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1978

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PITTSBURGH, PENNSYLVANIA 15213
731. Prediction Analysis in Political Research, by David K. Hildebrand, James D. Laing, and Howard Rosenthal.
735. Monetary and Other Explanations of the Start of the Great Depression. Allan H. Meltzer.
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THE CONDUCT OF MONETARY POLICY
UNDER CURRENT MONETARY ARRANGEMENTS

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1. Introduction

House Concurrent Resolution 133 required the Federal Reserve to break with past secrecy by announcing proposed annual growth rates for 'monetary aggregates' four times a year. Earlier the central banks of Germany and Switzerland announced intended annual average growth rates for a specific monetary aggregate. Later, central banks in Canada, France, Japan, Britain and elsewhere made similar decisions. I shall refer to all the monetary aggregates as 'money' to avoid excessive emphasis on details, and describe the change in policy as a decision to use money as the principal indicator of monetary policy as defined in Brunner and Meltzer (1967). The central banks of the various countries now set a target rate of interest, level of free liquid reserves, exchange rate or some other market variable that is thought to be consistent with a desired rate of growth of money. The desired growth rate of money is not an end but is a means to achieve some anticipated rate inflation and pace of economic activity in the near future – in the course of the next year or two.

There may have been a presumption that the growth rates of money would decline gradually but persistently under the new arrangement but this has not happened everywhere. Nor has the decision to announce growth rates of money reduced the attention paid to money market conditions in the United States. The Federal Reserve continues to implement policy by fixing a value of the Federal funds rate and supplying the reserves required to maintain the rate. The rate of growth of money, as usual, has been higher during the period of economic

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*I have discussed these ideas with Karl Brunner, and their development reflects his influence. The Hoover Institution has provided a congenial environment for our recent discussions. Gottfried Haberler commented on major points.

1 See Duwendag (1977) for a comparison of the proposals and the differences in implementation.

2 In the United States this presumption was fostered by the apparent commitment to stable prices in Resolution 133 and by the expressed concern about inflation and high market interest rates at the time.
expansion than during the preceding contraction. Lagged reserve requirements, regulation Q, and most other rules and procedures that reduce short-term control of money remain in effect.

Does the new procedure leave monetary policy and the policy process unchanged? I leave to others to decide how the growth rate of money would have differed if Resolution 133 had not been approved and all other factors—including the membership of the open market committee and its staff, the size of the deficit, etc.—remained the same. The principal effect of the resolution has been to change the monetary system. The monetary system now in effect in the United States and a few other countries combines pre-announced growth rates of money and fluctuating exchange rates. One of the more important differences from previous systems arises because monetary growth is announced in advance. The paper discusses some principal consequences of the system now in effect in several countries.

In the sections that follow, I, first, compare the information that the market received under the gold standard and the Bretton Woods system to the information available under the present arrangement. A principal advantage of the present system is the reduction of uncertainty about the future price level and exchange rate that follows improved information. The current system has implications also for floating and for the interpretation of floats as 'clean or dirty.'

A principal criticism of pre-announced monetary growth is that the central bank fails to offset real disturbances by increasing or reducing money. I analyze the effect of temporary and permanent real disturbances when money wages are fixed, at least for a time, and compare the response to active central bank policy with a policy of doing nothing. My conclusion suggests some tasks that the central bank can carry out to reduce uncertainty and improve welfare and comments on some current issues.

2. Features of recent monetary standards

Risks arise in nature and can be reduced or increased by social arrangements. Climate and disease are examples of natural hazards. The costs of these hazards can be reduced by pooling and by improvements in technology. The monetary system is a particular type of social arrangement, the one that determines the conditions under which money is produced or withdrawn. The use of money facilitates trade by lowering costs of acquiring information [Brunner-Meltzer (1971)] but introduces opportunities for gain and risks of loss in an individual's real wealth that are distinct from the risks that arise in nature or in other types of social arrangement.

3The general problem posed by the interrelation of social arrangements, information and uncertainty is discussed by Prescott (1977).
The risks in a monetary economy are the consequence of both real and nominal changes or shocks. Both types of shock may be temporary or permanent. The choice of monetary system can reduce or increase information about nominal changes and, in this way, reduce or increase the errors that are made in attempts to distinguish between real and nominal shocks and between temporary and permanent changes. This section compares the information about future prices and exchange rates provided by different types of monetary arrangements. I use a model of an open economy which suffers real and nominal shocks but ignore the effect of fluctuations in output on prices. A later section permits fluctuations in output to change prices and the exchange rate.

The long-run position known as purchasing power parity is a common feature of all monetary economics; \( p \) and \( p^* \) are the price levels at home and in the rest of the world, and \( X \) is the exchange rate expressed as units of domestic money per unit of foreign money,

\[
p = p^*X. \tag{1}
\]

This condition holds whenever anticipations are correct if proper allowance is made for costs of transfer and prices are adjusted for the effects of tariffs, excise taxes and the like. 4

2.1. The gold standard

In a classical fixed exchange rate system, the expected exchange rate of currency for gold was constant. In Britain prior to 1931 the gold value of the pound had been the same for almost two hundred years each time Britain was on the gold standard. Periods of fluctuating exchange rates were followed by a return to fixed rates at the previous exchange rate of pounds for gold. The gold value of the dollar was constant, in the same sense, prior to 1933. If \( p^* \) in eq. (1) is the gold price of output, \( X \) is the exchange rate of dollars for gold. Anyone who wishes to form an expectation of the long-run domestic price level, under a classical gold standard, must forecast \( p^* \).

The long-run price level is not certain, under the gold standard. The principal disturbances result from changes in technology, changes in the demand for gold, changes in habits of payments or intermediation and permanent real shocks. All but the last take effect slowly. The central bank and individuals can use the quantity equation to determine the maintained growth rate of the national money stock that satisfies eq. (1) for given expectations of economic conditions in the rest of the world. Call this growth rate \( \bar{M} \); let \( \bar{y} \) be the anticipated growth

4Departures from purchasing power parity may occur in the short-run as a result of errors in anticipations or incorrect information in a rational world. For a recent test of purchasing power parity see Roll (1977).
rate of output obtained from eq. (2),

\[ y = F(K, L) + \varepsilon. \] (2)

\( K \) and \( L \) are the endowments of capital and labor and \( \varepsilon \) is a random disturbance representing real shocks to output. The equilibrium rate of price change is, then, given by\(^5\)

\[ \bar{\beta} = \bar{M} - \bar{\gamma}. \] (3)

Everyone who believes that the gold standard will be maintained can form an anticipation of the long-run price level or sustained rate of inflation. For constant \( X \), expected \( \bar{\beta} \), \( E(\bar{\beta}) = \bar{\beta}^* \). A special case of (3) is a constant price level, \( \bar{\beta} = 0 \).

Equation (3) is a rule for money growth in the sense of Friedman (1960) or Sargent and Wallace (1975). Anyone can use the rule to forecast the future price level and as a guide to distributing wealth between real and nominal assets. If all bonds are payable in gold, bonds are a claim to a stock of real assets no matter where they are issued. There are no capital gains and losses on such bonds from devaluations and revaluations of currency. If some bonds are payable in gold, while others are not, wealthowners are rewarded for bearing the risk of loss from devaluation.

There is another, less commonly noted, feature of the gold standard: Wealth owners can distinguish between one-time changes in the price level and sustained changes in the rate of inflation. Prices or the rate of inflation fluctuate around an expected value that remains unchanged as long as \( \bar{\beta}^* \) is unchanged. Long-term investors have relatively reliable information with which to separate short-term variability from long-term variability or predictibility of the price level.\(^6\) Unlike the strong form of traditional expectations \([\text{Sargent–Wallace (1975)}]\), there is always an expected price level to anchor the long-run position that the economy is expected to reach.

2.2. Bretton Woods

The dollar standard that emerged under Bretton Woods differed from the classical gold standard in several ways. Exchange rates were not constant, so prediction of the long-term price level required an estimate of the changes in the exchange rate in addition to the estimates of \( \bar{\gamma} \) and \( \bar{M} \). Opportunities for capital gains and risks of capital loss on foreign securities and money made

\(^5\)Obvious adjustments can be made to allow for sustained, anticipated changes in habits of payment or velocity and for fiscal policy.

\(^6\)Klein (1976) distinguishes variability and predictability but uses the terms in a different way.
foreign and domestic assets poorer substitutes in portfolios than under the gold standard. It was more difficult to distinguish one-time changes in money from maintained rates of change. On some occasions the central bank might follow above average money growth with below average money growth. On other occasions, they would devalue. The consequence of the two policies for the long-run price level or rate of inflation are markedly different.

A sudden spurt of money growth could be intended as a one-time change in the money stock but, if maintained too long, excessive growth would be followed by devaluation at home or revaluation abroad. Those who believed that the prevailing rate of change of money overestimated the long-term growth rate of money shifted from real assets to bonds and from foreign assets to domestic assets. Those who interpreted the bulge in money as evidence of a higher maintained future $\hat{M}$ would shift in the opposite direction.

Two of the terms in eq. (1) acquired new definitions under the dollar standard; $p^*$ is the price of a world basket of goods and $X$ is the number of units of domestic currency that exchanges for a basket of foreign currency. The changing weights in the basket reflected differences in rates of growth of money and real income in relevant countries. There was less information about the long-run price level than under the gold standard, and there were more opportunities for wealth owners to gain or lose if they did not correctly separate real and nominal shocks, and permanent and temporary changes. The long-run price level was not indeterminate, however, and expectations about the long-run price level were not completely diffuse. For the United States, the long-run position of budget balance and the associated money stock determined the expected price level. For the rest of the world, domestic policies and the balance of payments provided information about future prices.

2.3. The current system

The decision to announce anticipated rates of monetary growth followed the shift to fluctuating exchange rates and was partly a consequence of the shift. Announcement of the anticipated rate of monetary growth increases information about monetary policy relative to the Bretton Woods system and enables wealth owners to separate more accurately than in the recent past changes in level from changes in the rate of change of money. A large jump in the money stock with the announced rate of change constant must soon be followed by a decline. If it is not, market participants begin to believe that the maintained growth rate has changed. The exchange rate and interest rate adjust.

7This is not a denial of market efficiency. Efficiency is a statement about the use of available information, not a statement about the accuracy of forecasts. Hamburger and Platt (1975) provide evidence that the Treasury bill market is efficient but forecast errors for changes in interest rates are large relative to the changes.
Announcing the growth rate of money is not equivalent to a fixed rule. The base from which the growth rate is computed changes, so the same announced annual rate of change is consistent with very different maintained rate of change. Growth rates are not fixed out to the horizon relevant for long-term investment but change quarterly or annually. Wealthowners have more information about the growth rate of money to use when forming expectations about inflation, appreciation or depreciation of the exchange and when separating one-time changes in level from changes in the maintained rate of change. But, the value of the information would be greatly increased and uncertainty greatly reduced if the anticipated growth of money for the next five years was announced also.

If announced growth rates are achieved, approximately, later announcements are more credible. The more credible is the announcement of planned money growth, the lower is the cost of short-term variability around the growth rate. Real rates of return to saving and investment are not likely to be much affected by random changes in the money stock if the changes are expected to be reversed and the announced growth rate is expected to be maintained. The much discussed variability found in weekly and monthly data on the money stock has lower real consequences if market participants are relatively certain that positive or negative deviations will be offset. Conversely, if the announced growth rates have low credibility, the cost of deviations and corrections rises. If the market misinterprets central bank policy by over- or under-estimating the future rate of inflation, the values of real and nominal assets and decisions to save and invest are affected. Real and nominal changes and permanent and temporary changes are separated less reliably.

Fluctuating exchange rates remove any effect of $p^*$, the foreign rate of price change, on $p$, but the accuracy with which exchange rates reflect differences in anticipated rates of inflation is no better than the market’s ability to distinguish between maintained inflation and one-time adjustment of the price level. The anticipated rate of inflation $E(p)$ depends only on domestic factors, $M$ and $y$ in eq. (3) but current and future price levels depend on $p$ and on real shocks – permanent and temporary – that cause one-time changes in the levels of output and prices but do not affect the maintained, anticipated future rates of change.

3. Clean and dirty floating

Once the growth rate of money is chosen, it matters little whether the growth rate is achieved by purchasing or selling foreign or domestic assets. Many economists who accept this proposition in other contexts fail to do so when discussing floating currencies. Central bank purchases or sales of foreign exchange are taken as evidence of intervention and called ‘dirty’ floating. It is possible to equate central bank intervention and dirty floating but this is less useful than distinguishing the two. This section discusses a basis for the distinction.
In a world without random shocks or real effects on the price level, the expected rate of change of the exchange rate is, from eq. (1),

\[ E(\Delta X) = E(\Delta P) - E(\Delta P^*) \]

If purchases and sales of foreign exchange do not change the expected rates of price change, they cannot change the market's expectation of the future exchange rate required for purchasing power parity. There are, however, differences in the wealth positions of the public and the central banks following intervention in the foreign exchange or domestic securities market. To the extent that differences of this kind affect the price levels of individual countries, they affect exchange rates.

Reliance on purchasing power parity may give the impression that the analysis is useful only for comparing long-run positions. Recognizing responses of interest rates and their relation to changes in exchange rates, however, removes this argument. The interest parity formula relates nominal rates of interest at home and abroad, \( i \) and \( i^* \), to changes in the exchange rate:

\[
\frac{1 + i}{1 + i^*} = \frac{E(\Delta X) - X}{X} - \frac{E(\Delta P) - E(\Delta P^*)}{E(\Delta P*)}.
\]

The expected change in the exchange rate, \( E(\Delta X) - X \), refers to the same term as the maturity of \( i \); so \( E(\Delta X) \) is the forward rate for that period. Substituting from purchasing power parity, we have an anticipation for each maturity such that

\[
\frac{1 + i}{1 + i^*} = E(\Delta P) - E(\Delta P^*).
\]  

Again, the equation holds up to random changes and differences in risk premia. Real changes, e.g. recovery and recession change \( i \) and \( i^* \) and also change the rate of inflation measured over the interval for which the anticipation is formed. Equation (4) implies, therefore, that if central bank operations do not change expectations, they do not change interest rates or exchange rates.

The instantaneous response of \( X \) to a purchase or sale of foreign exchange disturbs interest parity in a different way than does a purchase or sale of domestic assets, but the formula implies, and evidence suggests [Frenkel–Levich (1975)], that the instantaneous response is reversed quickly. The importance of central bank operations for interest rates and exchange rates, small differences in wealth effects aside, lies not in what the central bank purchases or sells but in how much it increases or reduces the rate of change of money relative to

\*Frenkel and Levich (1975) show that forward rates of exchange respond rapidly to new information and changes in anticipations.
expectations. As an example, suppose the home country central bank provides all of the expected growth of money by purchasing foreign exchange. Holders of foreign assets find that the covered spread has shifted in favor of home country securities, so they sell foreign securities, purchase home currency and use the currency to purchase domestic securities. The net effect, shown in eq. (4), is to leave interest rates and exchange rates in approximately the position they would have reached if the central bank had restricted purchases to domestic assets.

Evidence of intervention becomes available when the central bank depreciates the currency relative to expectations and, at the same time, exceeds the announced rate of money growth. A ‘dirty’ float occurs in this case even if the central bank purchases domestic assets. There is evidence of dirty floating also, if the exchange rate appreciates and the rate of money growth is less than announced. By reaching announced monetary growth rates, the central bank provides evidence of clean floating. Exchange rates may be above or below the values anticipated on some earlier date. Market efficiency does not imply clairvoyance. Unanticipated changes and errors can cause the actual rate to differ from the anticipated rate.

The same principles apply when future money growth is not announced. Observation of ‘dirty’ floating is considerably more difficult, however. A central bank can increase the rate of purchase of domestic assets relative to (unobserved) market expectations of money growth and attribute the depreciation of the exchange rate based on expectations of higher inflation to unexpected changes in the trade or capital account or to developments in the rest of the world. Central bankers have been known to use arguments of this kind. Announcing – and achieving – proposed money growth rates reduces opportunities for competitive devaluation and claims about dirty floating.

4. Responding to real shocks

The principal argument against announcing and maintaining a growth rate of money is that monetary policy can be used to offset unforeseen real shocks. My discussion of current monetary arrangements concentrated on nominal disturbances and neglected real disturbances. Some economists would offset part of the gain from reducing uncertainty, and probably more, against the loss of opportunity to use monetary policy as a counter-cyclical tool to offset real disturbances. Usually such discussion takes for granted that the central bank knows the size and duration of the shock and knows the proper action to offset its effects. The more relevant case for policy is one in which the central bank is uncertain about the size, duration and effects of the shock.

This section analyzes separately the response to temporary and permanent real shocks based on a quantity theory developed by Brunner (1976). The economy is open. Spending on home country nominal output, $py$, consists of
domestic purchases $aMV$ and exports $(1-a^*)M^*V^*X$. $V$ and $V^*$ are constants, for the present, and for simplicity let $V = V^*$. Spending depends on $M, M^*$ and $X$ and on the parameters $a$ and $a^*$ that describe the distribution of spending between home production and imports. The parameters $a$ and $a^*$ depend on the ratio $q = p/p^*X$.

$$aMV + (1-a^*)M^*VX = py; \quad a_q < 0, \quad a^*_q > 0.$$ (5)

The balance of trade of the home country is balanced when home country exports equal home country imports. There are no capital movements. With fixed exchange rates, the balance of trade determines the movement of international reserves ($R$) between countries; with fluctuating exchange rates, the trade balance determines currency depreciation or appreciation, changes in $X$. With fluctuating exchange rates, the change in $X$ keeps $dR/dt = 0$. Of course both $R$ and $X$ can change when there is dirty floating or with clean floating and announced monetary targets achieved by purchase or sale of foreign exchange.

$$ (1-a)MV - (1-a^*)M^*VX = \frac{dR}{dt}. \quad (6)$$

Money wages are written into long-term contracts that incorporate expectations about inflation and productivity growth. There are no auction markets for labor, so once wages are set they remain fixed until contracts change. Let the money wage be $w$ and the demand for labor be $L(w/p)$. Current output deviates from full employment output ($y_0$) whenever the price level changes. Equation (2), above, determines long-run expected output. Current output is given by (2'). Permanent shocks change $F$ and the level of full employment output, $y_o$:

$$ y = F\left[ K, L\left(\frac{w}{p}\right) \right] + \epsilon, \quad L' < 0.$$

(2')

Temporary real shocks cause output to fluctuate around $y_0$; these shocks are normally distributed with mean zero and constant variance.

The stock of money consists of domestic earning assets ($D$) and international reserves ($R$),

$$ M = D + R.$$

(7)

*The effect of introducing changes in the demand for money and changes on capital account is discussed below.
The central bank uses eq. (3) above to determine the growth rate of money. Assume that expected full employment output is constant and the expected rate of inflation is zero, so announced money growth is zero.\(^\text{10}\) With fixed exchange rates \(D\) and \(R\) change in opposite directions; with fluctuating exchange rates \(D\) and \(R\) are constant.

Constant \(M\) and \(V\) do not eliminate all nominal shocks. Changes in \(M^*\) change spending. Producers and consumers who wish to forecast prices and output must separate the effects of changes in supply from changes in spending and distinguish between permanent and temporary changes. If the demand for money is permitted to change, permanently or temporarily, the complexity of the problem increases. Changes in the demand for money add to the shocks that affect spending as well as output.\(^\text{11}\)

Equations (1), (2'), (5) (6) and (7) determine \(p\), \(X\), \(y\), \(M\) and \(dR/dt\) under the restrictions discussed above. The equilibrium position of the system is described by two equations. Trade and payments equilibrium is given by eq. (6) with \(dR/dt = 0\). The money and output market equilibrium is given by eq. (5) with \(y = y_0\) in the long-run and by eqs. (2') and (5) in the short-run.

4.1. Temporary real shocks

A temporary real shock changes \(y\) relative to \(y_0\) but does not change \(y_0\). The timing or direction of the shock is not known in advance, and the duration of the loss or gain in output is uncertain. Some weather and climate changes are examples of temporary real shocks. The disappearance and reappearance of anchovies from Peru, so often discussed in 1974, is another example. Disturbances of this kind occur frequently.

What can a central bank, operating in a system of fluctuating exchange rates and announced monetary growth rates, do when faced with a temporary real shock and rigid money wages? Should the central bank change monetary growth to offset the shock? Figure 1 helps to answer these questions.

Initially, the world economy is in equilibrium. For the home country, \(y = y_0\), and \(p = p_0 = p^*_0 X\). The market for home country output is shown on the left of fig. 1; \(d_0\) is aggregate expenditure; \(s_0\) is aggregate supply, and \(y_0\) is full employment output. The position of \(d_0\) depends on \(M\), \(M^*\), \(X\) and \(p^*\) and also on the common constant (world) velocity. The positions of \(s_0\) and \(y_0\) depend on \(K\) and \(L\). The position of \(s_0\) depends also on the fixed money wage rate and on \(e\).

\(^\text{10}\)These assumptions are convenient. The principal conclusions do not depend on the choice of constant prices and output. Fiscal policy can be incorporated by defining \(y\) as private product and adding \(g\) as in Brunner (1976).

\(^\text{11}\)Additional uncertainty would be added if fiscal policy and borrowing and lending (or the capital account) is permitted to change \(R\), \(M^*\), \(MX\) or the rate of interest.
The information summarized by \( d_0 \) and \( s_0 \) is shown again by \( a_0 \) in the right panel. The slope of \( a_0 \) is obtained from the output market equation—eq. (5) after substituting eq. (2')—holding money wages fixed and permitting current output to change as prices change. Since output changes with the price level, \( p^* \) (or \( X \)) does not change as much to restore output market equilibrium with fixed as with flexible wages; rigid wages make \( a_0 \) steeper.

The balance of trade equilibrium is shown as \( b_0 \), obtained from eq. (6). The slope is unity. The position of \( b_0 \) depends on \( M, M^*, V \) and \( X \). At points above (to the left of) \( b_0 \), the balance of trade is in deficit; to the right of \( b_0 \), the home country has a surplus.

A negative real shock is shown as a shift from \( s_0 \) to \( s_1 \). Output falls to \( y_1 \), and prices rise to \( p_1 \). The fall in output shifts the equilibrium position in the right panel as shown by the movement from \( a_0 \) to \( a_1 \). With \( p^* \) and \( X \) constant, \( p_1 \) exceeds \( p^*_0 X \); exports fall and imports rise. The balance of trade is in deficit, as shown on the right panel where the deficit is proportional to the distance between \( a_0 \) and \( a_1 \) at \( p^* = p^*_0 \). Output market disequilibrium is shown on the left by the distance \( y_0 - y_1 \). If the central bank does nothing, home currency depreciates \( (dX > 0) \). Depreciation increases spending on home country output and balances the trade balance; these effects are shown by the shift from \( d_0 \) to \( d_1 \) on the left of fig. 1, and the shift from \( b_0 \) to \( b_1 \) and from \( a_1 \) to \( a_2 \) on the right. Home prices rise proportionally more than the currency depreciates to balance the trade account. (See appendix.) Foreign prices fall to \( p^*_1 \).\(^{12}\)

By accepting a lower price level, foreigners absorb part of the real shock to home country output. The real value of foreigners' financial wealth increases, since \( M^* \) is unchanged, but if money wages remain unchanged also, employment and output fall abroad. Foreign governments may choose to maintain employment, and can do so by increasing \( D^* \) and \( M^* \). The rise in \( M^* \) raises \( p^* \) toward \( p^*_0 \), and, if \( M^* \) is correctly chosen, \( p^*_0 \) and foreign employment are restored.

The increase in \( p^* \) lowers \( X \); the home country exchange appreciates by less than the depreciation following the real shock. The balance of trade position moves from \( b_1 \) to \( b_2 \), and spending on home country output declines. The new position of short-run equilibrium is shown in fig. 1 at the intersection of \( b_2 \) and \( a_3 \) in the right panel and at the intersection of \( s_1 \) and \( d_2 \) on the left. The home country price level falls from \( p_1 \) to \( p_3 \), so real wages rise and real output falls. The amount by which home country money wages must be reduced to restore output to \( y_0 \) is now larger than before.

With a fixed growth rate of money and no adjustment in the level of money balances, there are no values of \( p \) and \( X \) that balance the trade balance and

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\(^{12}\)If the home country is the usual small open economy, \( p^* \) is not much affected by the change in \( p \) and \( X \). In the more general case applicable to the United States and the currencies linked to the mark, some effects on price levels seem likely.
restore home country output and employment to the former position of full employment shown as \( y_0 \). Formally, the problem is that the model does not have a consistent solution at \( y_0 \) following the real shock if \( M \) is held constant. The five equations—two demand and two supply equations and the balance of trade position—determine equilibrium values for \( p, y, p^*, y^* \) and \( X \) for given values of \( M \) and \( M^* \). With \( M^*, p^* \) and \( y^* \) fixed by decisions in the rest of the world and \( M \) fixed by the policy of maintaining announced money growth, the system will not generally find values of \( p \) and \( X \) that maintain the trade balance and full employment. Either output is less than \( y_0 \) or the balance of trade has a surplus or deficit.

Restoring equilibrium following a real shock requires the central bank to allow the money stock to deviate from the announced target level but does not require a change in the maintained rate of growth. The change in money stock adjusts real wages, by changing the price level, and adjusts the trade balance by changing \( X \). The change in \( M \) permits the system to reach a consistent solution at \( p^* = p^*_0 \). But home country output does not return to \( y_0 \), if foreigners maintain \( p^*_0 \), until money wages fall sufficiently to restore the former level of employment. Or, as seems more likely for current policy, the central bank can change the money stock to restore \( y_0 \) and allow the balance of trade to remain in deficit or surplus. There is, then, borrowing or lending at the exchange rate determined by the market and the stated employment policies of the countries. Once the temporary shock passes, the changes in \( M \) and \( M^* \) must be reversed. It is not difficult to see that adjustment to changes of short but uncertain duration often increase variability of output, employment and prices.

By holding interest rates and velocity constant and neglecting capital movements and foreign lending, I have perhaps overemphasized the role of government policy. The assumption that home prices are higher, temporarily, and interest rates are unchanged denies that the term structure of interest rates reflects the temporary increase in desired borrowing or lending by the home country. If market rates of interest and velocity change, private decisions move spending and the balance of payments deficit or surplus toward equilibrium even if the announced growth rate of money is maintained and there is no adjustment of the money stock. Private borrowing and lending enable the home country to run a deficit or surplus in the trade balance as is appropriate. A central bank that controls short-term rates of interest reduces the adjustment of velocity and distorts borrowing and lending.\(^{13}\)

The difference between central bank policy and private action does not arise from differences in information about the size and timing of the proper response. Neither the market nor the central bank has complete information about the parameters that determine the size of the appropriate adjustment to the shock

\(^{13}\)If velocity depends negatively (or positively) on \( y - y_0 \) (transitory income), velocity changes for this reason also.
or the length of time before the shock passes. Central bank action increases uncertainty, however, by adding a nominal disturbance to the real disturbance or to the combined effects of a real disturbance and a monetary disturbance abroad. The public must now devote resources to estimating how central bank policy has changed and the consequences of the changes for the long-run price level and the current allocation of wealth. A policy of distinguishing one-time adjustments of money from the maintained growth rate provides useful information. Statements about the desired rate of growth should be supplemented by statements about the desired level to be reached on average in a particular month or quarter if the growth rate of money varies.

There is another, more fundamental distinction between private and central bank responses. Private action will not attempt to restore \( y_0 \) following a real shock. Real wages are lower, following a real shock, so workers' desired distribution between labor and leisure changes. Since the shock is temporary, anticipated lifetime income is changed little. Some workers will choose voluntarily to work fewer hours at lower wages and more hours at the higher wages expected to follow some future, positive, temporary real shock. I see no reason why central bank policy should seek to raise prices and lower real wages to restore \( y_0 \).

A central bank faced with uncertainties about the position of equilibrium can allow interest rates and exchange rates to adjust and allow borrowing or lending to proceed without changing money growth. A policy of this kind reduces the costs of separating the effects of nominal and real disturbances and errors in estimating the duration of the temporary shock. This argument does not presuppose, as in strong versions of rational expectations, that the market can find a new general equilibrium without substantial search and much haggling and jiggling. Just as doubtful, however, is the ability of the central bank to provide the correct change in money to reach the changed full employment equilibrium.  

4.2. Permanent real shocks

A permanent real shock permanently changes \( y_0 \) and \( y \). The analysis, at first, is similar to the analysis of a temporary shock shown on the right side of fig. 1. Prices rise; the currency depreciates; and real wages must fall following the reduction in \( y_0 \). How the adjustment proceeds thereafter depends on whether the shock has reduced the stocks of capital and labor proportionally or to different degree and on the responses abroad.

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14The analysis has some relevance for the current position of the United States. Foreign countries choose monetary targets to achieve domestic goals. The real shock from the OPEC price increase lowered output and raised the price level. Failure to allow the market price of energy to adjust delays adjustment of output, spending and the trade balance.
A principal difference between temporary and permanent shocks is that permanent real shocks reduce current and expected income. Workers must distribute their share of the permanent loss of real income between wages and hours of work. The equilibrium that is reached, and the price level that clears the output and labor market depend on that choice. What seems certain is that employment will fall. How much it will fall is much less certain in the present state of empirical knowledge about labor leisure choice.

Economic disturbances do not come in neat packages labelled permanent and temporary. The oil price increase was viewed initially as a temporary gambit by some, a long-term reduction in domestic income by others. It takes time to accumulate information about what is short-lived and what is long-lasting.

An appropriate, initial response to a sustained real shock is to allow the market to determine the size and direction of adjustment to a new equilibrium. Fluctuating rates and maintained monetary growth rates permit the adjustment to begin. Adjustment of output to a new, sustained level of production and adjustment of the balance of trade to a position of surplus or deficit increase information about the proper adjustment of the level of money balances. A surplus or deficit in the balance of trade suggests whether the proper direction for further adjustment is to increase or reduce money.

5. Conclusion: The role of the central bank

Discussion of economic policy often treats information as complete or treats expectations as certain. Policies are assigned specific tasks that depend on the type of monetary system but depend also on the ability of policymakers to know equilibrium values of output, prices, and interest rates.

Monetary policy can increase or reduce the costs of acquiring accurate information about future values. Monetary policy is neither alone in this respect, nor unique. Many social institutions, particularly government institutions, can increase or reduce uncertainty by the choice of rules and the frequency with which decisions and rules change future values. But, monetary policy can reduce or increase the cost of distinguishing one-time changes in the price level from changes in the rate of inflation. The degree to which the costs are reduced depends on the choice of monetary system and adherence to the principles or practices required to maintain the system.

Resolution 133 calls on the Federal Reserve to use the growth of money as an indicator of monetary policy. The announcement of the growth rate reduces the cost of estimating the future rate of inflation, market rate of interest and exchange rate. Spurts or shortfalls in money are less likely to be misinterpreted as changes in the rate of monetary expansion, so they have less effect on decisions to invest in long-term assets or to consume. By reducing uncertainty about the
long-run price level and rate of inflation, pre-announced growth rates of money reduce social costs.

Monetary policy cannot eliminate fluctuations in prices, output or exchange rates by maintaining money growth at the announced rate. The rate of monetary growth that is selected matters for inflation and exchange rates. And prices, output and exchange rates are affected by real shocks. To achieve announced money growth rates, the central bank must give up efforts to offset the effects of temporary real shocks.

The paper uses a relatively simple model to analyze the response to temporary and permanent real shocks in an economy with fluctuating exchange rates and an announced growth rate of money. Money wages are rigid in most of the analysis, so real and monetary shocks have real effects. At issue for economic policy is not whether such effects occur but whether the benefit from offsetting real shocks more than compensates for the increased uncertainty about the future price level that arises once responses to real and nominal changes are intertwined. Moreover, to reduce the cost of temporary real disturbances, the central bank must know more than the public about the size and duration of real shocks and about the factors determining the responses of prices, output and exchange rates.15 The problem is not, as in some discussions, that the public can anticipate exactly what the central bank will do. Rather, the problem is that neither the public nor the central bank can be confident that variable monetary policy can reduce the co-mingled real effects of temporary and permanent, real and nominal disturbances with sufficient accuracy to reduce variability. This argument remains as valid now as when first presented by Friedman (1953).

By announcing money growth rates, central banks help to separate clean and dirty floating. The market adjusts the exchange rate for the rate of inflation expected to follow from the rate of money growth. If money growth exceeds the announced rate of growth, and the currency depreciates, there is evidence of a 'dirty' float. The movement of the exchange rate depends on the deviation from announced money growth, so a central bank can depreciate the currency by selling foreign assets and purchasing sufficient domestic assets to exceed announced money growth.

A system of fluctuating exchange rates and announced monetary growth rates does not reduce the desirability of having a central bank. The sustained long-term real growth rate changes from time-to-time with changes in technology, population and capital stock, so the appropriate growth rate of money changes. Long-lasting effects of permanent real shocks can at times be removed, or reduced, by changing the level of the money stock while keeping the maintained growth rate constant. To distinguish levels and rates of change, the central bank should announce both the growth rates and the expected level to be reached in

15 A more complex model with interest rates, velocity, lending and borrowing would increase the amount of information required for a correct decision and add to the difficulty of separating real and nominal changes and temporary and permanent changes.
the future, preferably for periods far enough in advance to be relevant for investment in long-term capital.

All disturbances cannot be predicted, so their effects on future price levels cannot be eliminated. But central banks can reduce the cost of disturbances by removing impediments to efficient adjustment and by maintaining policies that lower the cost of separating real and nominal shocks and temporary and longer-term changes. Attempts to regulate money growth by purchasing and selling securities at a fixed, but adjustable, interest rate increase the variability of money and uncertainty about the intentions of the central bank. The benefit of announcing monetary growth rates is reduced by failure to use more effective procedures for implementing policy than the procedures that have, so often, misled the Federal Reserve, market participants and the public.\footnote{Recent failures to achieve money growth rates suggest that the old pattern has not been broken. Money growth rises faster in periods of expansion and more slowly in contractions.}

The move to floating exchange rates and announced monetary growth was a step toward increased efficiency in the use of resources. By improving procedures for controlling money, the Federal Reserve can make the announced growth rates more credible. By announcing expected rates of monetary growth for periods longer than a year the Federal Reserve can provide the principal benefits of a monetary rule: greater predictability of the future price levels, and separation of real and nominal disturbances without surrendering the option to respond to sustained real shocks or to adjust the growth rate of money when the growth rates of capital stock, labor force or technology undergo sustained changes.

Appendix

I use relative rates of change to approximate adjustments in level.

Let $\varepsilon(u, v)$ denote the elasticity of $u$ with respect to $v$.

The movement from $a_1$ to $a_2$ in fig. 1 combines the response to two changes, the change in $y$ and the change in $X$. Differentiating eq. (5), after recognizing that $y = y(p)$ from eq. (2'), and combining the changes gives for the output market ($OM$):

$$\frac{dp}{p/OM} = \frac{\varepsilon(\alpha, q) \frac{\alpha M V}{py} - \varepsilon(\alpha, q) \frac{\alpha M^* X V}{py} - (1 - \alpha^*) \frac{M^* V X}{py} \frac{dX}{X}}{\text{denOM}} + \frac{1}{\text{denOM}} \frac{dy}{y}.$$
real shock:

\[ \text{denOM} = \epsilon(a, q) \frac{\alpha MV}{py} - \epsilon(a^*, q) \frac{\alpha^* M^* XV}{py} - 1 - \epsilon(y, p) < 0. \]

Both elasticities are less than unity in absolute value; the sum depends on several factors including the size of the shock \( dy/y \) and the currency depreciation \( dX/X \). (With a permanent real shock, \( \epsilon(y, p) \) does not appear in the denominator.)

The effect of currency depreciation on the balance of payments equilibrium in fig. 1 is

\[ \frac{dp}{p/BOP} = \left[ 1 - \frac{1}{\epsilon(a, q) \frac{\alpha}{1 - \alpha} - \epsilon(a^*, q) \frac{\alpha^*}{1 - \alpha^*}} \right] \frac{dX}{X}. \]

The elasticity in brackets is greater than unity.

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