The Link Between Money and Prices – 1971-76

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THAT group which gathers under the banner of monetarism has long blamed excessive monetary expansion as the source of inflation. They have argued that inflation, as a persistent increase in the general price level, results solely from a maintained expansion of the money stock at rates in excess of increases in the amount of money demanded in the economy.

The validity of this view, or at least its usefulness, rests on the issue of whether or not its predictions are consistent with the evidence.[1] The purpose of this exercise is to subject the money-price hypothesis to a test, using the experience of the past five years for evidence. This period is particularly useful in this context since it was unique in the number and magnitude of nonmonetary shocks to the economy. Price controls, devaluations, agricultural problems, new government regulations, the actions of OPEC (Organization of Petroleum Exporting Countries) and disappearing anchovies, among others, worked on the pattern of prices. The question is how these factors fit, if at all, in the money-price hypothesis and how well the hypothesis "performs" in such an environment.

The Money-Price Connection

The notion that inflation is a monetary process is based on the conception of "money" as that asset which minimizes transaction costs in the economy. The cost of the services derived from any money holdings, like that of other assets, are consumption opportunities that are foregone as long as the money is held in inventory. In this sense the price of money is the inverse of the general price index, properly weighted to include the prices of all consumption opportunities, current and future.[2] This view implies that disequilibrium in the market for money, with a given stock, can be eliminated only through a change in the general level of prices or the emergence of some force that works to shift the demand for money to equate the amount demanded to the stock supplied, at existing prices.

A fundamental tenet of what has come to be called the monetarist position is that the second situation is not likely, in the sense that disequilibrium in the market for money does not set into motion forces in other areas of the economy which then work to shift the demand for money, with little or no change in the existing price level. Similarly, this position denies the possibility of factors outside of the market for money generating a permanent change in the rate of inflation, without creating a situation of permanent excess money supply. Thus inflation, as a *continuing* increase

[1]Recently, Michael Levy attempted to provide evidence to refute the money-price linkage by showing that other variables, such as unit labor costs, capacity utilization rates, and measures of inflation severity and sensitivity, "explain" prices better than does money. Levy's effort falls far short, however, in that his tests were based on a basic misrepresentation of the theory which says inflation is a monetary phenomenon. The analysis presented here is addressed to this misconception and attempts to point out how much can be gleaned from the popular "evidence." See Michael E. Levy, "Constraining Inflation: Concerns, Complacencies, and the Evidence," *The Conference Board Record,* National Industrial Conference Board, Washington, D.C., October 1975, pp. 8-14. For a similar analysis and a critical discussion, see Peter Fortune, "An Evaluation of Anti-Inflation Policies in the United States" and "Comment" by William Poole in Federal Reserve Bank of Boston, *New England Economic Review* (January/February 1974), pp. 3-34.

[2]The general price level thus is more extensive than is accounted for by current price indexes, which typically include prices of output, but ignore the prices of existing assets. This raises very interesting questions for the issue at hand, but they will be ignored – in the spirit of commonly practiced macroeconomic analysis. See Armen A. Alchian and Benjamin Klein, "On a Correct Measure of Inflation," *Journal of Money, Credit and Banking,* February 1973, pp. 173-91.

in the general level of prices, is a manifestation solely of a persistent excess of money supplied at existing prices, and the money supply, in turn, is the result of actions by the monetary authorities.

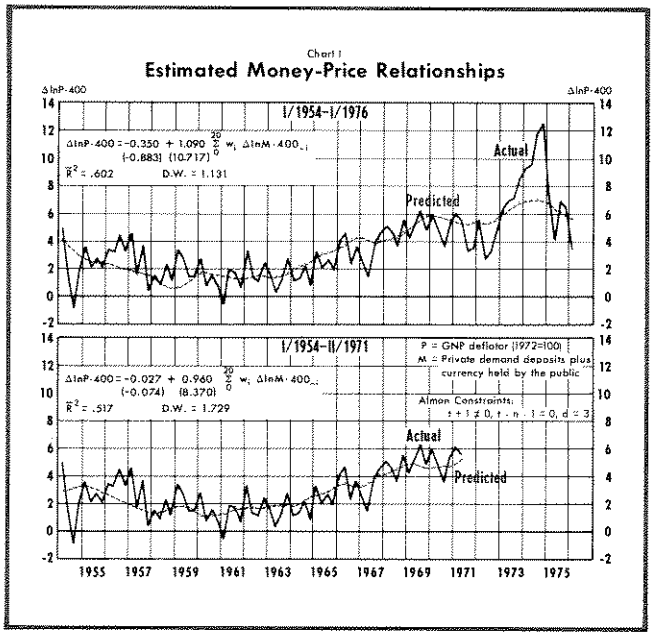
Empirically, this argument implies that the rate of change of prices can be expressed as a function of the rate of change of the money stock. With some regard for lags in adjustment, an equation of the following form is implied:

$$(1)\quad \Delta \ln P = \alpha_0 + \alpha_1 \sum_{0}^{n} w_i \Delta \ln M_{-i} + \mu$$

where $\alpha_0 = 0$ and $\alpha_1 \Sigma w_i = 1.0$, and μ demonstrates all of the usual nice properties. This equation says only that the fundamental rate of inflation is reflective of the long-term rate of monetary expansion. The exclusion of nonmonetary factors from the equation reflects the view that these factors can have only a temporary effect on the rate of change of prices.[3] The equation has been estimated for the period I/1954 - I/1976, with n = 20. Prices are measured by the GNP deflator and the money stock is taken to be composed of currency in the hands of the public plus private demand deposits. The fit is shown in Chart I. The explanatory power of the regression is reasonably good through most of the sample period, with the glaring exception of 1971-74. The errors in this period are the point of interest in this paper.

The period since mid-1971 is rather unique in the postwar period and offers a rare opportunity to test the money-price connection in that so many factors were working to disturb the relationship. Comprehensive price controls were introduced in August of 1971, and fiddled with over the next two and a half years. The formal arrangements on international exchange rates and payments collapsed under the pressure of diverse national economic policies. The agricultural sector was buffeted by price controls and massive and unexpected foreign demand. Finally, the oil embargo, the increase in the price of petroleum, and the government's programs aimed at the energy situation worked to increase the price of energy dramatically.

Chart I
Estimated Money-Price Relationships



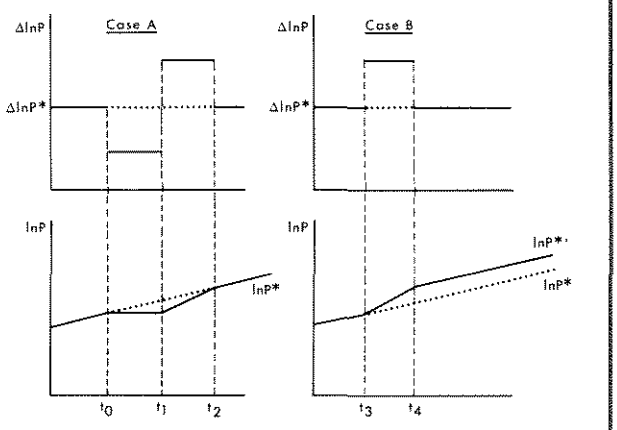
It is not sufficient to investigate the validity of the money-price hypothesis on the basis of the predictive power of equation (1) for a period like 1971-74, for the equation is specified on the presumption that other autonomous factors had no significant impact on the rate of change of prices during the sample period. Obviously, this was not the case over the past five years. The Durbin-Watson statistic (D. W. = 1.131) is indicative of an omitted-variable problem in the 1954-76 sample period. However, when equation (1) is run over the period I/1954 - II/1971 (Chart I), there is little indication of serial correlation (D. W. = 1.729). This suggests that, while equation (1) might have been a reasonable proposition, something caused it to go wrong in the 1971-74 period. The evidence suggests that nonmonetary factors were influencing the rate of inflation in this period.

The relevant point is not that nonmonetary factors affected the price level; instead, the focus is on the manner in which such influences are held to operate in the monetarist framework. In summary, the monetary explanation of inflation views these factors as being incapable of exerting a *lasting* influence on the rate of change of the general price level. Some factors,

[3]It is important to keep in mind that equation (1) is not intended to "explain" each and every wiggle in the rate of change of prices, but instead is a short-hand description of the fundamental inflation process. As such, it does not include those factors which have a temporary or short-run impact on the rate of price change. While this caveat might give the impression of defining away the problem, it is intended only to forestall arguments to the effect that some other price equation, based perhaps on measures of wages, productivity, and utilization rates, better "explains" the price data and thus is a better representation of the inflation process. These alternatives typically are structural equations, with endogenous variables on the right-hand side. Equation (1) is offered as a reduced form, where several potential exogenous shift variables have been excluded. As such, it is not offered in competition with structural price equations. In fact, it can be shown that models which incorporate the standard type of price equation can yield equation (1) in their reduced form. Leonall C. Andersen and Denis S. Karnosky, "A Monetary Interpretation of Inflation" (a paper presented to the Conference on Price Behavior, National Bureau of Economic Research Conference on Research in Income and Wealth, November 21, 1974).

Chart II

Effects of Nonmonetary Factors



however, are capable of affecting permanently the level of prices.

The various factors which have arisen since 1971 can be divided into two general categories: (A) those that temporarily affect the price level, relative to that consistent with monetary conditions, and (B) those that permanently displace the price level.

Referring to Chart II, Case (A) is descriptive of the monetarist handling of the effects of a shock like general price controls, instituted at t_0 and maintained until t_1, where the interval $t_1 - t_0$ is "reasonably" short. The duration of the control program is important because there is no doubt that differential price controls, if maintained for a long period of time or, at least, announced to be long-lasting, can be expected to affect in a fundamental way the allocation of resources within the economy. The consumption-investment pattern probably would be affected, and with it, wealth, and therefore the demand for real money balances. With an unchanged money stock, or a constant rate of increase, desired and actual real balances would be equated by a change in the general level of prices, but probably upward.[4]

In Case (A), the price level is temporarily displaced from that consistent with monetary conditions (P^*). Since price controls typically are aimed at those prices which are included in the price indexes, the data will show a noticeable deceleration of price change during the period that controls are in place ($t_1 - t_0$).[5] Once the controls are removed, however, prices adjust upward to the level dictated by the monetary situation, and the observed rate of change will increase sharply (period $t_2 - t_1$).

During the interval ($t_2 - t_0$) equation (1) would show abnormally large errors; overpredicting the rate of price change during the period of controls ($t_1 - t_0$) and underpredicting in the immediate post-control period ($t_2 - t_1$). Thus, the errors generated by a relationship like equation (1) in a period like ($t_2 - t_0$) are not sufficient to refute the money-price linkage. In fact, such an occurrence could be construed as offering evidence in support of the theory which yields equation (1), *if the price level returns to the path dictated by the rate of monetary expansion.*

Case (B) is somewhat more complicated, but then it is also more interesting. This situation is descriptive of the manner in which the monetarist framework views the impact of cost-push factors — autonomous decreases in aggregate supply resulting from nonmarket increases in factor prices, maintained by increased unemployment of those factors. For many years concern has been directed at labor as the prime source of such pressure, but the evidence has been far from conclusive on the willingness of labor to undertake such a policy.[6] OPEC has been quite generous, however, in creating a situation which comes as close to a laboratory experiment on this issue as economists could ever hope for.

The significant increase in the price of energy which has resulted since the oil embargo of late 1973 represents exactly the type of pressure typically identified with cost-push inflation. The oil price increase represents an unexpected and substantial rise in the cost of production across a large segment of the economy and, as such, results in a decrease in the productive capacity of the economy. Many processes now in place, implemented with some expectation of absolute

[4]On a more pedestrian level, the shift in resources between markets would destroy whatever small validity there remains of the fixed weight price indexes currently in use.

[5]Witness the remarks of James W. MacLane, Deputy Director of the Cost of Living Council under the Nixon administration: "These two items, beef and oil, have a large impact on the overall Consumer Price Index, and that is why we are keeping the price freeze on beef until September 12, and keeping a price ceiling on gasoline." *New York Journal of Commerce,* July 31, 1973.

[6]It is irrelevant that labor might act on the supposition that the monetary authorities will validate wage increases in excess of productivity gains, hoping thereby to avoid the increase in unemployment. That is a policy decision, reflected in the relative weight given to unemployment in the policy deliberations of the monetary authorities. Even though the money supply would then appear to be endogenous, relative to the wage rate, the fact remains that the monetarist position holds that in the absence of the increased rate of money growth, the rate of change in the general price level will not be affected in a permanent way by the increase in factor prices.

and relative factor prices, are made obsolete by the unexpected increase in energy prices. The effect is exactly that which would be associated with an autonomous rise in wage rates above that justified by increased productivity. With aggregate demand unchanged, an increase in the level of prices and a decrease in the rate of production would result.

So long as OPEC is willing to tolerate the reduced rate of oil production that their price actions cause, the wealth of the United States and others is permanently decreased. One manifestation of this wealth loss is a one-shot decrease in the demand for real money balances. With the money stock unchanged, or growing at the prior trend rate, equilibrium in the market for money is restored by a one-shot increase in the general price level. During the interval of this adjustment $(t_4 - t_3)$ the rate of change of prices will be seen to rise above the rate consistent with the rate of money growth. However, once the price level has adjusted, the *rate of change of prices* would return to the fundamental inflation rate consistent with the rate of monetary expansion.

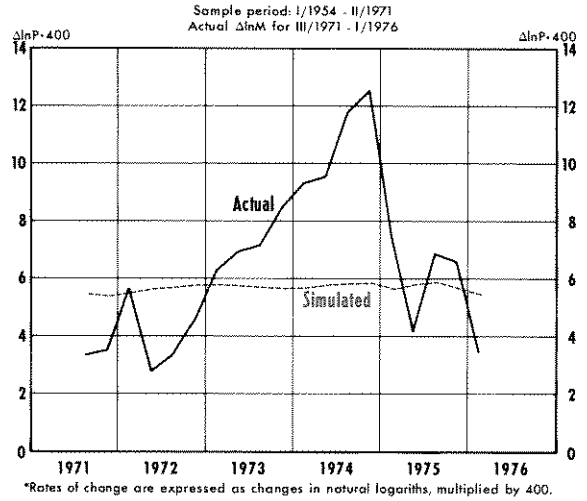
Through this period of adjustment the rate of price change would exceed that predicted by the rate of money growth. But, as in Case (A), care must be taken in viewing this experience as evidence contrary to the monetarist position. The monetary hypothesis says that nonmonetary factors can have only temporary effects on the rate of inflation, not that they can have no effect at all. The key to analysis of a situation like the change in energy prices is the behavior of the rate of price change after the adjustment to the initial shock. The monetarist position holds that, for a particular rate of money growth, the price level that results will be a constant proportion $(1 + p)$ of that consistent with the rate of monetary expansion. This is shown in the lower-right panel of Chart II, where, after adjustment at (t_4), the new price level increases at the same rate and thus runs parallel to P*.

Such a prediction is in direct contrast to that yielded by the more common view of cost-push inflation where an autonomous nonmonetary shock to aggregate supply is sufficient to set off a wage-price spiral which feeds on itself, independent of monetary developments.[7] It is not appropriate to hedge this

[7]Levy, for example, goes so far as to conclude that monetary actions have little direct influence on the rate of inflation, once factors such as unit labor costs, capacity utilization rates, and expectations are accounted for. In the context of his analysis, an increase in wages above gains in productivity raises unit labor costs and then prices. Such action then is sufficient to increase the rate of inflation permanently, with no recourse to whether or not the monetary authorities expand the money stock in response. See Levy, p. 12.

Chart III

Ex ante Simulation of Equation (1)



*Rates of change are expressed as changes in natural logarithms, multiplied by 400.

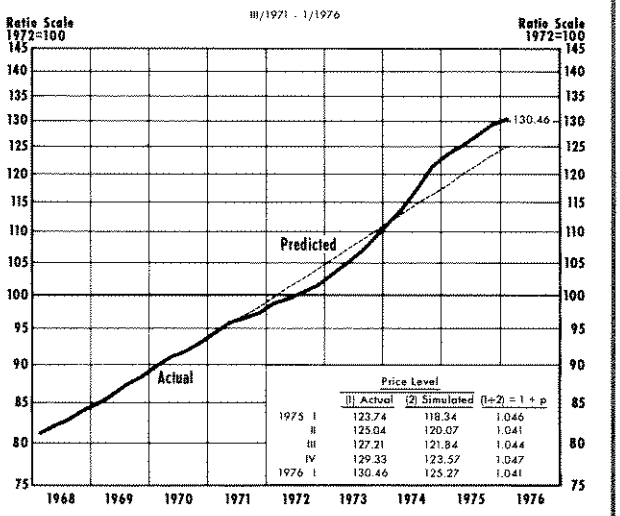
position in the current context, on the observation that the substantial rise in unemployment since mid-1974 has muted somewhat the thrust of the wage-price spiral. That point is, after all, an element of the alternative hypothesis — namely that autonomous increases in prices above market clearing levels can be maintained only through the acquiescence of the unemployed.

A Look at the Evidence

How well does equation (1) hold up in the face of the numerous nonmonetary shocks which have beset the economy since 1971? A preliminary indication is given by the predictions of equation (1) estimated from a sample ending in mid-1971 and simulated over the period III/1971 - I/1976 using the actual pattern of money growth. This simulation, shown in Chart III, yields errors in the 1971-76 period similar to the regression errors for the same period, which are presented in Chart I. The rate of price change is overestimated through 1972 and underestimated in 1973-74. The prediction errors since 1974 are more in line with the regression residuals in the 1954-71 sample period. The errors resemble generally the cases shown in the upper panels of Chart II, where the economy moves sequentially through Cases A and B.

But what of the price level? Using the actual level of the GNP deflator in II/1971 as the base, the price level implied by the simulation of equation (1) can be computed by accumulating the predicted rates of change. The results are presented in Chart IV and

Chart IV
Price Level Implied by Ex ante Simulation of Equation (1)



Price Level

	(1) Actual	(2) Simulated	(1÷2) = 1 + p
1975 I	123.74	118.34	1.046
II	125.04	120.07	1.041
III	127.21	121.84	1.044
IV	129.33	123.57	1.047
1976 I	130.46	125.27	1.041

are compared to the reported index. The predicted price level is above the reported deflator through 1973 and below thereafter.

The significant observation, however, is the behavior of the price level since 1974. The reported price index through the year runs almost parallel to that predicted by equation (1), averaging about 4.5 percent higher. This observation is consistent with the prediction that the various nonmonetary factors (with the union of government regulations and OPEC preeminent) that have worked to increase costs of production since mid-1971 have caused a one-time decrease in productive capacity, and with the rate of monetary expansion unchanged, an equal one-shot increase in the general level of prices.

. . . *But So What?*

These results show that, within the monetarist framework, the predictive performance of the money-price relationship over the past five years is not sufficient to reject the position that only money matters for inflation, as a *continuing* increase in the general level of prices. This does not say that the money-price hypothesis is proven true, but only that some of the often cited evidence does not show it to be false. As with any hypothesis that has not been refuted by evidence, acceptance of the money-price process remains a matter of confidence and is conditional on the results of further testing. Beyond providing the opportunity for some nose-thumbing to the critics of monetarist doctrine, however, the argument and evidence presented here have serious implications. If, in fact, the domestic price level has been significantly and permanently displaced by an autonomous decrease in wealth, then much of the current debate about the nature of the inflation, unemployment, and degree of capacity utilization are misplaced.

Consider the implications of a 4.5 percent increase in the price level for the productive capacity of the economy. The argument presented earlier explained this price increase as a non-recurring wealth effect. The channel through which this impact is transmitted is the productive capacity of the economy.[8]

The autonomous 4.5 percent increase in the price level in 1974 suggests an approximately equal decrease in productive capacity. The reasoning should be fairly obvious, especially in view of much of the work done on the effects of costs of information and adjustment on economic activity, especially investment. In a world where the mix of factors of production is expensive to change once production processes are put in place, an unexpected increase in a factor cost (in this case, energy) renders some portion of vintage capital obsolete. The immediate effect is a contraction of productive capacity. Vested production processes simply cannot be used profitably at the same rate as had been consistent with prior expectations about energy prices. Nothing happens to the productive capacity in an engineering sense, but the economically efficient rate of production is slashed.

In the normal course of events such an autonomous shift in relative factor prices would induce attempts to alter factor proportions, within the constraints imposed by adjustment costs. Other factors, including labor, would become relatively attractive and the demand for these other factors would increase — *relative* to energy. A problem would be expected to rise quickly, however, since the attention of "labor" will be directed at the *absolute* wealth loss they suffered, as

[8]The argument presented here is akin to that found in Edmund S. Phelps, "Stopover Monetarism: Supply and Demand Factors in the 1972-74 Inflation" (*Proceedings of a Conference on Japan-U.S. Economic Policy*, American Enterprise Institute, 1975), pp. 51-68. See also A. B. Balbach and Denis S. Karnosky, "Real Money Balances: A Good Forecasting Device and a Good Policy Target?" this *Review* (September 1975), pp. 11-15.

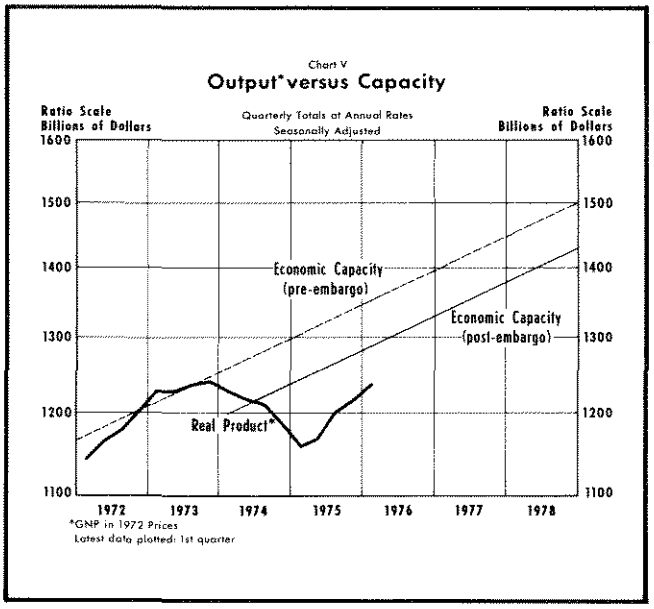
A clear statement of the alternative argument that the recession can be explained in terms of a decrease in aggregate demand induced by the decrease in real income suffered because of the increase in energy prices is found in Robert J. Gordon, "Alternative Responses of Policy to External Supply Shocks," *Brookings Papers on Economic Activity*, No. 1, 1975, pp. 183-204.

measured by the rise in the general price level.[9] The situation is further confused by the increased short-term, structural unemployment caused by the differential effect of increased energy prices on various segments of the economy. The actions of labor to resist absorbing their share of the aggregate wealth loss and government actions to reduce the burdens of rising unemployment would retard the factor substitution process and extend the duration of unemployment.

The end result would be pressure on the stabilization authorities to do something to stimulate employment with aggregate actions. As the price level adjustment to the wealth decrease runs its course, the rate of price change would fall toward the fundamental rate of inflation, currently about 5.5 percent per year, as shown by the results presented here. However, those analysts with a penchant for the Phillips-curve framework would view the deceleration of inflation and concurrent high or rising unemployment as reflecting restrictive stabilization actions.[10] The call would be for more concern about unemployment and less for inflation, that is, stimulative policy.[11]

This analysis is faulty, in the monetarist view, in that it misinterprets the economic data. Much of the decline in production in 1974 was due to the autonomous constriction of profitable production ventures. As such, it was beyond the control of the monetary authorities. This runs contrary to the analysis that the recession resulted because the government (that is, the Federal Reserve) did not increase the money supply to offset the increase in oil prices. The money-price hypothesis says that, if anything, the money stock could be reduced in order to avoid the increase in the price level, but in no way would monetary actions have much of a permanent expansionary effect on output. The economic contraction could be cushioned temporarily, but at the cost of a permanent increase in the rate of inflation.

In the same vein, much of the subsequent increase in unemployment, resulting from the interaction of



the wealth decrease, adjustment costs, and frustrated expectations, was not responsive, in any lasting sense, to stimulative actions of the Federal Reserve. Much of current unemployment is more of a problem of the legal infrastructure of the economy than it is one of deficient aggregate demand. As such, the problem requires structural change in the form of easing restrictions on the operation of markets, and not more money.

The effect of the autonomous shocks of the past few years on the productive capacity of the economy is shown in Chart V. The sustainable, long-term expansion path for total production in the economy, prior to the oil embargo, is labelled "Economic Capacity (pre-embargo)." This is a measure of the production potential of the economy, in the absence of such factors as the quadrupling of oil prices and new government safety, environmental and resource allocation programs. The analysis presented here suggests that this rate of production is no longer achievable, without fundamental change in the structure of the economy or an ever accelerating inflation. The new productive capacity is estimated to be 4.5 percent lower, as shown by the line labelled "Economic Capacity (post-embargo)."[12] By this measure total product in the first quarter of this year was 96.2 percent of capacity, as opposed to 91.9 percent of the old capacity measure. In other words, the economy is much closer to full employment than many analysts claim. For labor, this suggests that the *full employ-*

[9]One area where this would be manifested, albeit indirectly, is the escalator clauses in labor contracts.

[10]For example, the rate of change of prices fell from 11.4 percent in 1974 to 6.0 percent over the first half of 1975. The rate of unemployment rose from 7.2 percent of the labor force in December 1974 to 8.9 percent at mid-1975.

[11]See, for example, U.S. Congress, Hearings Before the Joint Economic Committee, *The 1975 Economic Report of the President*, 94th Congress, 1st Sess., February 5, 6, 7, and 14, 1975, pp. 534-49.

[12]This estimate does not incorporate the possibility that the trend rate of growth of productive capacity might also have been affected.

ment rate of unemployment is much higher, at least for the next several years, than previously.

Summary

The immediate purpose of this exercise is to present an empirical test of the proposition that inflation, as a continuing increase in the general level of prices, is everywhere a monetary phenomen. The test is severe, being based entirely on a rare situation characterized by the emergence of a large number of nonmonetary forces which many analysts claim to have an effect on the rate of inflation. The evidence shows the money-price hypothesis to be unscathed. The hypothesis is still refutable, but other forms of evidence are required.

The analysis implies that current measures of aggregate capacity utilization overstate the amount of slack in production that can be taken up through stimulative monetary and fiscal actions. This means that the economy will encounter an effective capacity constraint long before current measures of unemployment and capacity signal the danger. More than four percent of the productive capacity was destroyed by the events of the past few years. This potential is restored neither quickly nor cheaply.