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New Perspectives on Stabilization Policies

The spirit of Friedrich Hayek walks through these pages, explicitly in the quotation leading off the first article and implicitly in the approach followed by the authors of all three articles. The Nobel laureate spent his career expounding the efficacy of the classical adjustment process and the need for moderation in government-policy decisions. He would never have thought of himself as a revolutionary, but many of his intellectual descendants are now participating in a revolution which is just as impressive as the Keynesian Revolution of the 1930's. For example, Keynes in his research assumed a closed economy, but important differences are now seen to arise when we deal with an open economy. Again, Keynes assumed away the classical adjustment process, but that approach is now coming back in the guise of rational-expectations. Here then are some new perspectives based on the new theories, new facts and new tools of the 1970's.

Michael Keran and Michael Riordan test some of the new facts in the light of new theories, in the process of pointing out the dangers to the U.S. economy of expansive stabilization policies pursued in the rest of the world. They argue that expansionary policies abroad were a major cause of the 1973-74 acceleration in U.S. inflation—and that another shift toward expansion in 1975-76 could set the stage for some reacceleration of domestic inflation in 1977.

Keran and Riordan show that the world money stock—a summary measure of world stabilization policies—is an important factor in explaining price fluctuations of internationally traded goods. A simultaneous expansion of industrial countries' aggregate demand, resulting in synchronized monetary expansion, can lead to a more-than-proportional increase in world prices. And this price rise can significantly affect the domestic rate of inflation, even though it has less influence in this regard than domestic monetary policy. The analysis suggests an important policy implication: any single country can follow domestic stabilization policies to offset the effects of imported inflation, but the result could be disastrous if all countries followed such a policy simultaneously.

In earlier decades, industrial countries largely conducted their stabilization policies in isolation from each other; typically, when one was in an easy-money phase, others were in a tight-money phase, and vice versa. But the early 1970's were different, as most countries followed either tight-money or easy-money policies in a uniform pattern. World money growth accelerated in 1970-73 as the old system of fixed exchange rates broke down. As foreign central banks monetized the dollar inflows caused by large U.S. balance-of-payments deficits, they expanded their holdings of international reserves and their domestic money supplies. Then, with the abandonment of the fixed exchange rate regime in early 1973, they began to regain control of their domestic money supplies and money growth decelerated. These sharp fluctuations in world money were accompanied (with about a two-year lag) by an instability in prices of internationally traded goods.

In the model developed by Keran and Riordan, a 12-percent growth rate of the world money stock in 1975-76 suggests a reacceleration of world inflation in 1977. For the U.S., this could mean more inflation, depending on the size of the increase in prices of internationally traded goods and on the share of such goods in the domestic price index. The result could be a 7- to 8-percent rise in U.S. wholesale prices next year, compared to the 4-percent increase in the first nine months of 1976.

In a second article, Kurt Dew analyzes a recent theoretical controversy in stabilization policy, in contrasting the different policy approaches that go under the names of "optimal control" and "rational expectations." Advocates of optimal control tend to be activists, while those utilizing rational expectations tend to believe in the greater efficacy of passive policies. Optimal-control theorists suggest that policy-makers could improve upon passive policies through the utilization of econometric models as well as mathematically-derived rules for policy adjustment. Rational-expectations theorists, in contrast, tend to question the basic assumptions of the optimal-control approach, arguing that households and firms do not form their expectations of future events in the way that most economists think they do. Indeed, if households and firms form expectations in a "rational" way— using all instead of just a part of the available evidence—policy-makers have little if any latitude to exert a beneficial impact on economic welfare.

Dew asks: "Can the policy responses that are generated by optimal-control rules overcome the uncertainties regarding future economic behavior that are created by rational expectations?" As an example, he discusses the aggregate consumption decision, showing how the outcome of a particular policy can be adversely affected through a misinterpretation of the means by which the consumer forms his expectations. He analyzes the effects of a given increase in government expenditures upon consumption, assuming first that the policy-maker believes that consumers form expectations adaptively—the standard method in most models of the economy—and then contrasts the expected policy outcome with the actual outcome when expectations are rational.

The author notes that the rational consumer is concerned about future income, not past income, so that past policies only matter to him if they affect future income. The fiscal stimulus of an increase in government expenditures would be greater at the beginning of the spending program and would thereafter decline. The opposite would be true for a policy-maker using an adaptive-expectations forecast, who would be increasingly disappointed throughout the period when the government-spending program was in effect.

In a third article, Rose McElhattan conducts an incomes policy experiment on the U.S. economy—specifically, a government wage-restraint policy designed to improve the tradeoff between unemployment and inflation, apart from the traditional instruments of stabilization policy. She analyzes this new tool not in the spirit of advocacy, but rather in a pragmatic attempt to define its structure and to demonstrate the sensitivity of model results to different assumptions. The policy tested is one which sets the average increase in wages equal to the 3-percent trend rate of growth in labor productivity. Its economic impact is estimated through simulations of the U.S. economy over the 1967-70 period.

The simulation results suggest that a program which controls wage-rate increases can temporarily control the rate of increase in domestic nonfarm prices. But although the program might limit inflation, real-income growth during the control period might be insufficient to maintain employment at desired levels. Additionally, it should be emphasized that the simulation results are dependent upon the behavioral structure of the MPS model as well as the assumptions underlying the analysis.

McElhattan notes four important caveats needed to round out the analysis. First, under equally feasible alternative assumptions to those chosen, the impact of wage controls upon output and employment can differ considerably. Second, the monetary growth rate assumed in the analysis is too high to support for very long the low rate of inflation implied by the wage-growth assumption. Third, implementation of an incomes-policy can distort the pricing mechanism, because in trying to achieve a desired growth in the average growth rate, policy-makers would be forced to exert some control over wages in individual sectors or industries. Finally, policy implementation similarly can distort the distribution of income between capital and labor, thus destroying the program's political acceptability.

Stabilization Policy in World Context

Michael Keran and Michael Riordan*

"Whatever our views about desirable behavior . . . they can never legitimately be applied to the situation of a single country which is part of an international economic system, and any attempt to do so is likely in the long-run and for the world as a whole to be an additional source of instability."

F. A. Hayek, 1937.

One of the more painful lessons that economists, businessmen and policymakers learned in the first half of the 1970's was that their domestic economic environment is influenced not only by stabilization policy at home, but also by developments in other countries. Inflation in the U.S. in the 1973-74 period was higher because inflation was a worldwide phenomenon. The recession in 1974-75 was more serious because it was a worldwide phenomenon. In short, the synchronous development of inflation and recession has made the U.S. economy more unstable than it was in the 1950's and 1960's.

The purpose of this article is to explain how stabilization policies in the rest of the world could impact on the U.S. economy to frustrate domestic stabilization goals. According to one interpretation, "supply shocks" associated with the oil price rise, agricultural shortfalls, and other natural calamities have contributed to the inflation, but this is only a partial explanation. Rather, expansionary stabilization policies in the rest of the world were a major source of the acceleration in U.S. inflation in 1973-74, and expansionary policies abroad in the last year and a half could set the stage for some reacceleration of U.S. inflation in 1977.[1]

In Section I, we develop a simple model which provides a consistent explanation of how expansionary stabilization policies in the rest of the world can lead to higher domestic inflation and lower domestic real output growth than would be warranted by domestic policy alone. In Section II, we present empirical evidence in support of this model. In Section III, we evaluate the potential impact of recent world and domestic monetary policies on U.S. inflation in 1977 and beyond, and in a concluding section consider the implications of this analysis for making national stabilization policies in a world environment. A technical appendix provides a mathematical exposition of the model and its application to the U.K. and Germany.

The term "stabilization policy" refers here to traditional monetary and fiscal policy tools of aggregate demand management. In both the theoretical and empirical sections of this article, monetary policy will be given the primary consideration. This focus does not imply that fiscal policy is an inferior policy tool. However, over the historical period considered here, monetary policy has shown the greater variance and hence its impact on aggregate demand is more amenable to empirical testing.

*Keran is Vice President and Director of Research, and Riordan is Research Assistant, Federal Reserve Bank of San Francisco. The authors wish to thank David Condon for his research assistance.

I. The Basic Model

We can model the impact of world and domestic stabilization policies on short-run domestic equilibrium by drawing together elements of a monetary analysis of world inflation and a Keynesian analysis of national-income determination. Specifically, the model is based on the following relationships:

1. Domestic nominal aggregate demand is determined by domestic monetary and fiscal policy according to the standard Keynesian LM/IS analysis. Given constant stocks of capital and labor, and a constant level of technology, real aggregate supply is determined by the price level and the nominal wage rate. Internal balance is achieved when aggregate demand is equal to aggregate supply. Abstracting from capital flows, external balance is defined as the equality of exports and imports. Thus the equilibrium conditions for internal and external balance are identical.

2. Each country faces an elastic world demand for the internationally traded goods it produces, with the price level determined by the aggregate of world monetary policies.[2] We assume that no single country has a significant impact on the world demand for internationally traded goods. Furthermore, each country is assumed to have effective control over its domestic money stock, both under fixed and flexible exchange rates.[3]

3. By the "law of one price," the domestic price of internationally traded goods is jointly determined by world prices in foreign currency and the exchange rate between domestic and foreign currencies.

4. Money wages are rigid downwards but adjust upwards with a rise in the domestic price level. Hence, if exchange rates are "sticky" in the short run, for reasons to be explored below, world price inflation will be translated into domestic price inflation and then into domestic wage inflation.

According to this model, if a number of major countries uniformly follow expansionary monetary polices, the result will be increased demand for internationally traded goods, and a rise in the world price of traded goods. In the absence of exchange - rate adjustment, traded - goods prices will rise even in the country which has not participated in the expansionary policy.

Why, under flexible exchange rates, doesn't exchange-rate appreciation offset the world price rise? The simplest explanation is that world inflation will increase import and export prices proportionately, and hence will have no initial substitution (terms of trade) effect.[4] With no substitution effect, only the income effect will operate on the exchange rate. The higher domestic price level will reduce the real money stock, inducing a decline in real aggregate demand for goods, including imports. The exchange rate will appreciate in response to the resulting trade surplus. Only at this point will the movement in the exchange rate operate to offset the impact of the rise in world prices on domestic prices. While this income effect is powerful, most studies suggest that it requires a year or more to unfold. In addition, it operates only after the higher world price is passed through to higher domestic prices.

If nothing else happened, the unusual rise in domestic prices would be temporary. A trade surplus would eventually emerge, and the exchange rate would appreciate to reduce the domestic relative price of traded goods to non-traded goods. However, this result will not occur if there is an induced increase in money wages during the period when domestic prices are higher. Higher money wages will shift the aggregate supply curve upward, in the sense that for each level of output, the unit cost of production or supply price will be higher. The resulting equilibrium of aggregate demand and supply will be at a lower level of real output and a higher level of prices than would be expected from domestic monetary policy alone. In this case the relative price of traded and non-traded goods is reestablished by a rise in non-traded goods prices.

Thus expansionary policies in the rest of the world[5] can lead to both a higher inflation rate and a higher unemployment rate in the U.S. than would have otherwise occurred. By the same token, when other countries stop following expansionary policies, the U.S. inflation rate will decline to a level consistent with strictly domestic demand and supply considerations. The deceleration of traded-goods prices will reduce domestic inflation. Then, with a given aggregate demand, real income will rise, leading to an increase in real demand for output and a decline in unemployment.

This explanation of the interaction between world and domestic stabilization policies helps to reconcile a number of apparently conflicting explanations of the current inflation. It provides a method to link the traditional aggregate-demand analysis with both world-monetary and cost-push explanations of inflation, along the following lines.

(1) Domestic monetary and fiscal policies explain shifts in nominal aggregate demand if there is a stable relationship between nominal monetary and fiscal policies and nominal income. However, the split between prices and output cannot be explained by aggregate-demand analysis alone, but must also take into account the shifts in aggregate supply.

(2) The rest of the world's monetary policies can explain the process whereby inflation in internationally traded goods directly (if temporarily) adds to domestic inflation, and thus can explain how the Phillips curve, which relates inflation to output (or unemployment), can break down under certain circumstances.

(3) The response of domestic wages to domestic inflationary pressures (which can be viewed as a cost-push element) determines the extent to which world inflation is permanently or only temporarily translated into domestic inflation.

Four empirical propositions underlie this analysis.

1. The aggregate of stabilization (largely monetary) policies of the major industrial countries determines the prices of internationally traded goods.
2. The domestic price index (which is a weighted average of traded and non-traded goods prices) responds to both domestic and world monetary-policy actions.
3. The permanency of the impact of world prices on domestic prices depends upon the wage response to increases in domestic prices.
4. Domestic monetary and fiscal policies determine domestic aggregate demand but not the split between prices and output.

We shall now proceed to investigate the validity of each of these propositions.

II. Testing the Model

Standard regression techniques were used to estimate the functional relationships implied by the propositions developed in Section I. The source for all raw data, except where otherwise noted, was *International Financial Statistics* published by the International Monetary Fund. The data covered the period 1960.2 through 1975.3, which included a period of fixed exchange rates until 1973.1 and largely floating rates thereafter.

All equations were estimated in quarterly percentage-change format. This should be kept in mind in evaluating the quality of the statistical results. With this type of computation, the percent of explained variance (R^2) will be in the 40-to-80 percent range rather than the 90-to-99 percent range common to equations estimated in level form. By using change rather than level data, we omit the variance to be explained by trend (thus reducing R^2), leaving only the cyclical and random component. Actually the random component is magnified, because the change data add the random element in the two adjacent level observations. As the equation is not expected to explain random movement, this further reduces the R^2. The superior measure of "good fit" in this case is the standard error (SE) which has the same meaning in both level and change form.

World Inflation and World Money

Our key hypothesis states that the price level of internationally traded goods is a positive function of the nominal world money supply, which serves as a summary measure of the world's monetary stabilization policies. To test our hypothesis, we regress percentage changes in world prices on percentage changes in nominal world money.

The world price level is defined empirically to be the index of export prices of industrial countries expressed in U.S. dollars. There are several reasons for this definition. Since industrial countries predominate in world trade, they collectively determine the price level of internationally traded goods and therefore the world inflation rate. Secondly, data for industrial countries are the most complete and most reliable data available. Finally, a definition in terms of U.S. dollars removes the need to introduce the exchange rate explicitly into the empirical analysis, although the measure of world prices will obviously be influenced by exchange-rate movements.

The world money supply is defined to be the weighted average of the money supplies of ten major industrial countries. The money supply of each individual country is defined in terms of M_1, currency in circulation plus demand deposits. To convert different M_1 values into a common denominator, quarter-to-quarter rates of change are computed and a weighted sum of the changes calculated for each quarter. The weights represent each country's proportionate share in 1975 of the total trade of industrial countries.[6] These weights are adopted because, in view of the distinction between traded and non-traded goods, the impact of domestic demand-management policies on world prices will depend on the extent to which the country engages in trade.

A second-degree polynominal distributed-lag equation was estimated, linking quarterly percentage changes of world prices with quarterly percentage changes of world money supply. World money supply was lagged over 12 quarters. The results are summarized below (t-statistics in parenthesis).

$$\Delta \text{ Log } Pw_t = -\underset{(3.9)}{27.1} + \sum^{12} \underset{(5.1)}{3.59} \, \Delta \text{ Log } Mw_{t-12}$$

R^2/SE	DW/DF
.40/9.49	1.53/48

Δ Log Pw = Percent change in international traded goods prices, measured by export prices of industrial countries.

Δ Log Mw = Percent change in world money supply, measured by weighted average percent change of M_1 in 10 industrial countries.

The Durbin-Watson statistic indicates the presence of serial correlation, which suggests that an important explanatory variable may have been omitted from the estimation. We hypothesized that world prices would depend positively on nominal world money supply and negatively on real world income or output, but we do not have a suitable proxy for the latter variable.

In view of the unusually large quarterly variation in our measure of international prices, the predicted value of world prices differed substantially from the actual value on a quarter-to-quarter basis. For the period from 1973.3 to 1974.3, for example, errors ranged from a high of 32 percent to a low of 4 percent.

Period	Actual Value	Predicted Value	Error
1973.3	41	27	−14
1973.4	6	26	+20
1974.1	17	24	+ 7
1974.2	52	20	−32
1974.3	14	18	+ 4
Average	26	23	− 3

However, the average rate of increase in international prices over this period was 26 percent, and the equation performed reasonably well by predicting an inflation rate which averaged 23 percent over the period. Thus, the average error for the total of the five quarters was only 3 percent—less than any quarter-to-quarter error because of the tendency of quarterly errors to offset each other.[7]

Our estimation indicates that a one-percent increase in world money-supply growth will, over a period of about three years, add 3½ percent to world price inflation, or an average of just under one percent a year. The very high negative constant term implies that a world money-supply growth rate of approximately 7½ percent is necessary to achieve rough world price stability (27.1/3.59 = 7.5). A world money-supply growth rate less than 7½ percent would lead to world price deflation. This agrees with what we observe empirically. Between 1960 and 1970 world money growth averaged between 7 and 8 percent, and during this period world prices remained relatively stable (Charts 2 and 3).

National Income and Domestic Monetary-Fiscal Policies

The model presented in Section I assumed that domestic aggregate demand, measured by nominal national income, is positively related to domestic nominal money supply and nominal government expenditure. If the nominal aggregate demand function is linear homogeneous, then aggregate demand in real terms, measured by real income, would be positively related to the real money stock and real government expenditures. We test these two relationships by estimating percentage changes in nominal (real) income as a second degree polynominal distributed lag of nominal (real) money stock and government expenditure. In each estimation, explanatory variables are lagged over four quarters.

$$\Delta \text{Log } Y_t = \underset{(1.23)}{2.28} + \overset{4}{\Sigma}\underset{(3.85)}{1.04}\ \Delta \text{Log } M_{t-4} + \overset{4}{\Sigma}\underset{(0.23)}{0.3}\ \Delta \text{Log } G$$

R^2/SE .34/3.17 DW/DF 1.99/46

$$\Delta \text{Log } Y^*_t = \underset{(5.18)}{2.52} + \overset{4}{\Sigma}\underset{(6.92)}{0.97}\ \Delta \text{Log } M^*_{t-4} + \overset{4}{\Sigma}\underset{(0.36)}{0.04}\ \Delta \text{Log } G^*$$

R^2/SE .60/2.81 DW/DF 1.97/46

Δ Log Y = percent change in nominal income, measured by GNP in current dollars

Δ Log M = percent change in money supply, measured by M_1

Δ Log G = percent change in government expenditures in current dollars

An asterisk (*) indicates a real variable, defined by dividing the nominal variable by the GNP price deflator.

When the equation is estimated in nominal form, the sum of coefficients on nominal money supply is statistically significant. The sum of coefficients on government expenditure has the right sign but its t-statistic is insignificant; however, the inclusion of this variable improves the overall fit of the equation.[8] Only 34 percent of the observed variance of nominal income is explained by the equation. However, as income is measured on a quarter-to-quarter basis, the "random element" is magnified relative to the cyclical element, thus reducing the amount of total variance which the independent variables are expected to explain. The relatively low standard error (around three percent) indicates that the fit is reasonably good, and the fact that the Durbin-Watson statistic is close to two in value suggests that all the systematic movement in income has been accounted for.

When the equation is estimated in the real form, the coefficients remain approximately the same (supporting the hypothesis of homogeneity) but their statistical significance increases. The equation explains 60 percent of the variance in real aggregate demand, and the standard error of the estimates is slightly lower than in the nominal version. Dividing the equation through by a common price index which exhibits a large systematic variation increases the percentage of total variance which is systematic and reduces the percentage which is random. The fit of the equation improves as a result.

Our estimates indicate that income is approximately proportional to the money supply. That is, a one-percent increase in money supply leads to about a one-percent increase in aggregate demand. The factor of proportionality (income velocity) is approximately 2.5 whether the equation is estimated in real or in nominal form. Moreover, the relatively short lag with which changes in money-supply growth influence the growth of aggregate demand, indicates that the demand side of the economy adjusts very quickly, i.e. the economy moves along the aggregate-demand curve rather than off it.

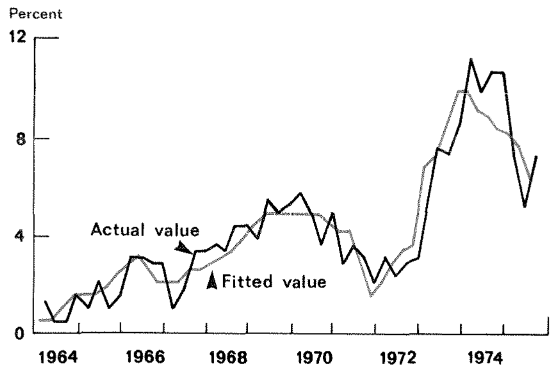
The assumption of unit elasticity for the aggregate-demand curve implies that nominal income will be constant at any point along a given demand curve. In other words, nominal income cannot change unless there is an underlying shift in the demand curve. Thus we may interpret our estimation of aggregate demand in nominal form as a measure of the shift in the aggregate-demand curve resulting from changes in domestic monetary-fiscal policies. By the same token, we interpret our estimation of the aggregate-demand equation in real form as a measurement of movements along the demand curve resulting from a change in the real money stock, with the nominal money stock held constant. To put it another way, an increase in the price level will decrease real money supply, inducing a decrease in aggregate demand for real goods, i.e., a movement along the demand curve. This interpretation, which is consistent with the evidence, allows us to distinguish *shifts in* the aggregate demand curve from *movements along* the curve. This will prove helpful in Section III, because it will allow us to sidestep the assumption of a stable Phillips curve in analyzing the trade-off between inflation and unemployment.

World and Domestic Monetary Policies and the Domestic Price Level

In Section I, we argued that the domestic price level could be influenced by monetary policy in the rest of the world as well as by domestic stabilization policies. Two alternative reduced-form tests can be applied to confirm this proposition. The common independent variable in each of these tests is the domestic money stock. This variable measures the impact of domestic stabilization action, and its inclusion is based on the proposition that inflation is in the long run a monetary phenomenon. The other influence on domestic inflation (as postulated in Section I) is world money growth, operating through the prices of internationally traded goods. This influence can be estimated either by adding world money directly as an independent variable affecting domestic prices, or by adding internationally traded goods prices to the domestic price equation. Both approaches were tested and gave roughly the same results. Only the latter version is reported below (Chart 1).

Chart 1

U.S. Inflation Rate



Source: Federal Reserve Bank of San Francisco—**IFS** data.

$$\Delta \text{Log CPI} = \underset{(3.9)}{-3.57} - \underset{(5.8)}{3.35}\,\text{DUM} + \underset{(7.4)}{\textstyle\sum 1.49}\ \Delta \text{Log } M_{t-12} + \underset{(5.3)}{\textstyle\sum 0.16}\ \Delta \text{Log } Pw_{t-4}$$

R^2/SE	.87/1.11
DW/DE	1.66/41

The equation explains 87 percent of the variance in the U.S. inflation rate. For every one-percent increase in the U.S. money stock (M_1) over the current and twelve past quarters, the U.S. inflation rate (CPI) will increase by 1.5 percent. For every one-percent increase in international inflation over the past four quarters, the U.S. inflation rate will increase by .16 percent. This lag reflects the time delay that is typically observed between changes in wholesale prices (by which international prices are measured) and changes in retail prices (by which domestic prices are measured).

A dummy variable (DUM) was added to the equation to account for Phases I and II of the price-control period (August 15, 1971 to December 1972). Our estimate suggests that, as a result of controls, the annual U.S. inflation rate was 3.3 percent lower over the 5½-quarter period than would otherwise have been the case. Removal of controls probably pushed up the U.S. inflation rate in following periods, but this is not incorporated in our equation because of timing problems. The adjustment did not necessarily have to occur immediately after the end of Phase II controls. Phase III lasted through 1973, and market conditions may have caused the adjustment to extend over an even longer period. The error pattern in the estimated equation (as shown in Chart 1) suggests that much of the adjustment occurred in 1974.

This equation was also estimated for the wholesale price index. The results are summarized below.

$$\Delta \text{Log WPI} = \underset{(3.0)}{7.0} - \underset{(1.6)}{3.4\text{DUM}} + \sum^{8} \underset{(3.7)}{1.98}\ \Delta \text{ Log } M_{t-8}$$

$$+ \sum^{2} \underset{(4.8)}{.41}\ \Delta \text{ LogPw}_{t-2}$$

$$\bar{R}^2/\overline{SE} \quad .63/4.15$$
$$DW/DF \quad 1.88/43$$

The results differ from those in the CPI equation in ways one would expect. The time lag between changes in the money stock and world prices and changes in the WPI are shorter, reflecting the fact that wholesale prices tend to move earlier in the cycle than do retail prices. The coefficient in world prices was much larger (.41 vs. .16) because the weight of internationally traded goods is much larger in the WPI than in the CPI.

Effect of Prices on Wages

In Section 1 and more explicitly in Appendix I, the responsiveness of exchange rates to differential (U.S. and world) inflation rates is related to the speed and completeness of the response of nominal wages to changes in prices. If this adjustment occurs quickly and completely—i.e. if the short run wage-price elasticity is unity—then the higher domestic prices induced by higher international prices will be permanent. The higher supply price of output will prevent an export surplus from developing and will frustrate any exchange-rate appreciation. Without such appreciation, there will be no offset to world inflation and the higher domestic prices will be permanent.

A very simple test was conducted to measure the influence of prices on wages, the former being measured by the CPI and the latter by an hourly-earnings index. If wages rise at the average rate of productivity plus some proportion of the rate of domestic inflation—and if we assume, as a first approximation, that average productivity growth is constant—then we can relate a distributed lag of past price changes to current wage changes. The number of lag quarters required for the coefficient relating prices to wages to approximate unity is crucial. The shorter the lag, the larger and more permanent will be the effect of world prices on domestic prices. The results for the U.S. are given below.

$$\Delta \log W = \underset{(2.1)}{1.75} + \sum^{12} \underset{(5.0)}{.90}\ \Delta \log \text{Pus}_{t-12}$$

$$\bar{R}^2/\overline{SE} \quad .45/2.3$$
$$DW/DE \quad 2.40/43$$

After 12 quarters (3 years), 90 percent of the original past inflation is reflected in U.S. wages. Longer lags do not increase the size of the coefficient. About 60 percent of the impact is achieved in the first year, and 80 percent by the end of the second year.

The critical period for the impact of domestic inflation on domestic wages is one year because, as discussed above, this is the length of the period over which aggregate-demand adjustment takes place. Over a longer period, income effects can create an export surplus, thus causing the exchange rate to appreciate and to offset the effects of world inflation. The share of internationally traded goods in the CPI market basket is approximately 25 percent—60 percent of which is .15, a number very close to the .16 coefficient on world prices in our estimated equation explaining domestic inflation. Similarly, 60 percent of the share of internationally traded goods prices in the WPI is .30, which is somewhat smaller than the estimated coefficient of .41.

Summary of Empirical Findings

(1) World money supply, as a summary measure of world monetary stabilization poli-

cies, is an important factor explaining the price of internationally traded goods. Our estimates indicate that over a period of three years every one-percent increase in world money supply growth in excess of 7.5 percent will add 3½ percent to international inflation. This magnified effect of world money supply on world prices provides support to the hypothesis that a simultaneous expansion of aggregate demand by industrial countries, resulting from synchronized money expansion, leads to a more than proportional increase in world prices. The implications of the hypothesis are explored in Section III.

(2) Domestic monetary and fiscal policy is an important determinant of domestic aggregate demand, with a relatively short lag of about one year. An increase in domestic money supply growth will increase domestic aggregate demand proportionately. On the other hand, changes in the real money stock will induce a movement along a given aggregate demand schedule of unit elasticity. An increase in prices, from whatever source, will decrease the real money stock and lead to a proportional reduction in the demand for real output after about one year.

(3) Both domestic money supply and world inflation exert significant influences on the domestic rate of inflation, although the importance of domestic monetary policy is proportionately larger. A one-percent increase in world inflation will, over a period of one year, add a .16-percent increase to the domestic CPI and .41 percent to the domestic WPI. In contrast, a one-percent domestic monetary expansion will, over a period of two years, add 1.5 percent to the domestic CPI and 2.0 percent to the WPI.

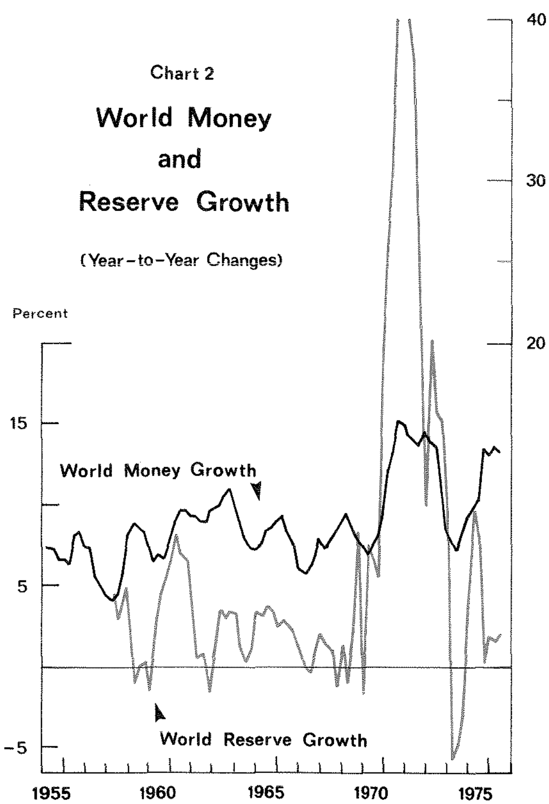
(4) Wages will respond to domestic inflation over a relatively long three-year period. However, in the critical first year—when it influences the extent of the impact of world inflation on domestic inflation—about 60 percent of the higher CPI will be reflected in higher wages.

III. Implications for the Future

The previous discussion suggests that expansionary monetary policies in the rest of the world can have perverse effects on a domestic economy. When one country acts in relative isolation to control domestic aggregate demand, it can, at least in the intermediate period of a business cycle, trade along the Phillips curve and gain an increase in output at the expense of an increase in the inflation rate. However, when many countries are operating in concert (whether by design or accident), the net effect on a domestic economy could be a higher inflation rate with little or no favorable impact on output or employment.

During the 1950's and 60's, industrial countries largely conducted their stabilization policies in isolation from others, reflecting their lack of synchronization of policies. Typically, when one country was in an easy-money phase, other countries were in a tight-money phase of the cycle. The net effect was relative stability in the growth of world aggregate demand.

The environment of the early 1970's was different. Most major industrial countries followed tight and easy monetary polices in a uniform pattern. This increased synchronization of monetary policy is illustrated in Chart 1, which shows the weighted-average money growth rate of 10 major industrial countries over the 1955-76 period. In the period through 1970, the world money stock grew at a relatively stable rate in the 7-8 percent range. While in individual countries money growth showed strong cyclical patterns—because they were in different phases of the cycle—the average money growth was relatively stable. Only in the 1970's was this pattern of stability broken. From 1971 through early 1973, world money stock accelerated to a 13-percent growth rate, but then it decelerated in 1973-74 to a 9-percent rate. Finally, in 1975 through mid-1976, it reaccelerated to approximately a 12-percent growth rate. This instability resulted from the synchronized pattern of monetary ex-



Source: Federal Reserve Bank of San Francisco—IFS data.

pansion of industrial countries during the 1970's.

Why Synchronized Monetary Cycles?

The acceleration in world money growth in the 1970-75 period was associated with the breakdown of the Bretton Woods fixed exchange-rate system.[9] Previously, countries other than the U.S. maintained the international value of their national currencies at a fixed rate by buying and selling dollars in the foreign-exchange market. This policy worked well for most countries in the period through the mid-1960's. But then the U.S. inflation rate accelerated, and the resulting balance-of-payments deficit increased the supply of dollars to the rest of the world relative to demand. The problem came to a head in August 1971, when the U.S. suspended convertibility of the dollar into gold for foreign central banks. While this event led to an exchange-rate adjustment (the so-called Smithsonian agreement in December 1971), most central banks still attempted to maintain fixed values of their national currency in terms of dollars. However, this policy required buying an increasingly large amount of dollar assets in response to the widespread attempts by private citizens (both here and abroad) to shift their portfolios out of dollars—first into the stronger currencies like the German mark and Japanese yen, and eventually into the currencies of almost all other industrial countries.

The international reserves of industrial countries grew at a relatively stable 7-percent rate from 1958 to 1970, but from that point to early 1973, as foreign central banks monetized dollar inflows, they expanded their holdings both of international reserves and of domestic money (Chart 2). Yet when most central banks collectively abandoned the fixed-rate regime in March 1973, there was an abrupt deceleration in the growth of international-reserve holdings. Within a short time, central banks returned the growth rates of their domestic money stocks to more normal levels. However, just as the acceleration in money led to a worldwide business cycle boom and inflation, so deceleration in money led to a worldwide business recession and a rise in unemployment to the highest levels since the 1930's.

Central banks have usually responded in the past to high unemployment rates by following an easy monetary policy, especially when there were no balance-of-payments constraints to interfere with that goal.[10] The same was true in 1975-76, as most countries reacted to high unemployment with a simultaneous domestic monetary expansion which then brought about another expansion in the world money stock.

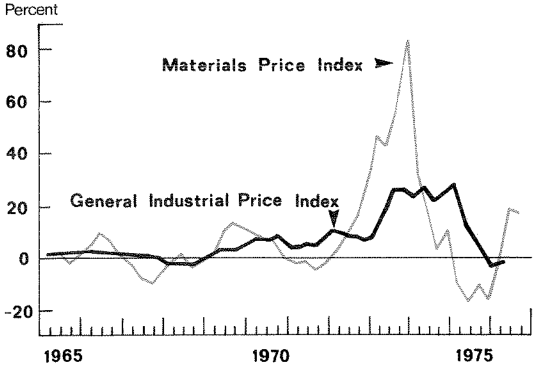
Consequences of a Synchronized Cycle

This instability in the average growth of world money was accompanied, with an average lag of about eight quarters, by greater instability in the prices of internationally traded goods. This relationship is seen in Chart 3. The broad - gauge measure of international prices was relatively stable in the 1950's and '60's, accelerated sharply in late 1972 and early

Chart 3

World Materials and General Industrial Prices

(Year-to-Year Changes)



Source: Materials Price: **The Economist** commodity price ($) index.
General Industrial Price: **IFS** index of export prices of industrial countries.

1973, decelerated sharply in 1975, and continued low in the first half of 1976.

Meanwhile, sensitive materials prices tended to move ahead of the general body of international prices. Materials prices generally move in a more dramatic fashion than the prices of other goods, reflecting the relatively inelastic short-run demand and supply for such goods. This greater price variance can, at times, give misleading signals as to the future course of other international prices. For example, sensitive materials prices increased 15 percent between late 1968 and late 1969, but were not followed by an equally substantial rise in other international prices. Eventually, the materials price increase was reversed. However, in 1972 this index provided a reliable leading indicator of a rise in the broader index of international prices—and in 1974 it foreshadowed the decline in general international prices. In each case the lead was about one year.

The current rise in materials prices raises the question of whether it is a prelude to another bout of international inflation or a random gyration soon to be reversed. The model developed here suggests that international inflation will, in fact, accelerate again in 1977. The reason is that the current rise in materials prices was preceded by a rise in the world money stock, as was the case in 1972, but not in 1968. If the lags between world money and international prices are stable, we would expect that a rise in prices of internationally traded goods will occur in 1977.

The duration of the rise in international prices depends upon the future growth in the world money stock. Given the lags in the system, however, a 10- to 14-percent rate of international price inflation in 1977 seems to be already determined by past monetary policies. This is in contrast with the negative rate of inflation in 1976 and the 26-percent inflation rate in 1974.

What do these international price developments imply for U.S. inflation in 1977? The model suggests that—contrary to general economic opinion—flexible exchange rates may *not* completely isolate a country from international inflation. The size of the inflation will depend upon the extent of the rise in internationally traded goods prices and upon the share of such goods in the domestic price index. On the basis of the estimates of Section II, the Wholesale Price Index (WPI) would rise 7 to 8 percent in 1977 versus a 4-percent annual rate in the first nine months of 1976. The Consumer Price Index (CPI) would rise 6 to 7 percent in 1977 versus a 5½ percent annual rate in the first nine months of 1976.

Compared to the 1973-74 experience, the impact of international inflation on U.S. inflation is expected to be relatively modest in 1977. However, the impact would be large by the standards of the 1950's and '60's, and could increase in later years. The table below summarizes the impact on U.S. prices of alternative world money growth rates.

U.S. Inflation Forecast
(Assume U.S. M_1 = 5 percent)

	World M_1 = 8%		World M_1 = 12%	
	CPI	**WPI**	**CPI**	**WPI**
1978	5.5	5.5	6.0	8.5
1979	4.5	3.0	6.0	8.5
1980	4.0	3.0	6.5	9.0

On the assumptions of a 5-percent growth in domestic M_1 and an 8-percent growth in world M_1 (the average of the 1960's) world prices would be stable and the U.S. inflation rate would be dominated by strictly domestic considerations. By the end of the decade, the CPI would rise at about a 4-percent rate and the WPI at about a 3-percent rate.[11] If world M_1 growth continues at 12 percent, then the longer-term trend in the U.S. CPI will be in the 6- to 6½-percent range and the WPI in the 8½- to 9-percent range.[12]

Conclusion

What implications can policymakers derive from this analysis? One possible implication is that policymakers should respond to imported inflation by expanding domestic aggregate demand sufficiently so that the higher prices will not induce a fall in real output. Even if a country cannot control its domestic inflation rate, it can at least control its domestic unemployment rate with appropriately stimulative stabilization policy.

This policy inference, however, is incomplete and therefore misleading. While it may be desirable for any one country to follow domestic stabilization policies to offset the effects of imported inflation, if all countries followed such a policy simultaneously the result would be explosive inflation. The expansion in world money supply would lead to an even larger world business-cycle expansion and pressures on internationally traded goods prices—and therefore to higher rates of imported inflation. To avoid the unemployment consequences predicted by the Phillips curve would require even further monetary ease, which on the aggregate of all countries would further aggravate the inflation rate.

In this context we have a "game theory" solution. If any one country took action in isolation it could achieve an unambiguous improvement in its situation by following an easy monetary policy. However, if all countries engaged in that practice, all would be worse off than before, in the sense that they would experience a higher rate of inflation with the same rate of unemployment. Thus, the optimal stabilization strategy in this world context would be for all governments to agree to follow moderate monetary policies. While this course would prevent any country which acts alone from improving its unemployment rate as fast as might otherwise be the case, the world as a whole would experience a deceleration in inflation with a given unemployment rate.

This clearly suggests that in an interdependent world, with its close ties in real and financial markets, the degree of monetary independence expected under flexible exchange rates has been circumscribed in a significant way. This provides a rationale for increased international cooperation, along the lines attempted at the economic summit conferences in Puerto Rico in June of this year and at Rambouillet in November 1975.

FOOTNOTES

1. This argument was presented by one of the authors in another context in the Spring 1975 issue of the **Review.** See M. W. Keran "Toward an Explanation of Simultaneous Inflation-Recession."

2. This relationship may be derived from the monetary theory of the balance of payments, which states that world prices are determined by the stock equilibrium condition of equality between world demand and supply of money balances. The excess of the growth rate of nominal world money supply over the growth rate of real world money demand determines the world rate of inflation. H. J. Johnson, "The Monetary Approach to Balance-of-Payments Theory," **Journal of Financial and Quantitative Analysis,** March 1972, J. A. Frenkel and H. G. Johnson, eds., **The Monetary Approach to the Balance of Payments,** University of Toronto Press, 1976, and R. Dornbusch, "The Theory of Flexible Exchange Rate Regimes and Macroeconomic Policy," **Scandinavian Journal of Economics** (forthcoming).

3. This assumption contrasts with that of the monetary theory of the balance of payments. It may be justified as follows: In a world of flexible exchange rates, monetary independence is achieved automatically through the absence of central-bank intervention in the foreign-exchange market. In a world of fixed exchange rates, this is achieved by central banks imposing capital market controls to such an extent that domestic and foreign financial markets are independent of each other over the relevant period of analysis, i.e. the business cycle. It may be argued that the experience of the early 1970's makes this assumption unrealistic. However, we would argue that when loss of domestic monetary control became a significant problem, central banks took actions to retain their monetary independence by moving to a flexible-exchange rate regime in March 1973.

4. An alternative explanation is that real net exports do increase, but that this is offset by a disproportionate

change in import and export prices. The latter explanation is perhaps more realistic in the case of those developed countries which import raw materials and export finished products. Since raw materials have a relatively less elastic short-run supply response to changes in demand than do finished products, raw-material prices will rise before finished-product prices. The temporary adverse shift in the terms of trade could offset the real export surplus and leave the nominal trade balance temporarily unchanged.

5. More precisely, in the case being considered, world stabilization policies lead to an expansion of world aggregate demand which exceeds the expansion of domestic aggregate demand. This is the most relevant case in terms of the U.S. in the 1970's. For formal analysis of this, as well as of the reverse case, see Appendix I.

6. The countries and their respective weights are: Belgium (.060), Canada (.071), France (.108), Germany (.166), Italy (.074), Japan (.115), Netherlands (.071), Switzerland (.027), United Kingdom (.099), United States (.213). The weights do not sum to one due to rounding. The weights are derived from export and import trade shares in 1975.

7. These observations represent an extreme example of a fairly common phenomenon in estimating "change" equations where the random element is large. These equations are more successful in forecasting the average value of the dependent variable than in forecasting the individual quarters.

8. An F-test indicates that the improved fit gained from the inclusion of this variable is significant at the .05 level.

9. See M. Keran, "An Appropriate International Currency: Gold, Dollars, or SDR?," Federal Reserve Bank of St. Louis, **Review**, August 1972 (Reprint 78), and D. I. Meiselman, "Worldwide Inflation: A Monetarist View," **The Phenomenon of Worldwide Inflation**, American Enterprise Institute, 1975.

10. Balance-of-payments constraints were eased in late 1974 for two reasons: (1) most industrial nations had an historically high level of international reserves at that time, and (2) flexible exchange rates were seen as a device to avoid traditional balance-of-payments consequences of easy money.

11. The differential reflects the lower productivity growth in the service industries (which have a larger weight in the CPI) than in the goods industries (which have a higher weight in the WPI).

12. The differential is due to the CPI's lower international-trade component, which more than offsets the lower productivity growth in the service industries.

APPENDIX I

Stabilization Policy in a World Context

This appendix formalizes the model presented in Section I. Since this paper concentrates on monetary variables, the model is simplified by assuming that both domestic nominal government expenditure and real world income are constant. To further facilitate exposition, it is assumed that all goods are internationally traded, although this assumption does not alter qualitative results.

The model is summarized by a system of six equations in six unknowns:

$$Pw = \alpha_0 \, Mw^{\alpha} \qquad \alpha_0, \ \alpha > 0 \qquad (1)$$

$$P = EPw \qquad (2)$$

$$Y = \beta_0 \, M \qquad \beta_0 > 0 \qquad (3)$$

$$Q = \gamma_0 \, (P/W)^{\gamma} \qquad \gamma_0, \ \gamma > 0 \qquad (4)$$

$$PQ = Y \qquad (5)$$

$$W = MAX \, \{\delta_0 P^{\delta}, \ \delta_0\} \qquad \delta_0 > 0, \ 0 \leq \delta \leq 1 \qquad (6)$$

where Mw and M are exogenous world and domestic money supplies, respectively, Pw and P are world and domestic price levels, E is the exchange rate in domestic currency, Y is domestic nominal income, Q is real domestic output, and W is the nominal wage.

Equation (1) expresses the world price level as a positive function of world money supply. In Equation (2) world and domestic price levels are linked by the exchange rate due to goods arbitrage. Equation (3) states that nominal income is determined by domestic monetary policy. This specification implies that the elasticity of the aggregate demand curve is unity. Equation (4) expresses aggregate supply as a function of the price level relative to the nominal wage. This particular specification is based on the assumptions of an aggregate Cobb-Douglas production function and profit maximization by competitive firms. Equation (5) is implied by an assumption of flexible exchange rates. Abstracting from capital flows and central bank interventions, net exports must be zero, in which case domestic aggregate demand and supply are equal.* Finally, Equation (6) states that wages are flexible upward, rising with prices, but rigid downwards. The term δ_0 may be thought of as the initial wage level. As a result of downward wage rigidity, the labor market does not necessarily clear and output may vary over the short run.

Upon differentiating, substituting, and rearranging, we arrive at the following relationships (lower case letters are logarithmic differentials):

$$p = \frac{\gamma}{1+\gamma} \left(\frac{m}{\gamma} + w\right) \qquad (7)$$

$$q = \frac{\gamma}{1+\gamma} (m - w) \qquad (8)$$

$$e = p - p_w \qquad (9)$$

---

*Under fixed exchange rates or a managed float, (5) is replaced by

$$PQ - Y = R \qquad (5')$$

where R is a reserve flow (a policy parameter). Since positive net exports add directly to income, equation (3) then becomes

$$Y = \beta_0 M + \beta_1 (PQ - Y) = \beta_0 M + \beta_1 R. \qquad (3')$$

$$p_w = \alpha m_w \qquad (10)$$

$$w = MAX\ \{\delta p, o\} \qquad (11)$$

Equations (7) and (8) indicate that domestic equilibrium price and output depend on domestic demand management policy, measured by nominal money growth, and also on nominal wage movements. The former causes a shift in the aggregate demand curve and the latter a shift in the aggregate supply curve.

We go on to consider the cases of first a simple domestic monetary expansion, and then a simultaneous domestic and world monetary expansion. Domestic and world money supplies have been assumed to be independent of each other.

Domestic Monetary Expansion

Since domestic monetary expansion places upward pressure on the price level, Equation (11) becomes

$$w = \delta p \qquad (11')$$

Substituting (11') into (7) and (8), and solving yields for m > o:

$$p = \frac{m}{1+\gamma(1-\delta)} > 0 \qquad (12)$$

$$q = \left(\frac{\gamma(1-\delta)}{1+\gamma(1-\delta)}\right) m \geq o \qquad (13)$$

$$e = p \qquad (14)$$

A domestic monetary expansion will have a positive inflation effect and a non-negative output effect. Domestic inflation is offset by proportional exchange rate depreciation. An interesting result here is that the closer the wage-price elasticity (δ) is to unity, the higher will be the inflation-depreciation effect and the lower will be the real output effect. In the limiting case where, $\delta = 1$ the output effect is zero.

A short-run relationship between the change in output and inflation is derived by combining (12) and (13) to yield:

$$q = (1-\delta)\ \gamma\ p \qquad (15)$$

As long as wages do not completely adjust to prices $(0 \leq \delta < 1)$ there is a short-run trade-off between inflation and output growth. The slope of this trade-off is related positively to γ , labor's share in output.

Simultaneous Domestic and World Monetary Expansion

Now consider a simultaneous monetary expansion at both the domestic and world level. If equations (7) - (11) were solved simultaneously for all endogenous variables, the solution would be exactly the same as the case of a simple domestic monetary expansion, except that the exchange rate would depreciate less or possibly even appreciate due to world price inflation.

$$e = p - p_w = \frac{m}{1+\gamma(1-\delta)} - \alpha m_w \qquad (14')$$

If, on the other hand, endogenous variables adjust at different speeds to shocks to the system, then these conclusions could be altered. In particular, suppose that wages and prices adjust quickly relative to the exchange rate.* Then world price inflation would have no initial impact on the exchange rate, but would be translated into proportionately higher domestic prices through (2) and then higher wages through (6). The initial domestic price inflation is a disequilibrium phenomenon and will eventually be partially offset by exchange-rate appreciation as the real sector begins to adjust to the price rise. Wages, however, will remain permanently higher because of the assumption of downward rigidity.

The extent of wage inflation in the economy will therefore depend on the interaction of world and domestic monetary policies. If world price inflation exceeds the domestic inflation rate warranted by domestic monetary policy, then wage inflation will be proportional to world price inflation. If, on the other hand, the world inflation rate is less than or equal to that warranted by domestic policy, then wage inflation will be proportional to domestic price inflation. World price inflation is given by equation (10), while domestic inflation warranted by domestic monetary policy is given by equation (12). The appropriate wage adjustment equation for a simultaneous domestic and world monetary expansion is therefore

$$w = MAX\ \{\delta\alpha m_w, \frac{\delta m}{1+\gamma(1-\delta)}\}\ ,\ \text{for } m_w,\ m \geq o \qquad (16)$$

Let $\Theta = 1/(\alpha+\alpha\gamma(1-\delta))$. In the case where $m_w \leq \Theta m$ world inflation is less than or equal to that warranted by domestic policy—equilibrium is defined by equations (12), (13), and (14'). The more interesting case is where $m_w > \Theta m$ world inflation exceeds that warranted by domestic policy.

Then combining (7)-(10) and (16) yields for m_w, m > o.

$$p = \frac{\gamma}{1+\gamma}\left(\frac{m}{\gamma} + \delta\alpha m_w\right) > 0 \qquad (17)$$

$$q = \frac{\gamma}{1+\gamma}\left(m - \delta\alpha m_w\right) \qquad (18)$$

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*For an explanation of why the exchange rate might be sticky, see Section I, p. 4.

$$e = \frac{1}{1+\gamma}\left(m - \frac{m_w}{\theta}\right) < 0 \qquad (19)$$

Domestic inflation is higher and domestic output expansion is lower than in the case of a simple monetary expansion, or in the case where $m_w \leq \theta m$. The exchange rate will unambiguously appreciate. If the wage-price elasticity (δ) is sufficiently close to unity, the output effect will be negative.

APPENDIX II

Evidence from Other Countries: The Case of the U.K. and Germany

The model developed above suggests that the impact of international inflation on the domestic price level depends upon (1) the share of internationally traded goods in the domestic price index and (2) the responsiveness of domestic wages to domestic prices. Both influences work to increase the impact of international inflation on domestic prices.[1]

Wages and Prices

In the body of this article the response of wages to prices was estimated using U.S. data. The results suggest that over a period of 3 years every 1-percent increase in consumer prices leads to a .9-percent increase in wages. Sixty percent of the wage increase occurs in the first year. Similar equations are estimated for the U.K. and Germany. Nominal wages are determined primarily by the growth in labor productivity and the rise in consumer prices. If productivity grows at a relatively constant rate, then an equation estimating changes in wages in response to changes in prices would as a first-order approximation give information on both sets of determinants. The constant term would show the growth in wages with respect to productivity, and the coefficient on the price variable would show the growth in nominal wages with respect to the rate of inflation.

On the basis of postwar economic history, one would expect that the coefficient relating wages to prices to be larger in the case of the U.K. than in the case of Germany. In the U.K. the strong labor-union movement has exercised its power systematically to protect the real wages of its members from the effects of inflation.[2] In Germany, on the other hand, the labor unions have been less militant. While German wages have risen faster than German prices in the last 15 years, labor unions apparently have not tried to use their power to vary wages substantially in response to inflation. The estimated equations for the U.K. and Germany are given below.[3]

U.K.

$$\Delta \log W = \underset{(1.4)}{3.0} + \sum^{2} \underset{(5.9)}{1.01} \; \Delta \log P_{t-2} \qquad \begin{matrix} R^2/SE & .39/7.49 \\ DW/DE & 1.67/45 \end{matrix}$$

Germany

$$\Delta \log W = \underset{(4.3)}{8.3} + \sum^{8} \underset{(.04)}{.018} \; \Delta \log P_{t-8} \qquad \begin{matrix} R^2/DE & .13/5.55 \\ DW/DE & 1.99/42 \end{matrix}$$

These equations are estimated over the period 1960.2 to 1976.3. In the case of the U.K., it takes two quarters for the full effects of a rise in the domestic price level to be transmitted to nominal wages. When longer lags are estimated, the coefficient rises above unity. The minimum standard error for this equation is achieved with a lag of eight quarters and a coefficient value of 1.39. This implies that money wages in the U.K. respond on average by more than the rate of inflation.[4] For Germany the coefficient relating domestic inflation to domestic wage rates was insignificant for all lagged periods investigated. The result presented was the lagged pattern (t-8) with the minimum standard error.

These results suggest that international inflation is almost completely transmitted to U.K. prices, but that it has a much smaller impact on German domestic prices. We can confirm this conjecture directly by estimating domestic price equations for both countries.

U.K.

$$\Delta \log CPI = \underset{(2.2)}{3.1} + \sum^{8} \underset{(0.7)}{0.15} \; \Delta \log M_{t-8} + \sum^{4} \underset{(5.5)}{.61} \; \Delta \log Pw_{t-4}$$

$$\begin{matrix} R^2/SE & .65/4.76 \\ DW/DE & 2.10/38 \end{matrix}$$

Germany

$$\Delta \log CPI = \underset{(0.6)}{-1.0} + \sum^{12} \underset{(2.4)}{.38} \; \Delta \log M_{t-12} + \sum^{4} \underset{(3.6)}{.15} \; \Delta \log Pw_{t-4}$$

$$\begin{matrix} R^2/SE & .38/2.44 \\ DW/DE & 1.61/42 \end{matrix}$$

The equation for each country is identical to the specification in the test for the U.S. inflation rate. For the U.K. the international inflation variable has a large and significant coefficient. For every 1-percent increase in international inflation (measured in a dollar-denominated index) over the previous four quarters, U.K. CPI inflation will increase .61 percent. In the German case a 1-percent increase in international prices leads to a .15 percent increase in domestic prices. Germany is almost as open an economy as the U.K. but its world inflation coefficient is much lower (.15 versus .61). A rough measure of the share of international goods in a country is the share of exports plus imports to GNP. For 1975 the share for Germany was 54 percent, and for the U.K. 56 percent.

These results are consistent with the wage equations presented above. Since German wages are less sensitive to domestic inflation than U.K. wages, a such smaller proportion of the international inflation will "stick" in Germany.

APPENDIX FOOTNOTES

1. A third influence is the speed of response of real income to changes in real money balances. Earlier work by one of the authors suggests that such response is relatively uniform across countries in the range of one to one and a half years. M. W. Keran, "Selecting a Monetary Indicator," Federal Reserve Bank of St. Louis, September 1970 (Reprint No. 59).
2. Sir John Hicks, "What's Wrong with Monetarism," *Lloyds Bank Review*, October 1975.
3. P is the consumer price index for both countries. W is an index of average monthly wages for the U.K. and an index of hourly earnings for Germany. International Monetary Fund, *International Financial Statistics* (computer tape).
4. This is explained partially by institutional factors. During 1973-74 the combination of domestic price control and threshold wage agreements in a world inflationary situation caused real wages to rise on trend. For a fuller explanation, see Marcus H. Muller, "Can a Rise in Import Prices be Inflationary and Deflationary? Economists and the U.K. Inflation, 1973-74" *American Economic Review*, September 1976.

Market Response to Economic Policies:
A Stumbling Block for Policymakers

Kurt Dew*

Two new themes—(1) optimal control and (2) rational expectations — have arisen recently in the economic-policy literature, and each of them promises to have a dramatic impact upon future analyses of appropriate policy-making. First, the literature on optimal control deals basically with the use of imperfect econometric models in forming policy decisions. The literature emphasizes the development of efficient rules for responding to the errors that would otherwise lead policymakers away from their economic goals. Optimal-control research seems to suggest that with a reasonably careful utilization of an econometric model and the use of mathematically derived rules for policy adjustment, the policymaker can improve upon alternative policies such as the constant money-growth rule proposed by Nobel laureate Milton Friedman. Some research even suggests that the adjustment process derived from optimal-control techniques is so efficient that the policymaker who uses the wrong model (i.e., one that doesn't describe the economy's behavior as well as other available models) may still improve upon Friedmanesque inactive policy by responding quickly to his mistakes.[1] Optimal-control results thus seem to provide arguments for activist economic policies.

In contrast, the rational-expectations literature tends to discredit activist policies because of a different interpretation of one of the fundamental issues in policy-making—the nature of the public response to economic-policy decisions. Since the time of Keynes, economists have made the reasonable assumption that economic agents — households and firms — cope with an uncertain future by making forecasts, and that these forecasts play a key role in determining eventual future levels of economic activity. Yet the rational-expectations literature suggests that households and firms do not form their expectations of future events the way that most economists presume they do. Furthermore, if economic agents form expectations in a way that is "rational" (i.e. using all the available information rather than just part of it), the latitude of policy-makers to exert a beneficial impact upon economic welfare is reduced or even eliminated. Policy-makers in such a world may not improve the expected future *levels* of economic activity, but they may, by informing consumers ahead-of-time about future policy, reduce consumer uncertainty about future *variations* in economic activity. Therefore, rules such as Friedman's constant money-growth rule, having the twin advantages of simplicity and clarity, are good policy prescriptions. The rational-expectations assumption thus tends to nullify the implications of optimal-control analysis and leads to the conclusion that passive policies are the most appropriate ones.

Consequently, a policy-maker's choice between active policies of "leaning against" the economic winds or passive policies such as Friedman's constant money-growth rule comes down to this: Can the policy responses that are generated by optimal-control rules overcome the uncertainties regarding future economic behavior that are created by rational expectations? To provide some insight into this issue, we describe two alternative methods used by economists to analyze the formulation of house-

*Economist, Federal Reserve Bank of San Francisco.

hold expectations. By considering the particular example of the consumption decision, we show how the outcome of a particular policy can be adversely affected through a misinterpretation of the means by which the consumer forms his expectations.

When the policy-maker writes his decisions in stone, a mistaken notion of the method of formulating consumer expectations can be disastrous. But the more interesting case is one where the policy-maker is more flexible, using the method of optimal control to adjust his policies to his initial errors. In this instance, we show that the policy-maker can improve his policy results by using optimal-control techniques, but that his misjudgment of the means by which consumers forecast future income nonetheless adds instability to the economy.

Formation of Expectations: Adaptive

The current standard approach to the modeling of expectation formulation assumes that economic agents form expectations adaptively. The adaptive expectations hypothesis is developed by induction. In the case of consumer forecasting of future income, for example, the consumer is presumed to begin with a forecast of levels of personal disposable income (PDI) in each future period. The consumer knows that he will commit forecasting errors, and he believes that these errors are related, in the sense that a low forecast in one year indicates that all his predictions may be too low. He reflects this knowledge by revising his future estimates upward when his current forecast is too low. We might suppose that a \$10-billion under-estimation of PDI this quarter will cause the consumer to revise his next year's forecast upward by 20 percent of the \$10-billion error. If so, this year's forecast will differ from last year's attempt by \$2 billion, 20 percent of \$10 billion.

But by the same token, last year's estimate was the result of a revision of the forecast of two years ago, which was increased or lowered depending upon whether it had been an under-estimate or an over-estimate. So we may think of this year's expectation of 1977 PDI as a forecast made in 1974 that has been subsequently revised in light of the errors in 1975 and 1976 income—or proceeding backward, may even think of it as a forecast originally made (say) in 1970 and adjusted for the errors made in PDI in each subsequent year. We might thus expect that the original estimate itself would become less and less important, and that the actual levels of PDI in periods after the original estimate would become more and more important. If so, we could safely state that the forecast of PDI for 1977 (or 1978, or any subsequent year) depends upon actual past levels of PDI. We might write this hypothesis in the form of an equation

$$(1)\quad E_{1976}(PDI_{1977}) = k_1\,PDI_{1976} + k_2\,PDI_{1975} + k_3\,PDI_{1974} + \ldots$$

Where the symbol

$E_{1976}(PDI_{1977})$ represents the estimate (E) in 1976, of personal disposable income (PDI) in 1977,

and k_1, k_2, k_3, . . . the weights used to project past levels of PDI into 1977.

We might further suppose that the estimate is a weighted average of the past values of PDI, so that $k_1 + k_2 + k_3 + \ldots = 1$.

The hypothesis that expectations of future values of an economic variable are weighted averages of past values of this variable is known as the hypothesis of adaptive expectations. Macroeconomists utilize adaptive expectations to help explain the sluggishness of the economy's response to external shocks. If the adaptive expectations hypothesis is correct, consumption (for example) would be set by the consumer at a level proportional to his estimate of the value of his own future income. But because the consumer forms his expectations adaptively, he is sluggish in revising his estimates and therefore sluggish in revising his consumption. Last year's PDI might lead him to expect an increase in his future PDI, but the lower PDI of earlier years also would have an effect on his forecast. Thus, he raises his estimate of expected future income more slowly than the rate of increase in present earnings.

Formation of Expectations: Rational

Some economists have challenged the adaptive-expectations assumption because the consumer under this approach tends to ignore some important information about the future path of key economic variables. The consumer may well have some notions of the intentions of public policy-makers, which it would be "rational" for him to include in his forecast of the growth of future disposable income.[2]

How would a consumer forecast the effect of government expenditures upon PDI? He might estimate the present value (PV) to him of the stream of future government expenditures:

$$(2) \quad PV = G_{1976} + \frac{1}{1+p} G_{1977} + \frac{1}{(1+p)^2} G_{1978} + \ldots$$

Where G_{1976}, G_{1977} . . . are the intended levels of government expenditure in the future, and p is the consumer's internal rate of discount of future disposable income, added to reflect the fact that a dollar received now is of greater value to the consumer than the same amount received later.

Or if the consumer were more sophisticated, he might analyze the full impact of government spending by estimating the value of the added disposable income accruing from the intended government expenditure.

$$(3) \quad PV = PDI_{1976} + \frac{1}{1+p} PDI_{1977} + \frac{1}{(1+p)^2} PDI_{1978} + \ldots$$

where PDI_{1976}, PDI_{1977}, . . . are the added disposable income in future years resulting from the intended government expenditure program.

The Consumption Function

According to the widely accepted life-cycle hypothesis, consumption expenditures during any particular period of time depend upon the current value the consumer places upon the income he expects to earn throughout his lifetime. Suppose, for example, the consumer were certain that he would earn $10,000 in personal disposable income for each coming year in perpetuity. To determine his life cycle income, he uses the relationship

$$(4) \quad A = k(PDI_{1977} + \frac{PDI_{1978}}{1+p} + \frac{PDI_{1979}}{(1+p)^2} + \ldots$$

Here "k" is a constant chosen so that the sum of the weights of each of the yearly forecasts of PDI is one, and A is a weighted average of the PDI's. For example, the weight of PDI_{1977} is k; the weight of PDI_{1978} is $k/1+p$; for PDI_{1979}, $^{k}/(1+p)^2$ and $k + {}^{k}/1+p + {}^{k}/(1+p)^2 + \ldots = 1$. Since in this case $PDI_{1977} = PDI_{1978} = \ldots$ = $10,000 and the weights on the PDI's sum to one, A = $10,000. The consumer is interested in the behavior of income over his lifetime because he prefers to minimize the year-to-year variation in his rate of consumption. The consumer's income may fluctuate as time goes on, but he attempts to mitigate the effects of his fluctuating income upon the level of consumption, and pays attention primarily to the average level of income he expects to receive over the long haul.

Aggregating consumption over the population of consumers, we may characterize the life-cycle hypothesis in two equations

$$(5) \quad a) \quad C_{1977} = aA$$

$$(5 \quad b) \quad A = \frac{p}{(1+p)} \left[PDI_{1977} + \frac{PDI_{1978}}{1+p} + \frac{PDI_{1979}}{(1+p)^2} + \ldots\right]$$

where C_{1977} = consumption in 1977
a = proportion of life-cycle income consumed in each period.

These equations describe how consumption is related to expected life-cycle income when A, the value of life-cycle income, is known to the consumer.

Consumption Function with Adaptive Expectations

When we cease to assume that the consumer's life-cycle income, A, is known beforehand, we must replace it with an estimate, denoted by E(A). If expectations of future PDI are adaptive, expectations take on a form

$$(6) \quad E_{1976}(A) = k_o\, PDI_{1976} + k_1\, PDI_{1975} + \ldots$$

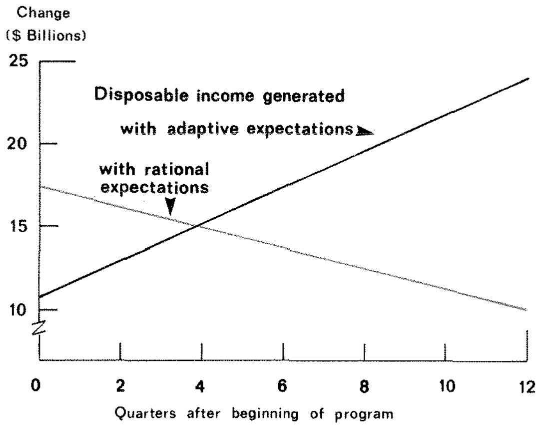
In other words, the current (1976) estimate of life-cycle income depends upon past disposable income. To illustrate the effect of adaptive expectations upon the consumption decision, we use a variant of the expression for the consumption function used by Modigliani.[3]

Since we assume that consumers form estimates of future income on the basis of knowledge of the past levels of income, we may conclude that they respond to a change in public policy as they would to any other economic shock, revising their expectations of future income only slowly as income increases. As a result of this sluggish response, a change in government expenditure increases the level of consumer expenditures quite slowly. To demonstrate this point, we use the consumption function from Modigliani to display the effect of adaptive expectations upon a critical variable, $\frac{\Delta PDI}{\Delta G}$, the income multiplier of an increase in government expenditures at any point in time.

Consider the case of a $10-billion increase in real government expenditures sustained over a three-year horizon. We assume at first that the policy-maker believes that consumers form expectations adaptively, and then contrast the expected policy outcome with the actual outcome

Chart 1

Income Generated under Adaptive Expectations and Rational Expectations



when expectations are rational. Although the new government expenditures increase income from the very outset at a rate in excess of $10 billion per year, the consumer initially has only a single quarter of higher income to offset his past experience of income at a lower level. He is thus slow to revise his estimate of life-cycle income upward, so that consumption at first rises by only a relatively small amount. However, as time goes on and the Government continues to spend at the higher rate, the consumer becomes increasingly convinced of the permanence of the additions to income. This increasing certainty leads to higher levels of consumption and therefore to steadily increasing levels of income, over and above the $10 billion per year in added income produced directly by the government expenditures.[4] If in general we define ΔPDI_t as the difference between PDI with and without the added government expenditures in period t, then the government-spending multiplier becomes $\frac{\Delta PDI_t}{\Delta G}$. Chart 1 indicates the path that income takes when the estimation of permanent income is based upon adaptive expectations.

The increase in the multiplier $\frac{\Delta PDI_t}{\Delta G}$ through time is due to the increased consumer estimate

Modigliani Equation

$$C = .663 \left[\sum_{i=0}^{11} b_i (PDI)_{-i} \right] + 54.43 \left[\sum_{i=0}^{7} c_i (W)_{-i} \right] + .74\, e_{-1}$$

$$\sum_i b_i = 1 \qquad \sum_i c_i = 1$$

C = per capita consumption
PDI = per capita personal disposable income
W = per capita net financial wealth
e = C actual (−1) − C estimate (−1)

The coefficients b_i in the adaptive expectations estimate of per capita PDI, the first term on the right of the above equation, are given in the table.

Percentage of life-cycle income	No. of quarters in the past
b_0 = .1564	0
.1427	1
.1291	2
.1157	3
.1024	4
.0891	5
.0762	6
.0632	7
.0502	8
.0376	9
.0249	10
b_{11} = .0124	11

In the equation above, wealth enters the consumption function by increasing the growth of the income multiplier more rapidly through time. We ignore this wealth aspect, since we are less interested in the size of the multiplier than in its time path. (Unlike Modigliani, we consider only the first term of the equation.)

of life-cycle income, which in turn results from expectations of future increases in government expenditures and higher estimates of consumption due to multiplier effects. In Table (II), the second column represents the consumer estimate of additional life-cycle income resulting from the three-year government expenditure program and its multiplier effects upon consumption. Similarly, the third column shows the portion of the higher life-cycle income due directly to government expenditures, i.e., without multiplier effects upon consumption.

Table I

Multiplier Effects Under Adaptive Expectations

Quarter	Increase in life-cycle PDI Total	Due to G
0	1.74	1.56
1	3.16	2.99
2	4.76	4.28
3	6.38	5.44
4	7.98	6.46
5	9.55	7.35
6	11.09	8.12
7	12.56	8.75
8	13.95	9.25
9	16.40	9.63
10	16.40	9.88
11	17.41	10.00

Thus, consumers' forecasts of the future government-spending contribution rise throughout the period, until at the end of three years the consumer expects to receive $10 billion per year in perpetuity.

There is a disturbing aspect to this adaptive-expectations approach. At the end of the three-year period, when it is public knowledge that the $10-billion government-expenditure program will be curtailed, the adaptively forecasting consumer is expecting the government to continue spending the $10 billion in perpetuity. It takes three more years without the $10 billion to disabuse him of this notion.

Consumer Knowledge of Policy-maker's Intentions

How would the consumer value the same 3-year, $10-billion per year program of increased government expenditures if, contrary to the policy-maker's belief, he were to perform according to a rational rather than adaptive scheme of expectations? This question can be answered by reference to equation (5b). As this equation suggests, the rational consumer is concerned about future income, not past income, so that past policies only matter to him if they affect future income. He will thus react to the government-expenditure program by evaluating its future effects. As the three-year period approaches its end, the program will have very little further impact on his consumption decision, because it will only affect his income for a few remaining quarters.

Table II

Multiplier Effects With Rational Expectations

	Increase in life-cycle PDI	
Quarter	Total	Due to G
0	6.50	5.27
1	5.90	4.86
2	5.31	4.44
3	4.86	4.02
4	4.15	3.60
5	3.60	3.17
6	3.06	2.73
7	2.52	2.29
8	2.00	1.84
9	1.48	1.40
10	0.98	0.93
11	0.48	0.47

The policy's impact on life-cycle income instead will be maximized at the outset, because government expenditures are expected to continue for twelve quarters into the future. Consequently, consumption out of life-cycle income —and the income multiplier—also will be greatest in the beginning of the program.

Chart I displays the difference between the income generated by a government program based on adaptive expectations and the income generated based upon rational expectations. In the latter case, the fiscal stimulus is greater at the beginning of the period and thereafter declines—just the opposite of what would be expected by a policy-maker using an adaptive-expectations forecast, who would be increasingly disappointed throughout the three-year period.

Since the rational consumer expects future consumption to be increased as a result of the higher government expenditures, the value to him of the government-spending program exceeds the value of the expenditures themselves, including the value of the added consumption induced by those expenditures. In either case, the value of the income multiplier of the spending program declines as time goes on, whereas the multiplier associated with an adaptive-expectations approach increases as time goes on.

Policy-maker's Mistaken Assumption of Adaptive Expectations

As Chart 1 shows, the policy-maker who mistakenly assumes that the consumer forms expectations adaptively would find his policy multipliers becoming increasingly incorrect over the three-year period. This is not an unusual turn of events for the macroeconomist. Indeed, substantial empirical evidence suggests that policy multipliers are subject to massive uncertainty. Carl Christ has pointed out that estimated values of policy multipliers differ widely among the major econometric models, and has suggested that this divergence of opinion seriously damages economists' ability to give policy advice.[5]

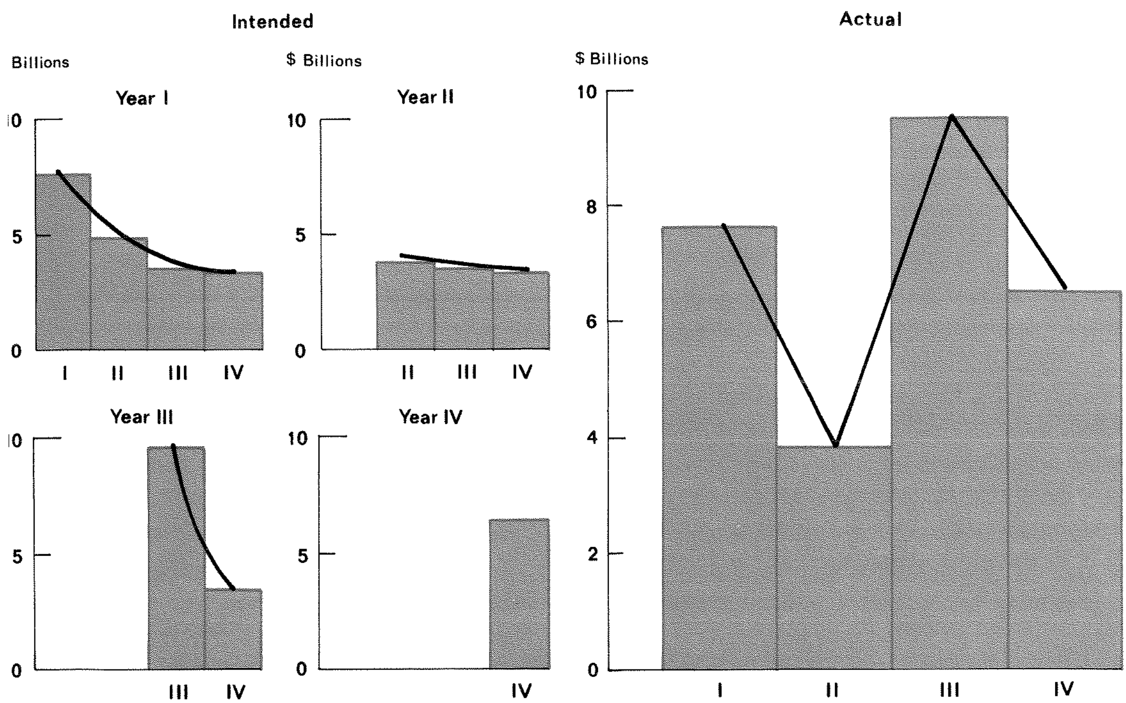
The lack of certainty about the effect of public policies would clearly be of serious concern if the policy-maker were required to write his decisions in stone. Arguing against the Christ conclusion, Gregory Chow has shown that a more flexible policy, which is revised when short-run errors occur, can under some circumstances be quite effective in offsetting multiplier errors.[6] Chow analyzes the policy-maker's behavior and his impact upon the economy when he receives conflicting signals from two major econometric models and erroneously follows the incorrect one. To evaluate his argument and obtain a realistic picture of the impact of public-expenditure decisions when based upon a mistaken understanding of consumer expectations, we must allow the policy-maker the latitude to adjust his decisions.

We will imagine a world in which the policy-maker believes that the consumer is an adaptive forecaster, but the consumer is actually "rational" in the sense that he bases his forecasts of disposable income upon his knowledge of the announced path of government policy. When the policy-maker discovers that he has made a forecasting error, he will adapt his policy to this mistake, revising his planned expenditures and announcing his revised intentions to consumers.[7] Such a policy-maker would begin by looking at his income goal for the first quarter. In the present example, suppose that the policy-maker wishes to raise the level of GNP by $10 billion above the level it would otherwise attain in each of the next four years,[8] and then reduce government expenditures to their old levels. At the beginning of the four-year program, the policy-maker might well announce—utilizing his adaptive expectations assumption—the desirable levels of increased government expenditures throughout the entire period.

We will assume that policy is revised once each year over the four-year period. We will also assume that the policy-maker does not "forgive" himself for policy mistakes, i.e., he intends to add the same $40 billion to the level of GNP throughout the period as a whole regardless of his year-to-year performance.[9] We can then determine the outcome at the end of each year, and, show how the policy-maker

Chart 2

Intended and Actual Expenditures



would revise his subsequent policy whenever he errs in hitting his GNP target.

Chart 2 pictures each of the strategies that the policy-maker constructs in this case. After a false start in the first year, he realizes that his policy did not incorporate sufficient stimulus in the last half of the four-year period. This turn of events results inevitably from his belief that the stimulus provided by *past* policies is the dominant concern of the consumer, when in fact the consumer is quite rationally concerned with the future stimulus the policy-maker *intends* to provide.

The policy-maker then makes three revisions in his forecast:

1.) Reduces the planned additions to income in the remainder of the period by the amount of the initial overshoot.

2.) Revises upward the consumption multiplier. The policy-maker mistakenly assumes that part of the added income was due to a shift in consumer's preference to a higher rate of consumption out of life-cycle income.

3.) Increases the estimate of life-cycle income. The policy-maker correctly detects that the consumer's estimate of life-cycle income was higher in the current period than he had expected, but he incorrectly concludes that the estimate of the next period's life-cycle income will also be higher. These revisions in the policy-maker's forecast result in a change in the planned policy over the following three years.

The policy-maker then revises his intended expenditures downward in an attempt to bring his projection of more rapid income growth back to desired levels.

Chart 3 pictures the effect of the four-year policy upon income, and contrasts this with the policy-maker's intended levels of income. In the end, the increased government expenditures produce $4.58 billion less PDI than intended, as Table III demonstrates.

The fundamental factor preventing the policy-maker from making the necessary adjustments to target income more closely is the temporary nature of government policy. Even though the policy-maker boosts expenditure levels by hefty amounts, the temporary nature of the program tends to offset these increases as the end of the program moves closer in time. If the policy-maker intended a permanent increase in annual income, the optimal-control procedure would provide him with much greater success.

Chart 3

Actual and Intended Changes in Disposable Income

Assumption of Adaptive Expectations

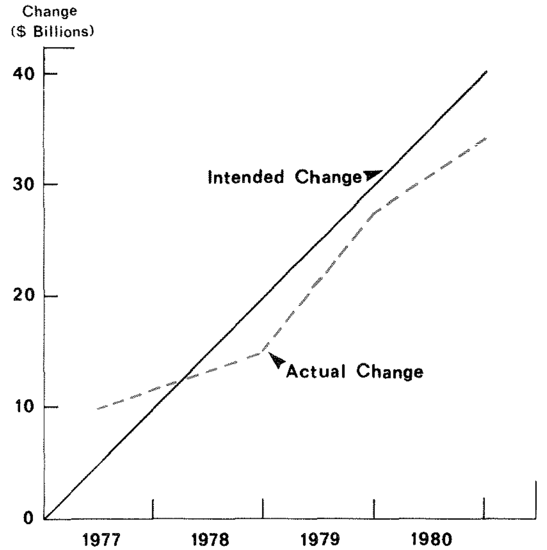


Table III

Income-Expenditure Patterns with Given Expenditure Information

Year	Expenditures	Income
1	7.63	10.68
2	3.85	5.52
3	10.34	12.34
4	6.03	6.88
Total	27.85	35.42

Ratio of income to expenditures—35.42/27.85 = 1.27

Conclusion

While consumer behavior is an important concern of the policy-maker, policy decisions are an equally important concern of the consumer. Since policy is announced ahead of time while other events affecting economic growth are not, it is reasonable to suppose that households and firms will be affected by policy decisions in a qualitatively different way than they are by other economic shocks.

This possibility serves to emphasize the importance of the distinction between the response of an economy to an unforeseen turn of events and the same economy's response to a predictable change in policy. While the existence of prolonged changes in economic growth is indisputable, the policy-maker's ability to offset these divergences in the short run is still open to question.

What we have shown is that announcing economic policies ahead of time may create serious difficulties for the policy-maker. This announcement can affect consumer expectations in ways that are difficult to forecast. But the government can take two measures that would reduce the extent of this problem.

(1). If the policy-maker did not announce his policies ahead of time, the consumer would have no information about future policies and would therefore form his expectations adaptively.

(2). If government-spending programs brought about permanent, rather than temporary, increases in future disposable income, the government-expenditure multiplier under rational expectations would not decline so rapidly through time, and control of income would become easier.

However, these options are, to our good fortune, not available to elected policy-makers. The benefits of a government elected by the people are, like most benefits, not without economic costs.

FOOTNOTES

1. Gregory C. Chow, "Usefulness of Imperfect Models for the Formulation of Stabilization Policies." Princeton University: Econometric Research Program, Memorandum #199 (1976).

2. Critics of the rational-expectations argument note that the conclusion that policy is impotent is based upon the very special assumption that economic agents forecast **prices** only. R. J. Gordon, "Recent Developments in the Theory of Inflation and Unemployment." **Journal of Monetary Economics,** (April 1976), pp. 185-219. If economic agents forecast quantities—e.g. consumers' forecast of future income in the commonly accepted life-cycle consumption hypothesis—then policymakers may still have a beneficial impact upon such goals as income, employment and price stability. Advocates of rational expectations disagree, as in R. E. Lucas, "Econometric Policy Evaluation, A Critique," **Journal of Monetary Economics,** (January 1976 supplement), pp. 19-46. Despite the possibility of a beneficial short-run impact on employment and income, if expectations are rational, policy-makers will still misjudge the long run impact of their decisions.

3. Franco Modigliani, "Monetary Policy and Consumption: Linkages via Interest Rates and Wealth Effects in the MPS Models." **Consumer Spending and Monetary Policy.** Conference Series No. 5 (Boston: Federal Reserve Bank of Boston, 1971).

4. In the first quarter of the expenditure program, for example, the increment provided by increased government spending to consumers' life-cycle income is 0.1564(10) = $1.56 billion. Since the change in consumption and income associated with the government-spending increase is found from the joint solution of

$$\Delta C_0 = .663\ [.1564 \Delta PDI)$$

and $$\Delta PDI_0 = \Delta C_0 + 10.$$

we have ΔPDI_0 = the change in income resulting from the first quarter of increased government expenditures

$$= \Delta C_0 + \Delta G_0$$

= 1.16 + 10 = $11.16 billion, measured at an annual rate.

5. Carl F. Christ, "Judging the Performance of Econometric Models of the U.S. Economy." **International Economic Review,** (February 1975), pp. 54-74.

6. Chow, op. cit., p. 23-24.

7. The policy-maker assumes the error to be partially carried forward through the lagged adjustment term, ϵ_{-1} in the consumption function, and through the effect of the unexpected level of income upon the adaptive-expectations estimate of life-cycle disposable income.

8. The four-year period is chosen because it is the length of the political cycle determined by presidential elections.

9. This presumption is consistent, for instance, with the wording of the Humphrey-Hawkins bill.

APPENDIX I

Derivation of government expenditures and their impact on DPI

In an adaptation of the Modigliani model, the policy-maker's model of income generation in the period i quarters ahead of the present period, τ, under his four-year policy of generating $10 billion per year of added PDI, can be expressed as

$$\Delta C_i = .663\ [\sum_{j=0}^{\tau} b_j \Delta PDI_j + 10 \sum_{j=\tau+1}^{i} b_j] + (.74)^{i-\tau} e_{-1}$$

$$\Delta C_i + \Delta G_i = \begin{cases} 10 - e_{-1} & j = \tau + 1, \ldots \tau + 4 \\ 10 & j = \tau + 5, \ldots, i \end{cases}$$

The consumer's model of income generation i years in the future is

$$\Delta C_i = .663\ [\Delta PDI_i + \sum_{j=i}^{4} \Delta PDI_{j+i} (1+p)^{-i}] \frac{p}{1+p}$$

$$\Delta C_i + \Delta \bar{E}_i = \Delta PDI_i .$$

The consumer treats this problem as a dynamic programming problem with $\bar{E}_i$ given.

These two sets of relationships highlight the difference between consumer and policy-maker. The consumer is choosing present consumption based upon his estimate of future income, but the policy-maker is forecasting consumption from information contained in past levels of personal consumption.

Suppose that instead of announcing his planned expenditures the policy-maker announced planned levels of income. While this may seem more devious than announcing planned expenditures, in the light of the earlier example it may be more informative to the consumer to release income goals, since the policy-maker's planned expenditures will not be realized anyway. In this case, the government would simply announce its intention to increase income by $10 billion in each of the next four years, stating that expenditures would be at whatever level is required to produce this outcome. This change in announced intentions would have no effect upon the policy-maker's procedures for forecasting future consumption and determining future expenditure intentions, but it would affect the consumer's valuation of future government policy and hence the final outcome both in terms of income and expenditures. For example, in the first year the policy-maker would proceed as before, choosing expenditure levels that produce $10 billion in income under the assumption that consumers forecast by means of an adaptive-expectations scheme. The consumer would use a different method for forming his expectations, however. Instead of using announced government expenditures to estimate future income, the consumer simply makes his own valuation of an added $10 billion per year in PDI for the second through the fourth years:

$$I_t = \frac{p}{1+p} \left(10 + \frac{10}{1+p} + \frac{10}{(1+p)^2}\right)$$

and adds this to income generated in the current year. By this method, the consumer considers himself wealthier in the first year than he did in the earlier example, primarily because he is unaware of the low level of intended government expenditures in years 2 through 4. The result is a relatively high level of consumption, $12.58 billion, somewhat above the $10.58 billion in added income shown in the earlier example in the text.

Planned Government Expenditures—Alternative Strategy

To spend in year	Planned in year 1	2	3	4
1	7.63			
2	4.91	.97		
3	3.58	3.45	9.67	
4	3.37	3.55	3.79	5.10

The table below shows the income resulting from the policy-maker's two alternative approaches to providing information to the consumer. The results are quite similar, but by revealing income intentions rather than expenditure intentions the policy-maker gains a marginal increase in the four-year ratio of income generated to expenditures—1.48 with the income policy and 1.27 with the expenditure policy. At the same time, he loses some control over income generated—$5.48 billion away from the $40-billion target with income policy, and $4.58 billion away from target with the expenditures policy.

Income-Expenditure Patterns with Given Information

	Expenditure Information		Income Information	
Year	Expenditures	Income	Expenditures	Income
1	7.63	10.68	7.63	12.58
2	3.85	5.52	.97	3.75
3	10.34	12.34	9.67	12.40
4	6.03	6.88	5.10	5.83
Total	27.85	35.42	23.37	34.56
Income-expenditure ratio		1.27		1.48

APPENDIX II

Consumer forecasts—prices only

A second type of rational-expectations model may be developed where economic agents forecast price rather than quantity variables. In this model, economic decisions might depend upon the divergence of actual prices from price forecasts. Consumers might, for example, adjust planned expenditures in an attempt to hold them constant in real (price-adjusted) terms, but would treat an unanticipated deviation of price from expectation as a temporary change in the relative price of present goods vis-a-vis future goods—perhaps postponing current consumption outlays when prices are unexpectedly high.

The consumption decision in 1977 would therefore depend upon

$$P_{1977} - E_{1976}(P_{1977})$$

which is the deviation of 1977 prices from the level expected in the previous year. This forecast of 1977 prices might be based upon all available information, such as the expected path of future government expenditures and the impact of these expenditures upon personal disposable income.

In the standard version of the life-cycle consumption model, the level of current consumption is assumed to depend upon the consumer's valuation of his future lifetime income. The problem generally is viewed as one of judging the approximate value of an uncertain quantity, in other words a forecasting problem. But suppose that the consumer did not have to forecast the future level of income but instead had a large measure of choice in the matter, given some "natural" restrictions such as his current holdings of capital goods and the value of his labor services. Then he could determine the value of his future DPI at his own discretion—depending, for example, upon whether he greatly preferred leisure to added wages. One of the determinants of his decision to work would be the price level. If prices were high relative to expectations, he might decide to increase his present offering of labor services, hence increasing his life-cycle income. At the old level of life-cycle income, the same consumer-laborer might respond to price increases by reducing present consumption, waiting for future periods when prices would be closer to his expectations to "catch up." However, unexpectedly higher prices would increase his life-cycle income as well, since he offers more labor services at higher prices. Therefore, the decision to reduce or increase consumption would depend on the relative magnitude of income and substitution effects.

In this model, then, consumers may be assumed to forecast prices only, and to consume on the average at a fixed rate. They will revise their planned consumption only if presented with a surprise change in prices. If prices increase above expectations, the consumer will believe the increase to be temporary, and therefore will find it advantageous to defer some present consumption to the future if the substitution effect of high present prices is dominant.

By the same token, if prices fall below expectations, present consumption will be increased at the expense of lost future consumption. When consumption is subjected to a shock, however, time is required for the consumer to readjust his consumption to equilibrium levels. Thus we have

$$C_t = a_1 C_{t-1} + a_2 C_{t-2} + a_3 [P_t - E_{t-1}(P_t)]$$

$$E_{t-1}(P_t) = E(P_t | I_{t-1}) \quad a_1, a_2 > 0, a_3 < 0$$

The second of these two equations states the rule by which the consumer forecasts future prices. E_{t-1} (P_t) is the price level that the consumer expects to find in period t from a perspective one period in the past. This forecast is conditioned on all the information, I_{t-1}, which is available to the consumer in the earlier period. The consumer may have some knowledge of the policymaker's plans, and he may have some knowledge of the behavior of the economy as well. These equations suggest that if the policy-maker informs the consumer in advance of his policy intentions, he cannot hope to influence the consumer's behavior. This is because the consumer is able to form price forecasts identical to those of the policy-maker when both possess equal levels of information. Consider, for example, the impact of an increase in government expenditures, G. In this case, the consumer revises his forecast of future prices:

$$E_{t-1}(P_t) = E(P_t | G)$$

The policy-maker may estimate the effect on consumption $E_{t-1}(C_t) = a_0 C_{t-1} + a_1 C_{t-2}$

$$+ E_{t-1}[P_t - E_{t-1}(P_t | G)]$$

but since $E_{t-1}(P_t) = E_{t-1}(P_t | G)$

i.e. consumer and policy-maker have the same information

$$E_{t-1}(C_t) = a_0 C_{t-1} + a_1 C_{t-2} + 0$$

and an announced increase in government expenditures has no effect upon consumption.

An Experiment with an Incomes Policy

Rose McElhattan*

The growth in output since the beginning of the recovery in early 1975 has matched that of previous upturns, but unemployment and inflation remain abnormally high. The twin problems of high unemployment and inflation may remain with us for several years; forecasts are remarkably similar on that point, with the jobless rate between 6 and 7 percent and the inflation rate around 5 to 6 percent in 1980.[1] The persistence of these twin problems helps explain why incomes policies are again receiving consideration by the press, economists and policy makers.

The term "incomes policy" refers to a wide range of government measures which supplement the traditional instruments of fiscal and monetary policy and which are designed to improve the tradeoff between unemployment and inflation. An incomes policy can incorporate direct government controls to hold down prices and freeze wages, as well as milder policies such as "jawboning." It can also include measures that would tend to promote competition in labor and products markets in order to keep prices down, such as more vigorous antitrust action. In general, incomes policies are designed to bring about a lower level of prices than would otherwise exist at a given level of unemployment. They are aimed at affecting prices through the supply side, such as by constraining costs of production or decreasing monopoly power.

European experiences with incomes policies in the post-World War II period mostly have involved a wages guideline, with wage increases tied to increases in output per manhour.[2] This paper applies an approach of that type to the U.S. economy. We consider the impact upon U.S. aggregate economic activity of an incomes policy which sets the average increase in wages equal to the trend rate of growth in labor productivity. The economic impact is estimated through simulations of the U.S. economy with a version of the MPS model (Massachusetts Institute of Technology/University of Pennsylvania/Social Science Research Council) over the 1967-1971 period. The policy analyzed here differs from the policies actually adopted in the 1971-73 period because it is concerned only with the rate of growth of wages. One advantage of such an approach, as we will discuss later, is that by controlling prices indirectly through wages, we can avoid direct cumbersome controls on final prices. We have analyzed the 1967-71 period because we lacked sufficient data to analyze the period of the late 1970's, and because that earlier period produced unemployment and inflation problems that our conventional tools of monetary and fiscal policy did not—or could not—solve.

The period beginning in 1967 was one of phenomenal increases in unit labor costs and soaring prices. Arthur Okun has suggested that we had a "second chance" in mid-1967 to stem the inflationary climb, which would have been successful if we had taken advantage of traditional fiscal and monetary policy tools.[3] But studies of that period, using a variety of monetary- and fiscal-policy mixes, indicate that we could not have avoided a substantial rise in inflation in late 1968 without suffering a high cost

*Economist, Federal Reserve Bank of San Francisco. The author wishes to acknowledge the assistance of David McKinnis and Miriam Ciochon.

in terms of lost jobs and output.[4] The present study is designed to determine what impact an incomes policy would have had in the 1967-71 period. We do not consider the difficult problem of policy administration, and during the model simulations of proposed wage constraints, we have made a number of assumptions which significantly affect the final results. We ask the following question:

> What is the result of imposing restraints solely on wages with respect to major economic measures such as unemployment, prices, real income and income shares?

This article describes an experiment in incomes policy. It is called an experiment because the results presented cannot be considered a forecast of what actually would have happened if such a policy had been implemented. Rather the paper considers the way in which the incomes policy would be analyzed, through the use of an economic model to determine the policy's impact on inflation, unemployment and several other variables. The paper points out the effects but ignores the costs of an incomes policy, such as administrative costs or possible resource misallocation. In summary, our experiment indicates that a wage-directed incomes policy will have an ambiguous effect on output and employment, depending on the assumptions made, and that the labor share of income will be less than otherwise would have been the case. The major benefit of the incomes policy would be a temporarily lower rate of inflation. How long this would last cannot be determined in the model. The paper does not consider the possibility of supplementing the incomes policy with monetary or fiscal measures, but attempts to retain historical monetary and fiscal policies.

The next section of this paper describes the price equation in the MPS model. This is followed by the simulation results of a wage-control policy, and then by a discussion of the meaning and applicability of the econometric results.

Inflation and the Price Equation in the MPS Model

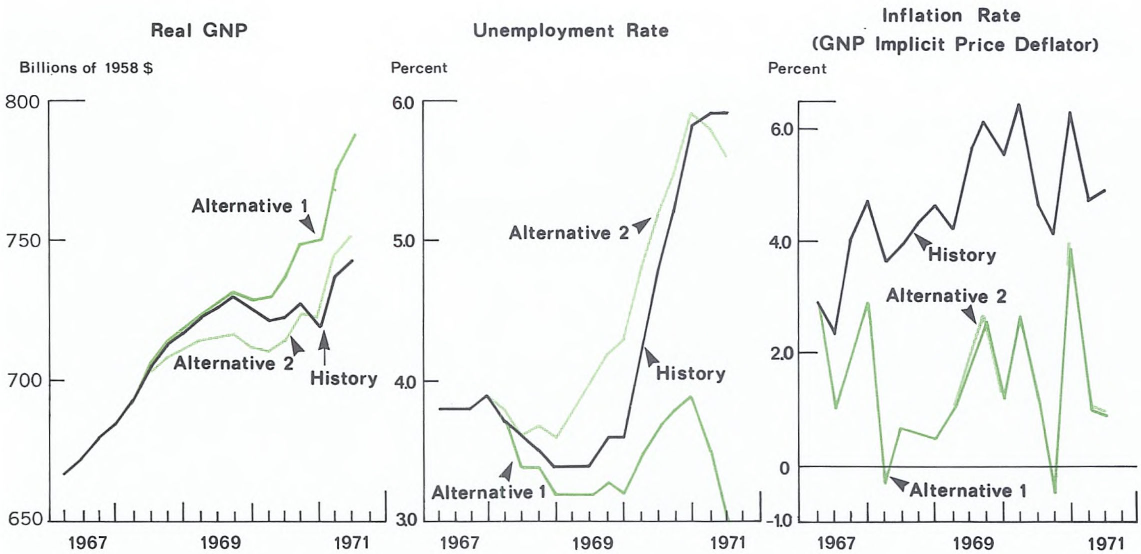
Incomes policies are essentially efforts to reduce the rate of inflation at a given level of unemployment. Policy measures which associate wage and productivity increases are designed to control the rise in unit labor costs, the predominant price-raising factor in the short-run in most large structural economic models.

The price equation used here ignores the role of money in price determination, which may appear at odds with monetary explanations of inflation. If inflation is fundamentally a monetary phenomenon, why is the money supply excluded from the direct determination of prices? The answer is that the price equation is embedded in a larger model in which prices and money are indeed tied together in the determination of income, output and employment. The channels in the MPS model through which changes in money affect prices and output have been discussed in detail elsewhere.[5] In brief, a change in the rate of growth of the money supply will have only transitory effects on real-sector variables such as employment and real output. In the longer run, the model has very classical properties, with real output being left unaffected by the change in the money stock, and with the rate of inflation being determined entirely within the monetary sector. In the shorter run, however, an acceleration in the rate of money growth initially stimulates the demand for goods and services as well as for the labor to meet that demand. The additional pressures in labor and other factor markets affect wages and other costs of production; in this sense, changes in business costs are the proximate but not the fundamental cause of inflation.

The price equation in the MPS model, as in most large scale econometric models, is a cost mark-up equation. It has been shown by Nordhaus that pricing behavior for a profit-maximizing firm results in an optimal price (net of indirect taxes) based on factor costs. These costs include the prices of capital services, labor, raw materials and a trend component to

Chart 1

Major Economic Variables— —Comparison of Historical Values and Wage-Control Model Simulations



capture the advance of productivity through time. The level of prices can then be determined by the level of these costs, a term representing productivity, and a scale factor, which represents the mark-up fraction.[6]

Numerous econometric efforts to find the impact of the price of capital services have been unsuccessful, so that this cost is generally assumed to be estimated in the constant term of the price equation. In addition, the price index which is estimated by the basic behavioral price equation is the deflator for nonfarm domestic business product. Also, it is a value-added concept, which means that the cost of raw materials to the nonfarm business sector does not enter directly in the determination of the price index. Raw-materials inputs to the business sector consist mainly of farm products and imports, so that any increase (say) in their prices will raise prices in the aggregate nonfarm business sector with a delay, as each price increase is passed on to final consumers. With these considerations in mind, we can represent the basic price equation as follows:

$$P = k \cdot W/Q \qquad (1)$$

where

P = Price deflator for nonfarm domestic business product
W = Employee compensation per manhour in nonfarm domestic business
Q = Output per manhour
k = Mark-up factor
W/Q = Unit labor costs

Price determination in the form of equation (1) means that if business profit margins (k) remain constant, then price changes will be strictly labor-cost determined. In this simplest representation, a rise in unit labor costs (W/Q) will be matched by a proportionate rise in prices. Thus the rate of price inflation is determined solely by the "pass-through" of labor-cost increases into prices.

Equation (1) is an oversimplified version of the MPS pricing equation.[7] Four major adjustments convert it into a form suitable for short-run price estimation in the MPS model. First, the mark-up is assumed to vary with demand pressure. Second, terms in current productivity and trend productivity are included. Third, the rates of change of farm and import prices are added to capture initial adjustment effects. Lastly, prices are assumed to adjust with a lag to cost and mark-up changes.

It is assumed that the mark-up fraction (k) depends upon the level of excess demand. Firms which possess some short-run monopoly power might raise their mark-up margins to a high level during a boom and shade their prices when demand weakens. Demand pressures are represented by the ratio of unfilled orders (OUPD) to shipments of producers' durable equipment (EPD), specifically:

$$k = b_1 + b_2(OUPD/EPD)_t - b_3(OUPD/EPD)_{t-1}$$

The negative coefficient (b_3) implies a rate-of-change variable which is intended to capture the effect on the mark-up of expectations of demand change.[8]

Secondly, it is assumed that firms base their estimate of the rate of technical change both on long trends and on more recent movements of average labor productivity. The value (Q) is replaced with two terms: a term representing current productivity (measured as an eight-quarter average to remove some of its cyclical movement) and a time variable to capture long-run trend movement. Thirdly, since the price index is a value added-deflator for the nonfarm domestic-business sector, the index will initially decline when farm or import prices rise if these costs are not immediately passed on to final consumers. In order to capture this temporary effect, a fixed-weight average of farm and imported-materials prices was added to the equation. Its coefficient should be negative. Finally, it is assumed that cost and mark-up factors influence prices with a distributed lag through time. To incorporate lagged adjustment, the price index was included with a one-period delay on the right-hand side of the estimated equation.

Equation (1) was estimated with these four modifications, subject to the constraint that the long-run elasticity of prices to wages be unity. The result was as follows (numbers in parenthesis are t values):

$$\ln\left(\frac{P}{W}\right) = \underset{(7.23)}{.7099} \ln\left(\frac{P_{-1}}{W}\right) + \underset{(2.83)}{.07331}\left(\frac{OUPD}{EPD}\right) - \underset{(-1.60)}{.04001}\left(\frac{OUPD}{EPD}\right)_{-1}$$
$$- \underset{(-1.13)}{.00746} \sum_{i=0}^{7} \ln\left(\frac{XBNF}{LMHT}\right)_{-i}$$
$$- \underset{(-.53)}{.01258} \ln\left(\frac{31.91\ PWM + 68.09\ PFM}{31.91\ PWM_{-1} + 68.09\ PFM_{-1}}\right) + \underset{(.09)}{.00011}\ JS4$$
$$- \underset{(-.99)}{.00109}\ JS2 - \underset{(-.13)}{.00016}\ JS3$$
$$- \underset{(3.56)}{.001438}\ TIME - \underset{(-3.60)}{.11742} \qquad (2)$$

1954:I to 1968:IV

$\bar{R}_e^2 = .9993$; SE = .0028; DW = 1.93; DF = 47

where

P = Price deflator for nonfarm domestic business product

W = Employee compensation rate in nonfarm domestic business

OUPD = Unfilled orders for producers durables

EPD = Expenditures on producers durables

XBNF = Nonfarm domestic business product and produce of households

LMHT = Manhours in nonfarm domestic business sector, including proprietors

PWM = Raw materials prices, imports

PFM = Raw materials prices, farm

JS2 = Seasonal dummy variable for the second quarter

JS3 = Seasonal dummy variable for the third quarter

JS4 = Seasonal dummy variable for the fourth quarter

Time = Time with 1947.1 = 1, 1968.4 = 88

The most notable features of this equation are the following:

(1) The lag structure of wages means that any wage change is almost entirely passed through to prices in a little over two years. A one-percent increase in wages will result in .75 percentage-point increase in the rate of inflation within one year and about .95 percentage-point increase by the end of two years.[9]

(2) The trend rate of growth in productivity results in a steady decline in prices each year of

about .60 percentage points, while a one-percent increase in the sum of current and lagged estimates of productivity leads to an additional decline of about .36 percentage points.

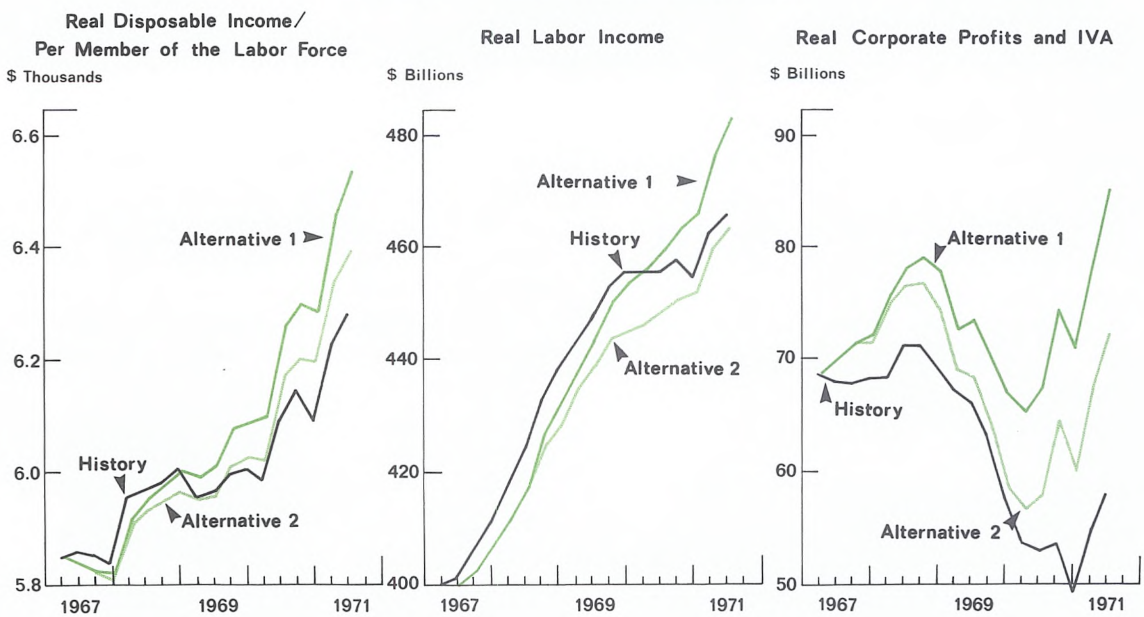
(3) Prices respond positively to demand pressures, even when unit labor costs are held constant. This is demonstrated by the estimated coefficients of unfilled orders to shipments. On average, during post-Korean War cycles, the demand effect is estimated to have raised the rate of inflation between trough and peak quarters about 2.5 percentage points, assuming no changes in the other price determinants in equation (2). This result is consistent with Gordon's recent work on the impact of excess demand on prices, which suggests that on the average, demand pressures have added about 2.8 percentage points (trough to peak) to the inflation rate during post-World War II business cycles.[10]

The pricing behavior estimated by equation (2) has major significance for stabilization policy. It suggests that an incomes policy which can restrain the rise in unit labor costs through control of wage-rate increases can successfully control domestic nonfarm prices, without directly controlling the latter. Incomes policies which fundamentally rely on wage restraints have an important advantage in that they obviate the need to create a cumbersome administrative apparatus to control final prices. Interesting examples of two such policies are the tax-based incomes policy advocated by Henry C. Wallich and Sidney Weintraub,[11] and an incomes policy recently updated by Vijaya G. Duggal and Lawrence R. Klein.[12]

The importance of the term representing demand pressures illustrates the potential significance of monetary- and fiscal-policy effects upon prices. An increase in aggregate demand which is initiated, say, by expansive monetary and fiscal polices can act to increase demand pressures and thereby prices. An incomes policy which holds down unit labor costs will not be able under such circumstances to stop the inflationary rise due to demand-pull pressures, and will not survive when monetary and fiscal stimulus becomes excessive.

Chart 2

Returns to Labor and Capital – –Comparison of Historical Values with Wage–Control Model Simulations

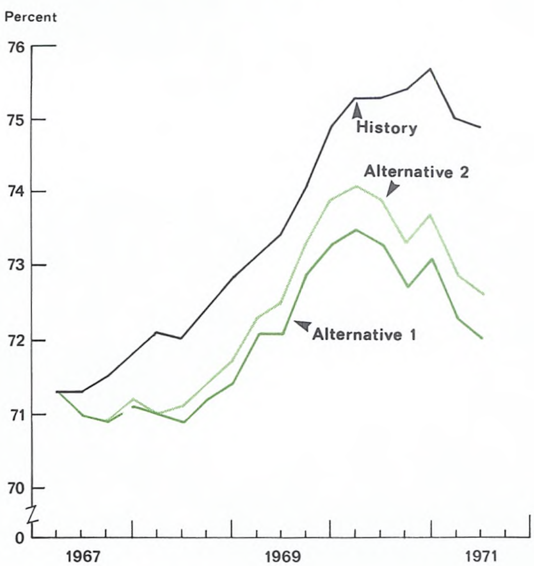


From this discussion of the direct determinants of prices, we can conclude that a change in wages equal to the change in productivity will result in unchanged prices after a two-year adjustment period, assuming no change in excess demand. If prices are held down by an incomes policy, a given amount of aggregate demand should, at least in the short run, result in greater real output and employment, since part of the demand does not become dissipated in higher prices. On the other hand, because of adjustment lags between wages and prices, holding down wages may initially hold down real income and could adversely affect employment. To determine the impact of wage controls upon economic activity, we turn to simulation experiments with the MPS model over the period from 1967.2 to 1971.2.

These experiments may be identified as Wage Control-Alternative 1, and Wage Control-Alternative 2. One common element is present in both experiments—the assumption of a constant 3-percent annual rate of increase in nominal wage rates, which is equal to the long-term growth rate in output per manhour. The historical and assumed wage rates are shown below.

Chart 3

Labor Share of National Income



Hourly Wage Rates in Nonfarm Private Domestic Business
Annual Rate of Increase, 1967-1 - 1971.2

	Historical Value	Assumed Value in Wage Control Alternatives
1967.1	2.5	2.5
.2	6.5	3.0
.3	6.7	3.0
.4	4.8	3.0
1968.1	10.7	3.0
.2	6.0	3.0
.3	7.5	3.0
.4	8.2	3.0
1969.1	4.5	3.0
.2	7.5	3.0
.3	6.2	3.0
.4	8.7	3.0
1970.1	6.4	3.0
.2	6.1	3.0
.3	10.2	3.0
.4	2.6	3.0
1971.1	8.0	3.0
.2	7.5	3.0

The difference between the actual historical value and a wage-simulation result is a measure of the impact of controlling the increase in wages.[13] But, if this difference is to reflect accurately the impact of wage controls, it is necessary that the structure of the MPS model allow all significant reactions to the wage change to take place. In several ways, the MPS model is not structured to capture the economic response to the wage changes we have made.

We have attempted to adjust the model for some of its structural shortcomings, and we acknowledge that the adjustments, which are our "best guesses," are somewhat arbitrary. It is for this reason that we present two wage-control alternatives and detail the judgmental changes imposed upon the results.

In Wage-Control-Alternative I, we not only assume a constant 3-percent average wage increase, but also adjust the cost of capital for producers durables to reflect the expected drop in inflation rates due to this 3-percent wage constraint.

The cost of capital depends in part upon real interest costs, which are determined by the difference between a nominal long-term interest rate and the expected rate of inflation. The expected inflation rate is estimated by a distributed lag on past inflation rates. In the wage-control simulation, the mechanical application of the distributed lag on past rates of inflation results in a very low expected inflation rate, and hence a very high real rate of interest and cost of capital. The high cost of capital worked in our initial simulations to reduce investment substantially in business durable equipment, so we then adjusted the cost-of-capital term so that it would not go above the rates experienced in the first half of the 1960's, when prices and interest rates were similar to their simulated values.[14]

Business expectations of future prices are an important determinant of investment plans and expenditures. Undoubtedly, an incomes policy can influence these expectations to a major extent. Our assumption regarding price expectations, and hence the cost of capital, implies that the business community believes the incomes policy will be successful in holding down unit labor costs through its constraints on wage-rate increases. If the business community believes otherwise, any number of alternative possibilities could emerge. For example, if business felt that controls would lead to bottlenecks in certain raw-materials areas, a sizable increase in demand could take place, creating price pressures which otherwise would not exist.

Our price expectations assumption also implies that market participants build their inflation expectations on more information about the effects of wage controls on prices than simply extrapolating past price changes into the future.[15]

Wage Control-Alternative 1 results in an improvement over historical values for real output, employment and prices (Table 1). Real output increases steadily and by 1970, GNP is $19.7 billion greater than historical estimates. The unemployment rate declines in response to the greater growth in real output and remains below 4.0 percent over the 1967-70 period; by 1970 it is 3.7 percent, compared with the 5.0-percent historical value. The rate of inflation responds to the drop in wages, falling in 1967 to 2.6 percent from its historical rate of 3.2 percent, and remaining below 2.0 percent over the following three years. By 1970, the inflation rate is 1.7 percent, compared with the historical rate of 5.5 percent.

Real disposable income per member of the labor force declines relative to historical values for the first two years of the simulation, but then increases substantially, reaching $6,231 in 1970, or $151 greater than its historical value. The changes in this measure mostly reflect the time required in the model for prices to adjust fully to changes in wages. Because of this delayed reaction, the real purchasing power of wage income will initially fall while profits, calculated residually, will show improvement. We may therefore expect some drop in labor income (relative to its historical value), as prices adjust slowly to the lower rate of wage growth. In fact, labor income does not increase relative to historical values until 1970, the last year of the simulation. The earlier increase in real disposable income represents an increase in the purchasing power of non-labor components: property and proprietor income, and transfer payments. Alternative I thus suggests that labor income may not show any marked increase (relative to historical values) when an incomes policy is initially instituted.[16] In Table 2, we show the effect of Alternative I upon real GNP and its components, along with the differences between these results and historical values. The decline shown here in personal consumption is related to the drop in real disposable income in the initial periods of the simulation. The relative decline in business fixed investment reflects the higher real interest

TABLE 1
Historical Values and Wage Control Alternatives
for Selected Economic Variables, 1967-70

	Historical Value	Wage Control Alternative 1	Change from Historical Value	Wage Control Alternative 2	Change from Historical Value
		(1) Real GNP (Billions of 1958 dollars)			
1967	$675.2	$675.3	$ .1	$675.1	$ –.1
1968	706.6	708.1	1.5	704.0	–2.6
1969	725.6	728.2	2.6	715.5	–10.1
1970	722.3	742.0	19.7	718.7	–3.6
		(2) Unemployment Rate (Percent)			
1967	3.8	3.8	.0	3.8	.0
1968	3.6	3.4	–.2	3.7	.1
1969	3.5	3.2	–.3	4.1	.6
1970	5.0	3.7	–1.3	5.4	.4
		(3) Inflation Rate (GNP Implicit Deflator)			
1967	3.2	2.6	–.6	2.5	–.6
1968	4.0	1.0	–3.0	1.0	–3.0
1969	4.8	1.2	–3.6	1.3	–3.5
1970	5.5	1.7	–3.8	1.8	–3.7
		(4) Real Disposable Income Per Member of the Labor Force			
1967	$5,849	$5,828	$ –21	$5,824	$ –25
1968	5,983	5,962	–21	5,937	–46
1969	5,984	6,043	59	5,981	–3
1970	6,080	6,231	151	6,145	65
		(5) Labor's Total Real Income ($ Billions)*			
1967	$404.2	$401.6	$–2.6	$401.6	$ –2.6
1968	428.0	422.0	–6.0	420.1	–7.9
1969	449.3	446.2	–3.1	440.1	–9.2
1970	456.0	461.0	5.0	449.1	–6.9
		(6) Real Corporate Profits and I.V.A. ($ Billions)**			
1967	$ 68.1	$ 70.4	$ 2.3	$ 70.3	$ 2.2
1968	70.0	77.6	7.6	75.6	5.6
1969	63.3	70.5	7.2	64.7	1.4
1970	52.2	69.4	17.2	59.6	7.4
		(7) Relative Income Shares of Corporate Profits (Percent)†			
1967	16.8%	17.5%	.7%	17.5	.7
1968	16.3	18.4	2.1	18.0	1.7
1969	14.1	15.8	1.7	14.7	1.6
1970	11.4	15.0	3.6	13.3	1.9
		(8) Labor's Share of National Income (Percent)			
1967	71.5	71.1	–0.4	71.1	–0.4
1968	72.4	71.1	–1.3	71.3	–1.1
1969	73.9	72.6	–1.3	73.0	–0.9
1970	75.5	73.2	–2.3	73.8	–1.7

*Employee compensation deflated by consumer price index.
**Corporate profits and inventory valuation adjustment deflated by consumer price index.
†Corporate profits divided by employee compensation.

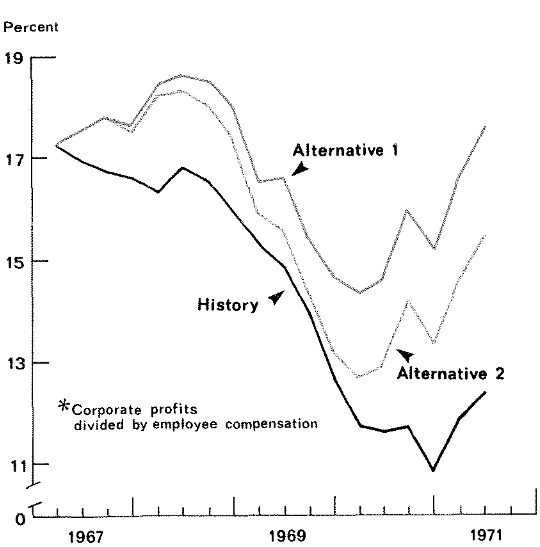
rate in the wage-control run as compared to its historical estimate. Nominal interest rates in the wage-control simulation do not decline as rapidly as prices, because price changes take some time—through adjustment delays in the model—to alter other economic and financial variables.

A substantial amount of the change in real GNP in this wage-control simulation is due to increases in real net exports and government expenditures. These factors may partly reflect some shortcomings in the basic model, for which adjustments are made in our second simulation.

Wage Control-Alternative 2 includes several of the same assumptions underlying the first alternative. We assume as before a constant 3-percent annual increase in nominal wages, and we continue the same adjustment to the cost of capital for producers' durable goods. But we also make two further adjustments. First, certain fiscal variables which are exogenous and fixed in current dollars are changed to reflect the lower prices generated by the incomes policy. Second, real exports, which are exogenous and thus not determined by the model, are kept at their historical values, while real imports, which are estimated by behavioral equations in

Chart 4

Profits Relative Income Share*



the model, are adjusted to change only in response to changes in real income.

Both Federal grants-in-aid to state-and-local governments and Federal transfers to persons (other than unemployment-insurance benefits) are exogenous variables in the model. The amount of these expenditures is, in some way, affected by current prices, and allocations could decline somewhat in the wage-control situation as a result of the significantly lower prices. Consequently, we adjusted the amounts of these two variables so that real expenditures equaled their historical real magnitudes. In Alternative 2, our adjustment implies that federal fiscal policy is determined in real rather than current dollar magnitudes, which is the reverse of the assumption under Alternative 1.

With Federal grants reduced, Alternative 2 shows smaller values than Alternative 1 for state - and - local government expenditures, amounting to about \$1 billion in 1969 and \$2 billion in 1970 (Tables 2 and 3). Restricting Federal transfers to their historical real-dollar magnitudes results in relatively smaller real disposable income and hence relatively smaller consumption expenditures. In Alternative 2, real transfers to persons (other than unemployment insurance) are reduced by \$1.3 billion in 1968, \$2.9 billion in 1969 and \$5.2 billion in 1970.

Export and import prices, as well as export volume, are exogenous variables in the model, while import volume is assumed to respond to relative prices and real income. Consequently, the decline in U.S. prices associated with an incomes policy should lead to substantial increases in net exports, since current-dollar exports remain at their historical levels and imports decline dramatically as U.S. prices fall relative to fixed foreign prices. But because of uncertainty regarding the world response to a decline in U.S. prices, we assumed that the incomes policy would be relatively neutral in its impact upon net exports, with no price effects on the quantities of internationally traded goods. Thus, there would be no gain in the U.S. foreign trade balance from the price ad-

TABLE 2
Real GNP and Components—Historical Values and Values Under Wage Control—Alternative 1
(Billions of 1958 dollars)

	1966	1967	1968	1969	1970
		Historical Values			
Gross National Product	658.1	675.2	706.6	725.6	722.3
Personal Consumption Expenditures	418.1	430.1	452.8	469.1	477.4
Business Fixed Investment	74.1	73.2	75.6	80.1	77.3
Residential Structures	21.3	20.4	23.2	23.7	22.2
Inventory Change	13.9	7.7	6.5	6.7	3.9
Net Exports	4.2	3.6	0.9	0.2	2.2
Exports	40.2	42.1	45.6	48.4	52.2
Imports	36.0	38.5	44.7	48.3	50.0
Government Purchases	126.5	140.2	147.7	145.8	139.3
Federal	65.4	74.6	78.1	73.4	64.4
State & Local	61.1	65.6	69.6	72.4	74.9
		Wage Control—Alternative I (Simulation period 1967-1970)			
Gross National Product	658.1	675.3	708.1	728.2	742.0
Personal Consumption Expenditures	418.1	429.7	452.5	470.2	485.7
Business Fixed Investment	74.1	73.1	74.0	74.5	71.0
Residential Structures	21.3	20.4	23.6	24.5	24.9
Inventory Change	13.9	7.6	5.3	4.1	5.9
Net Exports	4.2	4.1	4.1	6.5	10.6
Exports	40.2	42.1	45.6	48.4	52.2
Imports	36.0	38.0	41.5	41.9	41.6
Government Purchases	126.5	140.3	148.7	148.4	144.0
Federal	65.4	74.6	78.1	73.4	64.4
State & Local	61.1	65.7	70.6	74.9	79.6
		Change From Historical Values			
Gross National Product	0.0	0.1	1.5	2.6	19.8
Personal Consumption Expenditures	0.0	–0.3	–0.4	1.1	8.3
Business Fixed Investment	0.0	–0.1	–1.6	–5.6	–6.2
Residential Structures	0.0	0.1	0.4	0.8	2.7
Inventory Change	0.0	–0.2	–1.1	–2.5	2.0
Net Exports	0.0	0.5	3.2	6.3	8.3
Exports	0.0	0.0	0.0	0.0	0.0
Imports	0.0	–0.5	–3.2	–6.3	–8.3
Government Purchases	0.0	0.1	1.0	2.5	4.7
Federal	0.0	0.0	0.0	0.0	0.0
State & Local	0.0	0.1	1.0	2.5	4.7

vantage which could occur due to relatively lower domestic prices and the time delay involved in exchange-rate adjustments. Because of this assumption, net exports in Alternative 2 are close to historical values.

As a result of these adjustments, real GNP generally remains below historical values throughout the simulation, and the unemployment rate is higher than historical values from 1968 until 1971. (Table 1.) The inflation rate, on the other hand, remains substantially lower than historical rates; for example, it is 1.8 percent in 1970 compared with the actual 5.5-percent rate.

These results suggest that a wage-control policy may be successful in controlling the rate of inflation. But while reducing inflation, the growth in real incomes may be insufficient to maintain employment at historical levels during much of the period of controls.

Evaluation of the Incomes Policy Simulations

Our analysis has focused upon the consequences of a change from historical experience in average hourly wages. The findings are dependent upon the behavioral structure of the MPS model as well as the assumptions we have imposed along the way. If the model results are to have any applicability, they should be carefully interpreted within that context. To round-out our analysis, we should also consider the consequences of alternative assumptions, as well as other factors which could modify our conclusions.

Sensitivity to Alternative Assumptions

The model results suggest that a program which controls wage-rate increases can, for a time, control the rate of increase in final prices without direct price intervention. The impact of wage controls upon real output and employment, however, remains uncertain. Under equally feasible alternative assumptions, the impact of wage controls upon output and employment can differ considerably.

In Alternative 1, we assumed that Federal grants-in-aid and transfer payments were determined in terms of nominal dollars. Under this assumption, we obtained a sizable boost in such expenditures in terms of the real goods and services they commanded, because prices were considerably lower than in the real-life situation. Again, we assumed that a price advantage would occur in the U.S. relative to foreign-priced products, and this resulted in a sizable increase in net exports and thus a large stimulus to domestic activity. In the final analysis, Wage Control-Alternative 1 resulted in lower inflation than we actually experienced over the 1967-70 period, as well as a lower unemployment rate and a higher level of income.

In Alternative 2, by contrast, we assumed that Federal policy with regard to grants and transfers was determined in real terms rather than nominal. We adjusted the model so that these expenditures equalled their historical real-dollar magnitudes, and, in doing so removed a good deal of economic stimulus. We also assumed that the incomes policy would be relatively neutral in its impact upon net exports, so that internationally-traded goods would not be affected by price changes brought on by the wage policy. This assumption kept net exports in Alternative 2 close to historical values. As a result, prices were kept lower, but unemployment rose and real income and output declined relative to their historical values.

Linkage Between Money and Price Changes

In the MPS model of the U.S. economy, the percentage change in prices over the long-run tends to equal the percentage change in the money supply. Price reactions to changes in money begin with changes in interest rates, and these lead to changes in the cost of capital and in the demand for real output. Changes in demand for final products lead to changes in

TABLE 3
Real GNP and Components—Historical Values and Values Under Wage Control—Alternative 2 (Billions of 1958 dollars)

	1966	1967	1968	1969	1970
			Historical Values		
Gross National Product	658.1	675.2	706.6	725.6	722.3
Personal Consumption Expenditures	418.1	430.1	452.8	469.1	477.4
Business Fixed Investment	74.1	73.2	75.6	80.1	77.3
Residential Structures	21.3	20.4	23.2	23.7	22.2
Inventory Change	13.9	7.7	6.5	6.7	3.9
Net Exports	4.2	3.6	0.9	0.2	2.3
Exports	40.2	42.1	45.6	48.4	52.2
Imports	36.0	38.5	44.7	48.2	49.9
Government Purchases	126.5	140.2	147.7	145.8	139.3
Federal	65.4	74.6	78.1	73.4	54.4
State & Local	61.1	65.6	69.6	72.4	74.9
			Wage Control—Alternative II		
Gross National Product	658.1	675.1	704.0	715.5	718.7
Personal Consumption Expenditures	418.1	429.6	451.1	465.6	476.5
Business Fixed Investment	74.1	73.1	73.7	72.9	67.5
Residential Structures	21.3	20.4	23.6	24.3	24.9
Inventory Change	13.9	7.6	4.9	2.9	4.1
Net Exports	4.2	4.1	2.5	2.6	3.9
Exports	40.2	42.1	45.6	48.4	52.2
Imports	36.0	38.0	43.1	45.9	48.3
Government Purchases	126.5	140.3	148.3	147.3	141.9
Federal	65.4	74.6	78.1	73.4	64.4
State & Local	61.1	65.6	70.2	73.8	77.5
			Change From Historical Values		
Gross National Product	0.0	–0.1	–2.6	–10.1	–3.6
Personal Consumption Expenditures	0.0	–0.4	–1.7	–3.5	–0.9
Business Fixed Investment	0.0	–0.1	–1.9	–7.2	–9.7
Residential Structures	0.0	0.1	0.4	0.6	2.7
Inventory Change	0.0	–0.2	–1.6	–3.8	0.1
Net Exports	0.0	0.5	1.6	2.4	1.6
Exports	0.0	0.0	0.0	0.0	0.0
Imports	0.0	–0.5	–1.6	–2.4	–1.6
Government Purchases	0.0	0.1	0.6	1.4	2.6
Federal	0.0	0.0	0.0	0.0	0.0
State & Local	0.0	0.1	0.6	1.4	2.6

labor demand, and these bring about changes in wages which in turn become the major determinant of prices. The imposition of controls on wage increases thwarts the major channel by which monetary changes lead to price changes. The blockage of this channel, however, will not eliminate the pressures upon prices precipitated by the initial change in the money supply. If an incomes policy is to have any long-run success in keeping prices down, long-run monetary growth rates must be consistent with the price objectives of the incomes policy. In our simulations, the historical M_1 money supply grew at a 5.5-percent average annual rate over the 1967-70 period. This rate is too high to support for very long the zero or one-percent rate of inflation implied by our wage-growth assumption.

Policy Implementation and Resource Allocation

We have not touched upon the difficult problem of implementing the intended incomes policy, because our econometric model simply assumes that the intended policy is successful. The important point to bear in mind is that the average wage is not a policy variable which can be manipulated by policy-makers, being unlike tax rates, federal expenditures, or discount rates in this respect. To achieve a desired growth in the average wage rate, policy-makers must exert some control over individual sector or industry wages and, unavoidably, their actions in doing so will change the relative price structure which would otherwise exist. Such interference in the marketplace can distort the operation of the pricing system which, even in markets characterized by large power groups, has proved to be a relatively efficient means of allocating resources in a complex society.

Implementation of an incomes policy apparently will have to be flexible enough to consider individual cases, in order to allow markets to allocate resources freely. Policy-makers in this situation try to insure that the average wage level does not drift upward, while allowing movement in the structure of wages to guide resources efficiently. Although this intention is clear in principle, its implementation presents a formidable task and constitutes one of the greatest problems facing incomes policy.

The results of our model simulations depend upon the policy-maker's success in dealing with problems of implementation, which have been recognized by supporters of wage guidelines, such as Sidney Weintraub and Robert Solow:

> A proper policy would maintain the average wage movement within the average improvement norm. Simultaneously it would seek to achieve a strong measure of equity between wage earners of similar skills. It must also aim to direct labor into industries, occupation, and geographical areas of most urgent need. . . . Policy implementation is difficult though the general principles are less recondite.[17]

> The guideposts are intended to have an effect on the general level of money wages and prices, not on relative wages and relative prices. Most of the things we expect free markets to accomplish are real things, more or less independent of the price level. Ideally, the guideposts should permit markets to allocate resources freely, insuring only that the price level does not drift up in the process. . . . In practice, the guideposts will operate unevenly; relative prices and resource allocation may thus be affected. . . . One can hope that the uneven effects of guideposts will be of second order. . . . This inevitable unevenness in operation strikes me as the main weakness in the guideposts.[18]

Income Distribution: Profits and Wages

Our experience with incomes policies suggests that it will be impossible to maintain any form of wage and/or price programs unless the policy is generally regarded as equitable.[19] As we indicated, the real purchasing power of labor income is likely to fall relative to profits when a wage-restraint policy is initiated. This unequal burden may stand in the way of successful policy implementation.[20]

Again, we have assumed restraints only on wages, largely because it seemed realistic to accept the falling-profits trend which actually occurred between 1967 and 1970. But in doing so, we have implicitly assumed that the resulting income distribution was acceptable to both labor and profit recipients, and to the extent that it is not true, the policy has little chance of success.

Summary and Conclusions

We have tried to answer the question: What impact would an incomes policy have upon U.S. economic activity? Our simulated incomes policy involved restricting the growth of the average wage rate in domestic nonfarm business to 3 percent a year, equal to the trend rate of growth in output per manhour in that sector since the late 1930's. We analyzed the impact of this policy on the U.S. economy from 1967.2 - 1971.2, employing simulation techniques in a version of the MPS model.

We presented results of the proposed wage-control program under two alternative sets of assumptions. The results generally suggest that a program which controls wage-rate increases can for a time control the rate of increase in domestic nonfarm prices without any direct intervention in prices. However, a wage-control program can have ambiguous effects on output and employment. The model results are sensitive to assumptions regarding the foreign sector's reaction to lower U.S. inflation, and regarding fiscal policy's impact on allocating funds (in either real or nominal terms).

Both alternative wage-control simulations suggest that labor's real income may decline relative to its historical value for some time after the institution of an incomes policy which restricts wage growth. In addition, labor's share of total income is likely to fall relative to the share of total income going to corporate profits. Under both simulations, however, business plant-equipment expenditures were somewhat less than their historical values, because nominal interest rates did not fall as rapidly as final prices while the real cost of capital remained higher than its historical cost. Finally, we should emphasize that we maintained the historical money growth and federal tax rates in our simulations, so that the results would reflect only the impact of keeping wage growth within the limits set by the long-run productivity trend.

FOOTNOTES

1. For example of forecasts, see **Sustaining a Balanced Expansion** (U.S. Congress: Congressional Budget Office, Washington, D.C., August 3, 1976), and the article, "UCLA Gives Forecast on Ford or Carter Economy," **Los Angeles Times,** September 24, 1976, p. III-13.
2. Ulman, Lloyd, and Flanagan, Robert J. **Wage Restraint: A Study of Incomes Policies in Western Europe.** Berkeley: University of California Press, 1971.
3. Okun, Arthur M. **The Political Economy of Prosperity.** New York: Norton, 1970.
4. Rasche, Robert H. "Simulations of Stabilization Policies for 1966-1970," **Journal of Money, Credit and Banking,** February 1973, pp. 1-25.
5. De Leeuw, Frank and Gramlich, Edward M. "The Channels of Monetary Policy," **Federal Reserve Bulletin,** June 1969, pp. 472-491, and Ando, Albert, "Some Aspects of Stabilization Policies, the Monetarist Controversy, and the MPS Model," **International Economic Review,** October 1974, pp. 541-571.
6. Nordhaus, William D., "Recent Developments in Price Dynamics," **The Econometrics of Price Determination,** Conference sponsored by the Board of Governors of the Federal Reserve System and Social Science Research Council, October 30-31, 1970, Washington, D.C. pp. 16-49.
7. For a detailed description of the price equation in the MPS model see George de Menil and Jared J. Enzler, "Prices and Wages in the FR-MIT-PENN Econometric Model," **The Econometrics of Price Determination, op. cit.,** pp. 277-308.
8. Consider a simplified adaptive expectations model in which expectations of a variable (x^e) are updated for each period by a fraction (a) of the discrepancy between the current observed value of the variable (x_t) and the value that had been accepted (x^e_t)

$$x^e_{t+1} - x^e_t = \alpha(x_t - x^e_t) \qquad (1) \quad \alpha < 1$$

(1)

Assume that the expected value of the variable, x_t^e, is some function of known variables; for simplicity, assume that

$$x_t^e = Bx_{t-1} \tag{2}$$

Then substitute (2) in (1),

$$x_{t+1}^e - x_t^e = \alpha(x_t - Bx_{t-1}) = \alpha x_t - \alpha Bx_{t-1} \tag{3}$$

9. We may simplify and rewrite equation (2) in order to emphasize the lag patterns associated with the key price-determinant variables.

$$\begin{aligned} \ln P_t = {} & .2901 \ln W + .0733\left(\frac{OUPD}{EPD}\right) - .0400\left(\frac{OUPD}{EPD}\right)_{-1} \\ & - .0014 \text{ TIME} - .0075 \sum_{i=0}^{7} \ln\left(\frac{XBNF}{LMHT}\right)_{-i} - .1174 \\ & + .7099 \ln P_{t-1} \end{aligned} \tag{3}$$

The presence of the lagged dependent variable ($P_{}$) means that we may replace that term by its equivalent, i.e., equation (3) lagged one period. This substitution will produce a variable in prices lagged two periods ($P_{}$) which may also be replaced with equation (3) lagged 2 periods, and so on. In this way, the distributed lag for each independent variable in the equation may be determined.

The coefficients associated with the lagged values of the natural logarithm of wages are as follows. Let lnW = w

$.2901w_t$	$.0372w_{-6}$	$.0047w_{-12}$	$.0006w_{-18}$
$.2509w_{-1}$	$.0264w_{-7}$	$.0034w_{-13}$	$.0004w_{-19}$
$.14622_{-2}$	$.0187w_{-8}$	$.0024w_{-14}$	$.0003w_{-20}$
$.1038w_{-3}$	$.0133w_{-9}$	$.0017w_{-15}$	$.0002w_{-21}$
$.0737w_{-4}$	$.0094w_{-10}$	$.0012w_{-16}$	$.0001w_{-22}$
$.0523w_{-5}$	$.0067w_{-11}$	$.0009w_{-17}$	

10. Gordon, Robert J., "The Impact of Aggregate Demand on Prices," **Brookings Papers on Economic Activity,** No. 3, 1975.

11. Wallich, Henry C. and Weintraub, Sidney, "A Tax-Based Incomes Policy," **Journal of Economic Issues,** June 1971, pp. 1-19.

12. Duggal, Vijaya G. and Klein, Lawrence R., "An Approach to Disinflation," **Wharton Quarterly,** Winter 1974.

13. The simulation programs used with the MPS model enable us to generate historical values, make any changes from actual values we wish, and then compare the two simulation results to obtain an estimate of the impact of the change. The program first simulates each of the model equations separately, using historical values as independent variables, and records the errors for each equation. Next, the equations are simulated simultaneously in the full model, using values of the variables generated by the model and adding the error made by that equation which was previously calculated. Each equation, simulated in this way, will reproduce the actual values except for some rounding errors. In the next simulation a change is made to some variable, such as wages, and the single equation errors previously calculated are added to each equation. The difference between the last two simulations is the measured effect of the change in the last simulation.

14. Simulation results which leave capital costs unadjusted are shown below. The table provides the change from historical values for the various components of GNP, and may be compared with the results shown in Tables 2 and 3 in the text. For the following simulation, the only change from history which we imposed upon the model was to set the rate of growth of wages at 3 percent annually. The inflation results were similar to Alternatives 1 and 2, and the unemployment results were 3.8% (1967); 3.5% (1968); 3.5% (1969); 4.3% (1970).

Real GNP—Change from Historical Values
(Billions of 1958 $)

	1967	1968	1969	1970
GNP	0.1	0.7	–2.3	9.4
Pers. Cons. Exp.	–0.3	–0.4	0.6	7.0
Business Fixed Inv.	–01	–2.0	–8.5	–13.3
Resid. Structures	0.1	0.4	0.8	2.8
Inventory Change	–0.2	–1.6	–4.5	–1.1
Net exports	0.5	3.3	6.7	9.1
Exports	0.0	0.0	0.0	0.0
Imports	–0.5	–3.3	–6.7	–9.1
Gov't. purchases	0.1	1.0	2.6	4.8
Federal	0.0	0.0	0.0	0.0
State & Local	0.1	1.0	2.6	4.8

15. See article in this **Review** by Kurt Dew, elaborating upon the formation of expectations.

16. It should be noted that this reduction in labor's income share is the result of the incomes policy assumption as well as the particular mix of monetary and fiscal policy that existed in the historical period. If policy-makers do not desire such a shift away from labor income, they could try to redistribute income toward labor through a tax or transfer program.

17. Weintraub, Sidney, **Keynes and the Monetarists,** New Brunswick, N.J.: Rutgers University Press, 1973.

18. Solow, Robert M., "The Case Against the Guideposts," **Guidelines** (Schultz, George P. and Aliber, Robert Z., editors), Chicago: University of Chicago Press, 1966.

19. On this point, see Anne Romanis Braun, "What is Incomes Policy and What Can it Achieve?" **Finance and Development,** April, 1975.

20. For this reason, a policy which restrains wages may be accompanied by some rules to restrain the growth in profits. A "Fair Shares" incomes policy has been suggested by Duggal and Klein (footnote 12). Under their proposal, nominal wages and profits both would increase at the same rate, which is equal to a trend rate of growth in productivity. This policy has the effect of stabilizing labor and profit shares in the distribution of national income. In particular, the extra funds collected from corporations would be plowed back (through federal programs) into the income stream, where they could generate additional income and jobs. Thus, Federal programs have the ability to counter the initial adverse effects on real wages created by incomes policies.