use it as a medium of exchange, so called dollarization. They can adopt a currency board.¹⁰

Each sovereign country can eschew all of these options allowing its currency to float, adjust freely, adjust with a crawling peg, or adjust at the government's discretion. With floating rates, governments have all the options available to the major currency countries. They can adopt a monetary rule, establish free banking, or use discretion.

In choosing among the variable options, a country faces costs of seigniorage, uncertainty and flexibility. Dollarization sacrifices seigniorage, so it is always more costly than a currency board. Neither dollarization nor a currency board can be abandoned without a change in the law, so the degree of credibility is similar. Since a currency board retains seigniorage for the country, it dominates dollarization.

Three types of uncertainty are particularly relevant when choosing a monetary standard. These impose costs associated with bank runs, costs of achieving and maintaining credibility, and costs from reduced flexibility to respond to specific events.

Bank runs or currency drains can arise in any fractional reserve deposit system. A currency board or dollarization maintains the value of the currency, but the value of money in bank deposits can be uncertain if a bank becomes illiquid or insolvent. To reduce uncertainty for the system, a currency board or dollarization regime should negotiate standby borrowing arrangements with a foreign lender to serve as lender of last resort. As an alternative, a currency board could adopt Bagehot's rule to lend freely at a penalty rate. A high penalty rate would prevent abuse. Historically, many currency boards relied on borrowing from banks in the reserve currency country.

¹⁰ A currency board is a rule-bound monetary authority that issues local currency based on a 100% reserve held mainly in marketable securities of a major currency country. Schwartz (1993), Walters (1987). The board maintains convertibility of banknotes (currency) at a fixed exchange rate. This eliminates foreign exchange risk for domestic currency against the principal or reserve currency without losing seigniorage.

Cukierman and Meltzer (1991) define average credibility for a regime in which the central bank announces money stock targets. Average credibility is the difference between the actual and the announced rate of money growth. The same measure would apply in the case of a monetary rule and with some adjustment in a fixed exchange rate system. In the latter case, the relevant difference would be between the expected rate of money growth and the money growth rate consistent with maintenance of the fixed exchange rate.

A rule for money or the exchange rate, if maintained, increases credibility and reduces uncertainty. To maintain high credibility of either a fixed exchange rate or zero expected inflation, a country cannot rely solely on the actions of a monetary authority. Money wages must be sufficiently flexible to keep the unemployment rate within a socially acceptable range. Fiscal policy must be sufficiently disciplined to avoid deficits that cannot be financed without causing inflation or devaluation. With a fixed exchange rate, the reserve currency country must avoid making large policy changes or adopting policies that spread inflation or deflation through the exchange rate system. Wage flexibility, fiscal policy, and policies abroad affect credibility of the fixed exchange rate by changing the expected rate of money growth in the dependent country. In the next three subsections, I discuss each of these issues.

Wage Flexibility

If money wages are inflexible, fixing the nominal exchange rate makes a second nominal price inflexible. There is no consistent solution for market clearing nominal prices. The indeterminacy is removed by changes in resource use and factor unemployment or excess demand.

Money wages may not be completely rigid. If wages adjust slowly, factor use rises or falls as production costs adjust gradually to the equilibrium implied by the fixed exchange rate. A well-known conjecture suggests that the more credible the fixed exchange rate, the lower is the social cost of adjustment. The very slow adjustment of nominal wages and unemployment following Britain's return to the gold standard in 1925 suggests that even with a credible commitment adjustment to a fixed exchange

rate can be costly.

Governments have been unwilling to accept the costs of a fixed exchange rate system, so they have adopted crawling pegs and devaluations. Experience in Britain, Italy and Spain before and after the breakdown of the European Exchange Rate Mechanism in 1992-93 suggests that the costs of keeping exchange rates fixed can be high. Unemployment rates of 12 to 25% were insufficient to reduce costs of production enough to restore aggregate demand in these countries, given German monetary policy. Recessions did not end until the countries devalued or floated.

The inflexibility of money wages in a fixed exchange rate system depends in part on the choices made by reserve currency countries. If these countries follow an adaptive rule that holds expected inflation at zero and maintain a credible fixed exchange rate regime, expectations of inflation should approach zero. Wages would be more flexible where prices are expected to be stable.

Fiscal Policy

A country cannot maintain either a permanently fixed exchange rate or zero (low) inflation, if it runs large, persistent budget deficits. If deficit finance requires sustained money creation, it is inconsistent with zero (low) inflation or, in the case of fixed exchange rates, inconsistent with inflation rates abroad. The monetary rule would not be credible.

Vegh (1992) used data from International Financial Statistics to study eleven stabilization programs in Latin America and Israel. His work suggests the importance of deficit finance for success or failure of these programs. Successful programs were able to keep inflation at an annual rate of about 20%. None of the programs maintained a fixed nominal exchange rate throughout the period studied. Some fixed the nominal exchange rate to bring down inflation before adopting a crawling peg. Others devalued repeatedly and by large percentage rates.

Table 1 shows data for ten of the eleven countries. I have omitted Chile's program for 1977-83 because Vegh omits the first part of a crawling peg program and includes the fixed exchange rate period. I consider the latter below.

Insert Table 1

The data in Vegh's tables typically cover four to five years after the stabilization began. The "last" observations are therefore not the end of the story. Some of the successes continued. Bolivia, Israel, and Mexico have avoided a new surge of inflation. None of these countries has been able to keep its nominal exchange rate fixed. Argentina's 1991 stabilization is not included in Vegh (1992). It is the only case of a Latin American stabilization plan that maintained a fixed nominal exchange rate for more than three years. Argentina used a quasi-currency board and permitted dollars to circulate as parallel currency. It also avoided budget deficits.

Table 1 shows that the budget deficit was reduced and remained substantially below its peak in each of the successful cases. The deficit share of GDP is not uniform across countries. In several of the stabilization failures, the deficit share rose above the previous peak by the end of the observation period.

Uruguay (1968) is an apparent exception. At the "end" of the stabilization plan, the reported deficit share is about the same as at the deficit's trough. The deficit shares in the two previous years were -5.8% and -2.6% of GDP, however, so the case is less exceptional than it appears to be.

The deficit share that is consistent with successful stabilization differs with the saving rates of the various countries, their ability to borrow internationally, and thus the way in which resources are used. A country that borrows to increase productive capital can sustain a larger deficit share than a country that borrows to finance future consumption.

Much has been written in recent years about the credibility of monetary policy. Much less attention has been given to the credibility of fiscal policy. Yet, it is difficult to conceive of a credible monetary policy that leaves fiscal policy unrestricted. A high saving rate, as in Italy, or a desire by foreigners to accumulate domestic assets, as in the United States in the 1980s, can postpone the effects of fiscal policy on the exchange rates or the rate of inflation. If the government issues debt to spend mainly for consumption, transfers and subsidies, debt expands without commensurate increases in productive assets. Devaluations and inflation reconcile the discordant

Table 1
Stabilization Programs

Country and Date of Stabilization (Success or Failure)	Consecutive Quarters of Fixed Exchange Rate	Size of First Devaluation %	Peak Inflation 4 Quarter %	Trough Inflation 4 Quarter %	Peak Deficit % GDP	Trough Deficit % GDP	Percentage Reduction M ₁ Growth Peak to Trough	Last Inflation Rate (4Q) Shown %	Last Deficit Shown % GDP
Bolivia 1985 S	0	NA	20,072	8.1	-29.4	-3.4	11415.0	17.4	-3.3
Argentina 1967 F	12	70.6	37.7	7.2	-4.6	-1.6	56.5	66.0	-5.2
Brazil 1964 S	3	107.4	96.4	20.7	-4.2	-0.4	77.0	21.8	-0.4
Uruguay 1968 F	13	379.8	167.2	12.9	-3.0	-1.3	92.7	83.0	-1.4
Argentina 1979 F	0	NA	169.0	82.3	-3.2	-2.7	125.6	203.0	-7.2
Uruguay 1978 F	0	NA	79.5	15.0	-0.8	0.2	124.0	58.5	-3.9
Argentina 1985 F	3	53.1	1036.2	78.5	-11.0	-1.5	677.4	383.9	-6.1
Brazil 1986 F	2	34.2	263.5	62.1	-14.5	NA	630.2	389.6	-14.4
Israel 1986 S	4 *	36.5	464.5	15.6	-13.0	0.7	395.8	18.2	-4.4
Mexico 1988 S	3	16.3	177.4	17.0	-3.6	3.3	128.5	19.5	+3.3

* quarters of appreciation
Source: Vegh (1992)

policies.

Influences from Abroad

A fixed exchange rate commits a country to accept policy impulses from the reserve currency country. These will be consistent with stability only if the reserve currency country follows appropriate policies.

Monetary history offers many examples of inappropriate policies in the reserve currency or central country that spread to the periphery. U.S. policies in the early 1930s spread deflation and recession through all the gold standard countries. U.S. policies in the latter part of the 1960s and early 1970s spread inflation to countries in the Bretton Woods System. German policies in the early 1990s imposed disinflation on members of the European Exchange Rate Mechanism.

Both Chile (1979-82) and Israel (1985-88) used a fixed exchange rate as a nominal "anchor" to reduce domestic inflation. Each country fixed its exchange rate to the U.S. dollar. The results achieved were very different. Israel reduced inflation with no more than a two month decline in output. Thereafter income and output rose as inflation fell. Chile suffered a severe contraction. In 1981-82, real output fell 15%, and one-quarter of the outstanding stock of base money -- bank reserves and currency -- was eliminated. See Table 2.

Table 2 here

The different experiences reflect the differences in the movements of the dollar in the two periods. Israel fixed its dollar exchange rate after the dollar started to devalue against other currencies. From 1985 to 1988 the Federal Reserve's multilateral nominal trade weighted index for the dollar fell 35%, from 143 to 93 (base 100, 1973). The multilateral, real exchange rate fell by 1/3 in the same period. This sizeable and rapid devaluation was accompanied by a sharp decline in oil prices. Both the oil price decline and the devaluation of the dollar worked to increase Israel's current account surplus and lower costs of production relative to costs in other countries.

From 1980 to 1983, the U.S. multilateral, nominal dollar exchange rate

Table 2
Exchange Rates, Base, Money and Output

Israel				
Date	Annual Growth of Base Money (B) Percent	IS/\$ Index	IS/SDR Index	Output Growth (y) Annual Percent
1985/3	228.1	100	100	-6.2
1985/4		100	106	
1986/3	51.1	99	115	7.5
1987/3	16.8	107	131	5.5
1988/3	-3.9	112	135	0.3

Chile				
Date	B	P/\$ Index	P/SDR Index	y
1979/2	40.8	100	100	8.0
1980/2	38.2	100	102	7.5
1981/2	8.0	100	89	5.4
1982/1		100	86	
1982/2	-26.6	117	101	-15.2
1983/2	-2.9	188	165	-0.7

Source: IMF: International Financial Statistics

appreciated 43%, and the real exchange rate appreciated 38%. Oil price rose during this period, particularly in 1979-81. These changes imposed deflationary impulses on the Chilean economy and changed the terms of trade to encourage imports and reduce exports.

Table 2 compares dollar and SDR indexes for the Israeli shekel and Chilean peso to show the shekel's depreciation and the pesos appreciation. The Israeli appreciation against non-dollar currencies permitted base growth (and inflation) to fall while growth of output rose. Chile's fixed exchange rate with the dollar and appreciation against the SDR was followed by falling base money and deep recession.

The Israeli and Chilean experiences, like the experience under the gold standard and Bretton Woods, reflect a common problem. Stabilizing an economy, or maintaining stability, by fixing the exchange rate can work only if the reserve currency country maintains stability. This seems obvious, but it is often neglected in discussions of stabilization policy. As noted above, stability with fixed exchange rates also requires reasonable flexibility of money wages. Credible policies may increase flexibility of wages and costs.

It does not follow that a small, open economy should adopt floating rates and money stock control. Fiscal discipline is necessary for effective control of exchange rates or the money stock. Also important is the variability of the demand for money, particularly in economies that try to use money stock control to reduce persistent, high inflation. Money stock control provides greater stability than a fixed exchange rate if there is sufficient fiscal discipline, if the economy has sufficient size, or if wages are relatively inflexible. This list is not exhaustive, but it suggests how difficult it is to make precise general statements about the optimal monetary rule or the welfare maximizing policy choice.

The optimal choice for third countries depends, therefore, on internal and external circumstances. The adaptive rule for zero inflation, proposed above, provides a public good by reducing one of the principal risks that countries accept when adopting a fixed exchange rate. Real adjustments would occur and would spread to

third countries when productivity changes.

A currency board is one way of making a more credible commitment to a fixed exchange rate. However, there is no domestic lender of last resort in such a system, so the risk of systemic financial failures is higher than with a central bank. A fixed exchange rate administered by a central bank is a weaker and less credible commitment.

No general conclusion can be drawn. Countries with a long history of inflation have more to gain from closing down the central bank's monetary operations to increase credibility. Government borrowing agreements with the reserve currency country can be used as a substitute for the lender of last resort.

Some Political Economy Aspects

Although it is difficult to decide on a general optimum, it is not difficult to judge that many countries are far from any optimum. High and variable inflation, relatively large budget deficits, and uneconomic subsidies financed by an inflation tax are among the policies that countries have adopted. Each of these policies can misallocate resources or increase the risks or uncertainty that the public bears.

Recent work in political economy analyzes the politics and economics of these choices. One strand emphasizes credibility. The public benefits from credible policies because they can form more accurate anticipations. Errors are smaller, so utility increases.

A second type of literature analyzes why policy remains inflationary despite the welfare costs of high and variable inflation. Two types of answers are of interest.

Alesina and Drazen (1991) assume two groups. Each is uninformed about the costs and benefits received by the other group. They struggle over shares of the budget. The first one to offer to reduce his or her share bears the larger cost of stabilization. Each group waits for the other to make the first move, and each loses from inflation as a consequence of delay.

The Alesina-Drazen analysis uses a game theoretic framework that emphasizes redistribution and uncertainty about costs of ending inflation and costs of waiting.

They make the distribution of the losses to the first mover a predetermined, larger share of the total loss. In practice, the distribution is part of the bargaining process, and, there are more than two parties, so coordination of gainers and losers is more difficult than the model allows. Nevertheless, their model shows why a policy that would raise everyone's welfare is delayed for a long time. And it highlights the role of consensus and the difficulty in achieving a consensus among groups, individuals and their political agents. By extension, the analysis can be applied to the choice of a policy rule, say a decision to adopt a fixed exchange rate or a monetary rule.

Fernandez and Rodrik (1991) ask: "Why do governments fail to adopt policies that economists consider to be efficiency enhancing?" They analyze a model in which voters decide on trade liberalization. They recognize, however, that the problem is general. Their solution is of general interest.

Once again distribution of the returns or gains is central; the gains are not distributed uniformly. Individuals are rational, but they are uncertain about how the gains will be distributed ex post. They may oppose reforms from which they would gain if adopted or support reforms which impose losses on them. They can correct the latter ex post, but they do not learn about the former if the reform is defeated.

Models that highlight the distribution of gains and losses and the role of uncertainty may explain why countries often adopt price or wage controls as part of a stabilization plan. Voters may be concerned that they will lose because real wages will fall or because profits will increase while wages fall. Controls may reassure them that, despite the efficiency loss, their relative and absolute position will be improved, their losses limited, or their uncertainty reduced.

These political economy models suggest reasons why countries do not adopt fiscal policies that would support either domestic or international price stability. They seem relevant to the Brazilian experience where many heterodox stabilization plans have been adopted, and orthodox stabilization has been avoided.

The Brazilian Experience

Brazil illustrates several of the principles discussed here. The financing

requirement for the operating deficits of all levels of government and state enterprises has been met by issuing government securities and base money. Under prevailing institutions, the monetary base generally could not be controlled by the central bank; for most of the past fifteen years, holders of securities could put securities to the central bank without loss of principal value.

Beginning in 1986, several attempts were made to stop the inflationary process by freezing prices and wages, replacing the currency, blocking bank deposits, and using other heterodox measures. Some of these attempts slowed the rate of inflation for short periods. Others had little effect. Usually there was no attempt to eliminate the operational budget deficit. It would be surprising if government policy retained credibility after years of inflation and the many failed attempts to end it.

There is no fixed nominal value in Brazil. The stock of base money rises with government financing and accumulation of foreign exchange. The exchange rate adjusts on a crawling peg with additional adjustments at intervals to change the terms of trade temporarily. Most nominal values are indexed partly or fully.

Table 3 reproduces and extends a table from Meltzer (1992) showing compound annual growth rates for base money, other monetary aggregates, government debt, prices and nominal GDP for 1981-90 and 1985-90. The third row adds the 1989-93 period.

Table 3
Compound Rates of Change for Money, Debt and Prices^a

	Base	M₁	M₃	M₄	Debt^b	Prices	GDP
1981-90	159	154	154	154	153	161	158
1985-90	210	200	191	189	180	206	203
1989-93	249	248	244	251	235	264	253

^a end of year data

^b privately held government debt

The close correspondence in maintained growth rates shows the high correlation

between ex post trend rates of increase in the principal monetary aggregates and measures of inflation.

The data in Table 3 tell an unusual story about Brazil's sustained high inflation. Monetary velocity declined on average for broad measures of money. M_1 velocity rose on average, but the 1993 value is below the value reached in 1984. The most that can be said is that M_1 velocity has a modest, positive trend that is interrupted by some policy changes as in 1986. There is, however, no evidence of a flight from money. On the contrary, broad monetary aggregates rose relative to GDP, on average. Chart 1 shows measures of velocity computed using money stock values at the end of the year.

Chart 1 here

End of year data may bias velocity measures downward, thereby understating the contribution of velocity to the Brazilian inflation. Chart 2 recomputes velocity for M_1 , M_2 , and M_4 using annual averages of the monetary aggregates. M_1 velocity shows a steep rise from 12.2 in 1980 to 48.5 in 1993. Broader measures of velocity decline as in Chart 1. M_4 velocity, for example, falls from 4.6 in 1980 to 2.6 in 1993.

Chart 2 here

The movements of velocity imply that Brazil's inflation has been a monetary phenomenon. As shown in Table 3, base money rose relative to government debt, on average; the share of the budget financed by money increased over time.¹¹ By the 1990s, most of budget deficit was represented by interest payments on the debt. Table 4 shows these data.

The two main problems of a successful stabilization plan for Brazil are to establish credibility and close the budget deficit. Both problems would be solved by establishing a credible currency board.

At the end of 1993, Brazil's stock of currency was valued at US \$ 3.8 billion.

¹¹ Changes in international reserve affect movements of the base. In most years, changes in international reserves were small. For the years through 1990, international reserves declined on average, so base growth to finance the budget is understated. There is a relatively large increase in international reserves in 1992 and small increases in 1991 and 1993, so base growth 1989-93 overstates the amount of deficit finance.

Chart 1

Ratio of GDP to Money Supply

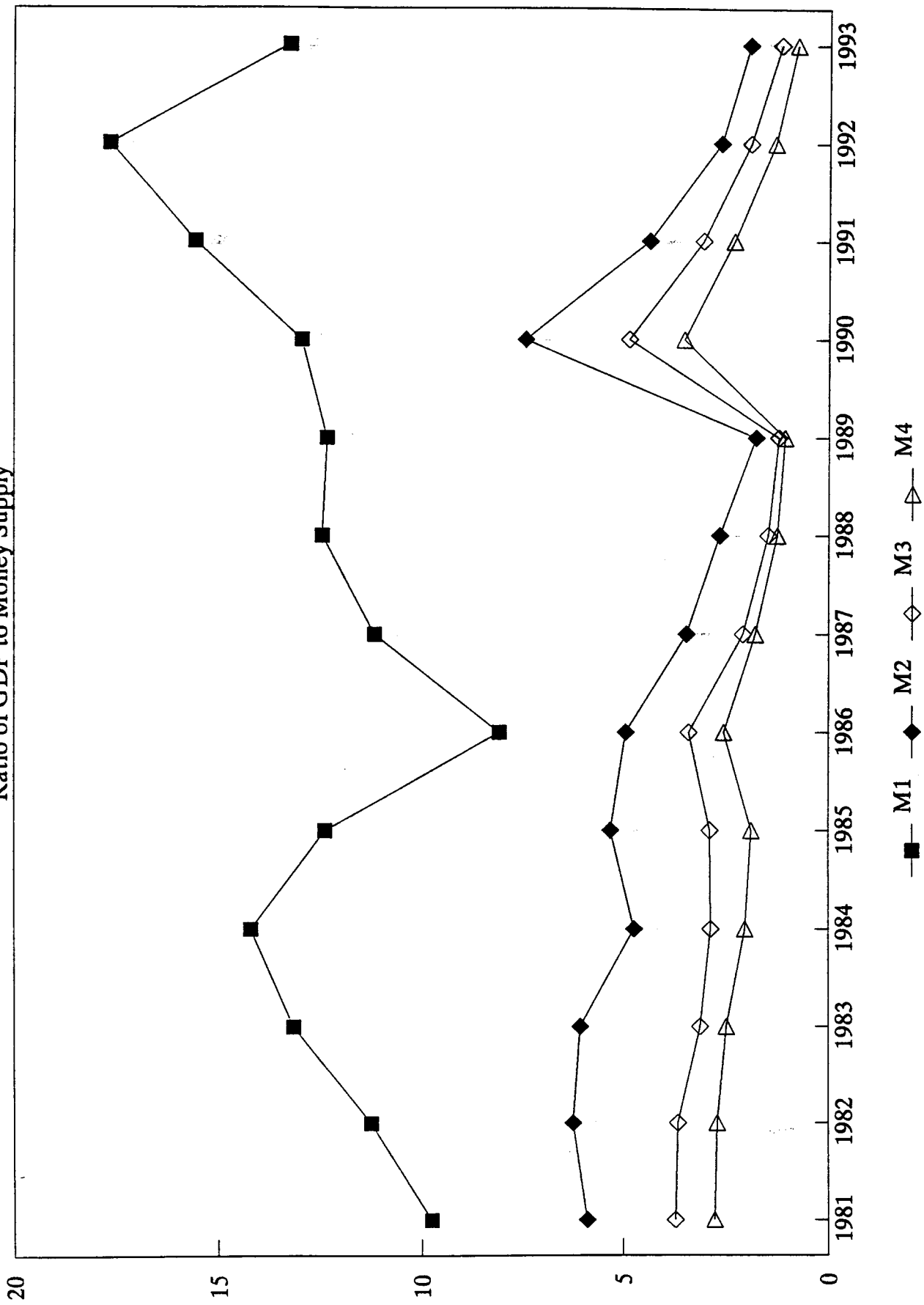
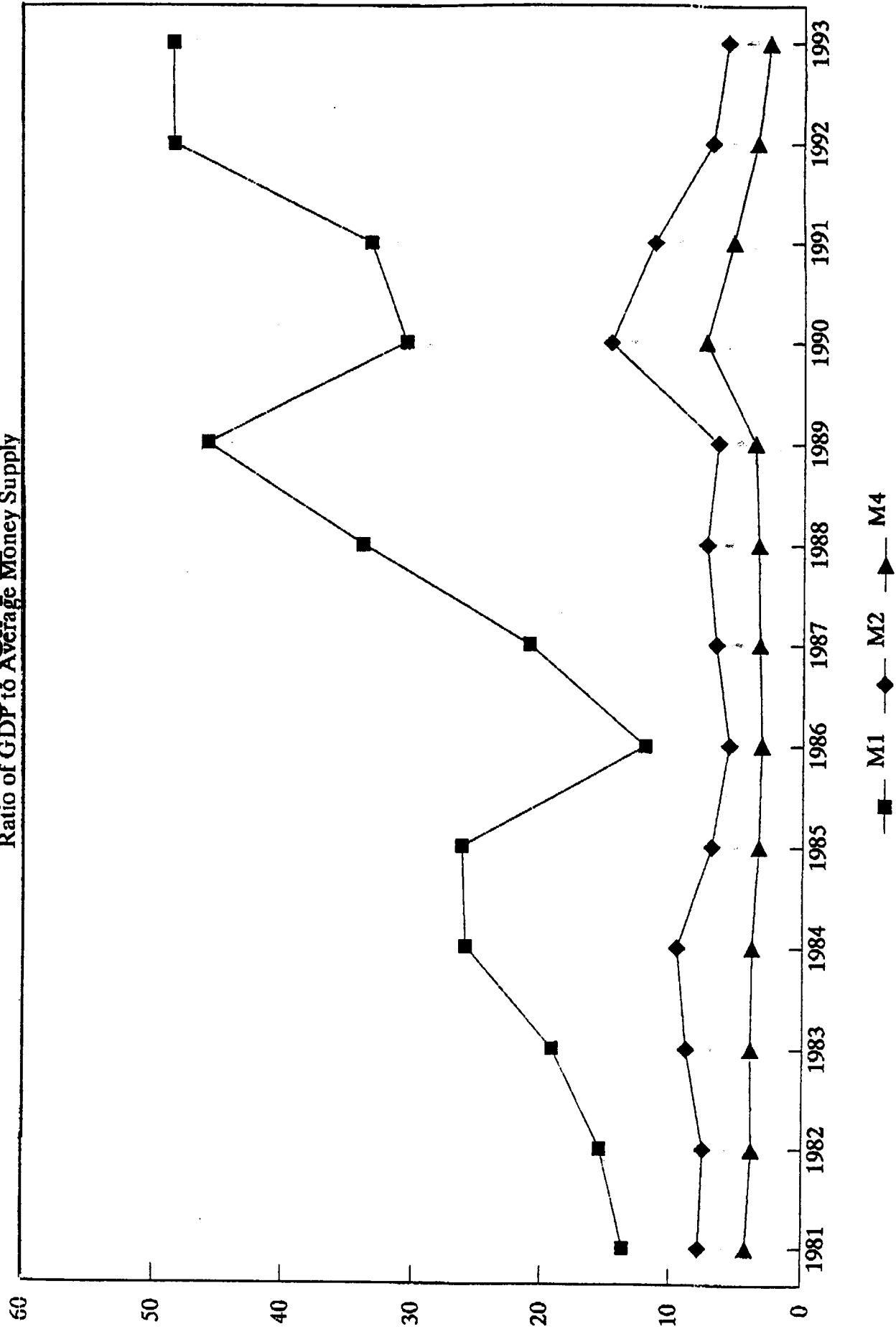


Chart 2
Ratio of GDP to Average Money Supply



International reserves exceeded \$35 billion in March 1994, so reserves were more than sufficient to guarantee currency convertibility as required for a functioning currency board.

Table 4
Deficits, 1986-93

Year	Operational Deficit % GDP	Interest Payments % GDP	Operational Deficit US \$ Billions	Interest Payments US \$ Billions
1986	1.6	3.2	\$ 40.5	\$ 81.1
1987	5.7	4.7	97.8	80.6
1988	4.8	5.7	61.9	73.5
1989	6.9	5.9	94.8	81.0
1990	(1.2)	3.3	(25.4)	69.9
1991	(0.6)	2.8	(9.6)	48.2
1992	1.6	3.4	26.5	56.3
1993 ^a	(0.2)	2.5	(2.3)	28.3

Source: Table 3.3 Public Sector Borrowing Requirement, Brazil Economic Program. Items in parentheses are surpluses.

^a Through November.

Credibility of a currency board would be strengthened if it was adopted by the legislature. Under the rules of the currency board, Brazil would have a fixed, nominal exchange rate with the U.S. dollar. Increases in currency would be backed 100% by reserves.

A credible currency board would reduce inflation toward the U.S. level, currently about 3%. Suppose that Brazil's inflation rate falls to 15% and that interest rates on outstanding debt fall to 20%. When the adjustment is complete, interest payments on the public debt would decline from approximately Cr \$900 billion in 1993 to approximately Cr \$120 billion. Since the financing requirement is less than interest payments, the operational budget would have a surplus. The budget position would be consistent with the currency board and would contribute to its credibility.

Conclusion

Rules and institutional reform can raise welfare by reducing risks to the minimum inherent in nature and optimal trade and payments arrangements. Characterizing the optimal monetary arrangement is difficult, however. There is no unique monetary system that is best for all countries and all circumstances.

The paper discusses several of the factors that affect the choice of a monetary system. These include fiscal arrangements, the degree of wage flexibility, and the importance of trade. I note these factors but emphasize the relation between major currencies and the currency of developing or small countries.

The choice set available to small or developing countries expands if reserve currency countries adopt stable policies. If reserve currency countries create a public good -- price stability or stable expected inflation -- other countries can achieve both stable expected inflation and stable exchange rates. This increases global stability, reduces risks, and increases capital mobility and trade.

The paper, therefore, considers policies for reserve currencies and other currencies separately. I propose an adaptive monetary rule for reserve currencies to maintain zero expected inflation. These countries benefit from the proposed rule by reducing risk of inflation and by removing the response to variable inflation as a source of exchange rate variability. Third countries can then fix their currencies to one (or more) of the reserve currencies by decree or law or by establishing a currency board. Their choice of a fixed exchange rate requires fiscal discipline. Their choice between a currency board and central bank pegging depends on the relative importance of credibility and of a lender of last resort. Again, no single optimal arrangement is desirable or appropriate for all countries.

I propose a currency board for Brazil to establish a credible anti-inflation policy. This policy would lower interest payments and, thus, convert the government borrowing requirement into a surplus. A sustained budget surplus would contribute to the program's success and reinforce its credibility.

References

- Alesina, A. and Drazen, A., (1991). "Why Are Stabilizations Delayed?" American Economic Review, 81, pp. 1170-88. Reprinted in T. Persson and G. Tabellini (eds.) Monetary and Fiscal Policy v.2 Politics. Cambridge: MIT Press, 1994, pp. 387-414.
- Bagehot, W., (1873). Lombard Street, New York: Scribner, Armstrong.
- Bernholz, P., (1982). "The Political Economy of Monetary Constitutions in Historical Perspective," xeroxed, Basle.
- Bordo, M.D. and Schwartz, A.J., (1981). A Retrospective on the Classical Gold Standard. Chicago: University of Chicago Press.
- Bordo, M.D. and Schwartz, A.J., (1994). "The Specie Standard as a Contingent Rule: Some Evidence for Core and Peripheral Countries" in B. de Macedo and B. Eichengreen, (eds.), Historical Perspectives on the Gold Standard, (forthcoming).
- Brunner, K. and Meltzer, A.H., (1983). "Strategies and Tactics for Monetary Control," Carnegie Rochester Conference Series, 18 (spring).
- Cukierman, A., (1992). Central Bank Strategy, Credibility and Independence: Theory and Evidence. Cambridge: MIT Press.
- Cukierman, A. and Meltzer, A.H., (1986). "A Positive Theory of Ambiguity, Credibility, and Inflation", Econometrica. Reprinted as Chapter 8 of A.H. Meltzer, A. Cukierman, and S.F. Richard (eds.), New York: Oxford University Press, 1991.
- Cukierman, A. and Meltzer, A.H., (1991). "The Credibility of Monetary

Announcements," Chapter 9 in A.H. Meltzer, A. Cukierman, and S.F. Richard, (eds.), Political Economy. New York: Oxford University Press.

Fernandez, R. and Rodrik, D., (1991). "Resistance to Reform: Status Quo Bias in the Presence of Individual - Specific Uncertainty," American Economic Review, 81, 1146-55. Reprinted in T. Persson and G. Tabellini (eds.), Monetary and Fiscal Policy, v. 2 Politics. Cambridge: MIT Press, 1994, pp. 371-86.

Friedman, M., (1951). "Commodity Reserve Currency," Journal of Political Economy, 59, (June), pp. 203-32. Reprinted in M. Friedman (ed.), Essays in Positive Economics, Chicago: University of Chicago Press, 1953, pp. 204-50.

Gould, J.P., Miller, M.H., Nelson, C.R., and Upton, C.W., (1978). "The Stochastic Properties of Velocity and the Quantity of Money", Journal of Monetary Economics, 4, (April), pp. 229-48.

Hayek, F.A. The Denationalization of Money, 2nd ed. London: Institute of Economic Affairs.

Kydland, F.E. and Prescott, E.C., (1977). "Rules Rather than Discretion: The Inconsistency of Optimal Plans", Journal of Political Economy, 85 (June), pp. 473-92.

Lutz, V.C., (1936). The Rationale of Central Banking, London: King.

McCallum, B., (1987). "Optimal Monetary Policy in the Light of Recent Experience: The Case for Rules." Carnegie Rochester Conference Series on Public Policy.

Meltzer, A.H., (1983). "Monetary Reform in an Uncertain Environment," Cato Journal, 3 (Spring), pp. 93--112.

Meltzer, A.H., (1985). "Overview" in Price Stability and Public Policy, Federal Reserve Bank of Kansas City, pp. 209-22.

Meltzer, A.H., (1992). "Inflation and Money in Brazil", xeroxed, Washington: The World Bank.

Meltzer, A.H. and Robinson, S., (1989). "Stability under the Gold Standard in Practice," in M.D. Bordo, ed., Money, History, and International Finance: Essays in Honor of Anna J. Schwartz. Chicago University of Chicago Press, pp. 163-95.

Schwartz, A.J., (1993). "Currency Boards, Their Past, Present, and Possible Future Role", Carnegie Rochester Conference Series on Public Policy, 39 (December), pp. 147-87.

Vegh, C.A., (1992). "Stopping High Inflation: An Analytical Overview", IMF Staff Papers, 39 (Sept.), pp. 26-47.

Walters, A., (1987). "Currency Boards" in J. Eatwell, M. Milgate, and P. Newman, (eds.), The New Palgrave: A Dictionary of Economics. New York: St. Martin's Press.