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Reflections on Money and Inflation

by William T. Gavin

Economist William T. Gavin writes on issues in monetary theory and monetary policy for the Federal Reserve Bank of Cleveland.

Current economic forecasts indicate that inflation will reach 4 percent to 5 percent in 1984. These forecasts have been made in an environment of unprecedented acceleration in the growth of the money supply. People who are accustomed to thinking of inflation as a monetary phenomenon will experience a sense of déjà vu. Throughout the 1960s and 1970s, forecasters and policymakers underpredicted the basic trend of the price level. These predictions led to errors in both the public and private sectors of the economy. By now, these errors, and their consequences, have been well documented. However, our inflationary heritage should prompt us to question recent forecasts of so little inflation in the face of so much money supply growth.

The link from money to prices is characterized by a long and variable lag. There are many reasons for this variability. We do not have empirical measures of either inflation or money that correspond to the theoretical concepts of inflation and money in economists' models (see Alchian and Klein 1973).[1] Since the measures of money and inflation that we use will approximate ideal measures only on average over extended periods, we should expect that the relationship between the two will be a long and variable one. Additional explanation for the long and variable lag can be found in the literature of monetary economics (see Friedman and Schwartz, for example). What is most relevant in this short note is that the "money-causes-prices" hypothesis offers a simple, reliable, and long-term perspective on inflation.

People who predict inflation with the quantity theory of money do not necessarily deny the sort of short-term price formation process outlined by Kowalewski and Bryan in this issue of the *Economic Review*. For some purposes, understanding the process of short-term price formation is quite useful. However, to use their framework for longer-term

1. *See also* Improving the Monetary Aggregates, *Staff Papers, Board of Governors of the Federal Reserve System, 1978.*

inflation forecasts requires knowledge of many variables and entails many risks. The quantity theory approach is attractive, because it requires fewer variables and because it performs over broad sweeps of time.

The Money Connection

We begin by considering the past relationship between money and prices. The average annual inflation rate for the United States since 1960 is shown in table 1, column 2. Between 1960 and 1980, the rate of increase in the GNP implicit price deflator has grown rather steadily from 1.4 percent in 1960 to 9.7 percent in 1980. The low rates in 1971–72 probably reflect the Nixon administration's wage and price controls. The high reported inflation rates in 1973 through 1975 reflect the relaxation of those controls and the temporary increase accompanying the quadrupling of world oil prices.

To illustrate the connection between past money growth and current inflation rates, the average money supply growth over the three previous years is shown in table 1, column 3. As expected, there is no clear relationship between short-run changes in the money supply and the price level. However, the trends over time clearly correlate.

The annual percentage increase in wages is shown in column 4. The trends in wages,

Table 1 Long-Run Trends in Prices, Money, and Interest Rates

Year	Inflation rate[a]	Money supply growth,[b] 3-year moving average	Wage growth, average annual percent change	Aaa corporate bond rate	*Ex post* real interest rate	Actual money growth,[b] year-to-year percent change
1960	1.4	1.9	3.7	4.4	3.0	0.4
1961	1.0	1.8	3.5	4.3	3.4	2.9
1962	2.0	1.7	3.9	4.3	2.3	1.8
1963	1.5	2.9	3.5	4.3	2.7	3.9
1964	1.4	3.3	4.4	4.4	3.0	4.3
1965	2.4	4.2	3.7	4.5	2.1	4.3
1966	3.7	3.8	6.0	5.1	1.5	2.8
1967	3.0	4.4	5.3	5.5	2.5	6.2
1968	4.7	5.3	8.1	6.2	1.5	7.1
1969	5.4	5.7	6.1	7.0	1.7	3.8
1970	4.9	5.2	6.5	8.0	3.2	4.8
1971	4.6	5.0	5.7	7.4	2.8	6.5
1972	4.2	6.5	7.3	7.2	3.0	8.1
1973	6.9	6.7	7.6	7.4	0.6	5.6
1974	9.7	6.1	10.3	8.6	-1.1	4.7
1975	7.4	5.0	7.8	8.8	1.4	4.9
1976	4.5	5.2	8.0	8.4	3.9	6.0
1977	5.9	6.2	7.3	8.0	2.1	7.9
1978	8.1	7.2	8.5	8.7	0.6	7.9
1979	7.8	7.6	8.8	9.6	1.8	7.2
1980	9.7	7.3	10.2	11.9	2.3	7.0
1981	8.3	6.4	8.6	14.2	5.8	5.0
1982	4.3	6.7	6.9	13.8	9.5	8.1
1983	4.0	7.4	4.7	12.0	8.1	9.2

a. The inflation rate is measured as the average annual percent change in the GNP implicit price deflator.

b. Because historical data were not available at press time, the M-1 data used in these calculations do not reflect revisions made in February 1984.

SOURCES: Board of Governors of the Federal Reserve System; U.S. Department of Commerce; and Moody's Investor Service.

prices, and monetary growth all display the same upward sweep between 1960 and 1980. Almost any price index for a broad category of goods or services will display this same trend. The final nominal price listed in table 1 is the Aaa corporate bond rate. Market interest rates also show this same upward trend.

Interest rates are determined in markets for loanable funds. As do other prices, interest rates fluctuate with changes in supply and demand. The market interest rate has two components—a premium for expected inflation and the real interest rate. The premium for expected inflation is the amount that borrowers must pay lenders so that the real value of the funds loaned is maintained over the life of the contract. The real interest rate is the market interest rate minus the expected inflation premium. In the long run, the real interest rate is independent of both reported inflation and money supply growth. From 1960 to 1980, there was no trend in the real interest rate series (column 6), as there was in the other series.

It has been the aim of monetary policy for a number of years to reverse the inflationary trend common to all of the variables in columns 2 through 5 of the table. This policy was presented as a way to reduce money supply growth gradually until the inflation trend was eliminated. The decline in prices and wages since 1980 suggests that the Federal Reserve has moved toward that goal. The average annual increase in wages fell quickly and evenly, about 1.8 percentage points each year, from 10.2 percent in 1980 to 4.7 percent in 1983. There has been a similarly large, but not as even, drop in the inflation rate from 9.7 percent in 1980 to 4 percent in 1983. Most of that decline—over 4 percent—occurred in 1982. From column 3 of the table, it is apparent that the three-year average growth of money did not slow by much in 1981 and, in fact, increased in both 1982 and 1983. The actual yearly pattern was much more volatile (column 7). M-1 growth peaked at 7.9 percent in 1978 and declined to 7.2 percent in 1979 and to 7.0 percent in 1980. M-1 growth declined further to 5.0 percent in 1981, but in the next 2 years M-1 growth accelerated to 8.1 percent and 9.2 percent, respectively. How could this pattern of money growth be responsible for such a sharp deceleration in inflation? Did not the 1981–83 acceleration in money growth merely offset the 1978–81 deceleration?

Putting Velocity in Perspective

The quantity theory of money implies that trends in money growth can be used reliably to predict inflation if a stable relationship exists between money and GNP, or if changes in the velocity of money are predictable within a narrow range. If velocity were to change over time simply as a function of time itself, velocity could be predicted far into the future and the Federal Reserve could set targets for money far into the future as well. However, if velocity is a function of many factors that could change over time, it would be imprudent to set money targets for many years ahead and not adjust them if velocity veered from its expected course.

The long-run trend in velocity depends on the stage of development in the market economy and on factors that determine the costs and benefits of holding money. An examination of M-1 velocity from 1915 to the present reveals three periods during which velocity shows distinctly different trends (see figure 1). During 1915–30 velocity growth was approximately zero on average; during 1930–45 velocity declined considerably; and during 1945–80 velocity grew steadily. *Within* each of these periods, velocity growth was reasonably predictable, but at the time of transition from one of these historical periods to the next, velocity growth was uncertain.

Currently, it is not clear whether M-1 velocity is establishing a new trend. When velocity declined precipitously in the first half of 1983, analysts contended that a new trend was emerging; when velocity rebounded strongly in the second half of 1983, analysts held that the performance of the first half was merely an aberration. To complicate matters further, it is likely that revised data for 1983 show only a moderate decline and rebound in velocity.

Deregulation and Velocity

The unusual behavior of M-1 and its velocity since 1981 remains somewhat mysterious, but it is most likely because of the transition effects stemming from the Depository Insti-

Fig. 1 Velocity of Money: 1910–83

SOURCE: Board of Governors of the Federal Reserve System. There is a break in the series in 1960, because the definition of money differed after 1960.

tutions Deregulation and Monetary Control Act of 1980. The implementation of this law changed many of the regulations governing the payment of interest on bank deposits. These regulations changed the opportunity cost of holding money balances and may have caused a temporary surge in M-1, as people shifted savings balances into NOW (negotiable order of withdrawal) and Super-NOW accounts (both included in M-1). The new regulations may also have resulted in a permanent shift in the amount of money that people would be willing to hold, given the level of economic activity. The large growth rates of M-1 in 1982 and 1983 are consistent with the notion that people shifted savings balances into NOW and Super-NOW accounts. The slowdown in the second half of 1983 could indicate an end to this transition.

Some people contend that, since enactment of the Monetary Control Act, M-1 has become more like historical definitions of M-2. If M-1 grows 6 percent in 1984—the midpoint of the 4 percent to 8 percent range suggested by the Federal Reserve in February 1984—then the three-year average M-1 growth would be approximately 8 percent in 1984. Depending on how much M-1 has become like M-2, the inflation trend would probably fall between 5 percent and 8 percent. This range is somewhat higher than ones posted by forecasters who do not rely heavily on money growth rates.

Unfortunately, it is difficult to be confident about the inflation outlook because of recent erratic behavior in the velocity of money. When errors in prediction of velocity become unusually large, the simple quantity theory approach becomes less reliable, and the basic factors determining velocity itself must be examined. Once this Pandora's box is opened, quantity-theory inflation forecasters might appreciate the difficulties that confront inflation forecasters who use a GNP-gap approach (e.g., Kowalewski and Bryan). And they can wish that velocity will soon become predictable again and remain so for a long time.

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The Outlook for Inflation

by K.J. Kowalewski and Michael F. Bryan

The authors are economists with the Federal Reserve Bank of Cleveland. Sections of this paper draw heavily from unpublished research of the Federal Reserve Bank of Cleveland.

The past three years have witnessed a dramatic decline in the rate of inflation in the U.S. economy. Over the twelve months ending in December 1983, consumer prices as measured by the Consumer Price Index fell to a 3.7 percent rate of growth, its slowest pace in over a decade. Because this *disinflation* occurred as the U.S. economy suffered three years of economic slack, we might question whether a return to a period of prolonged economic growth would coincide with a reacceleration of prices. Given the high costs already incurred in bringing down inflation to its current pace, the potential for renewed price pressure is possibly a more urgent issue now than ever before.

This article addresses the prospects for returning to a higher inflationary track during the current economic recovery. Section I contains an overview of the past behavior of prices and wages during periods of recovery. Section II outlines a framework of price and wage behavior. Section III examines the prospects for recovery price behavior in light of historical precedent, current economic conditions, and both fiscal and monetary policies.

I. The Past Is Prologue

One reasonable place to begin an analysis of the recovery price outlook is to examine the price indexes themselves and how prices and wages have behaved in previous recoveries.

Taken at face value, the evidence of past experience is encouraging for 1984. Three major price indexes (the Consumer Price Index, the Producer Price Index, and the implicit GNP deflator) over the past six recoveries have decelerated on average between 1 percentage point and 3 percentage points in the first year of recovery (see figure 1). These price indexes continue to grow more slowly than during the four quarters ending in the trough quarter. In other words, inflation measures of common product markets have tended to follow a nonincreasing path throughout

1. Gordon (1981) argues that the law of supply and demand is incomplete, since it ignores (1) the speed at which prices adjust to imbalances between supply and demand, and (2) the identification of the agent that changes prices.

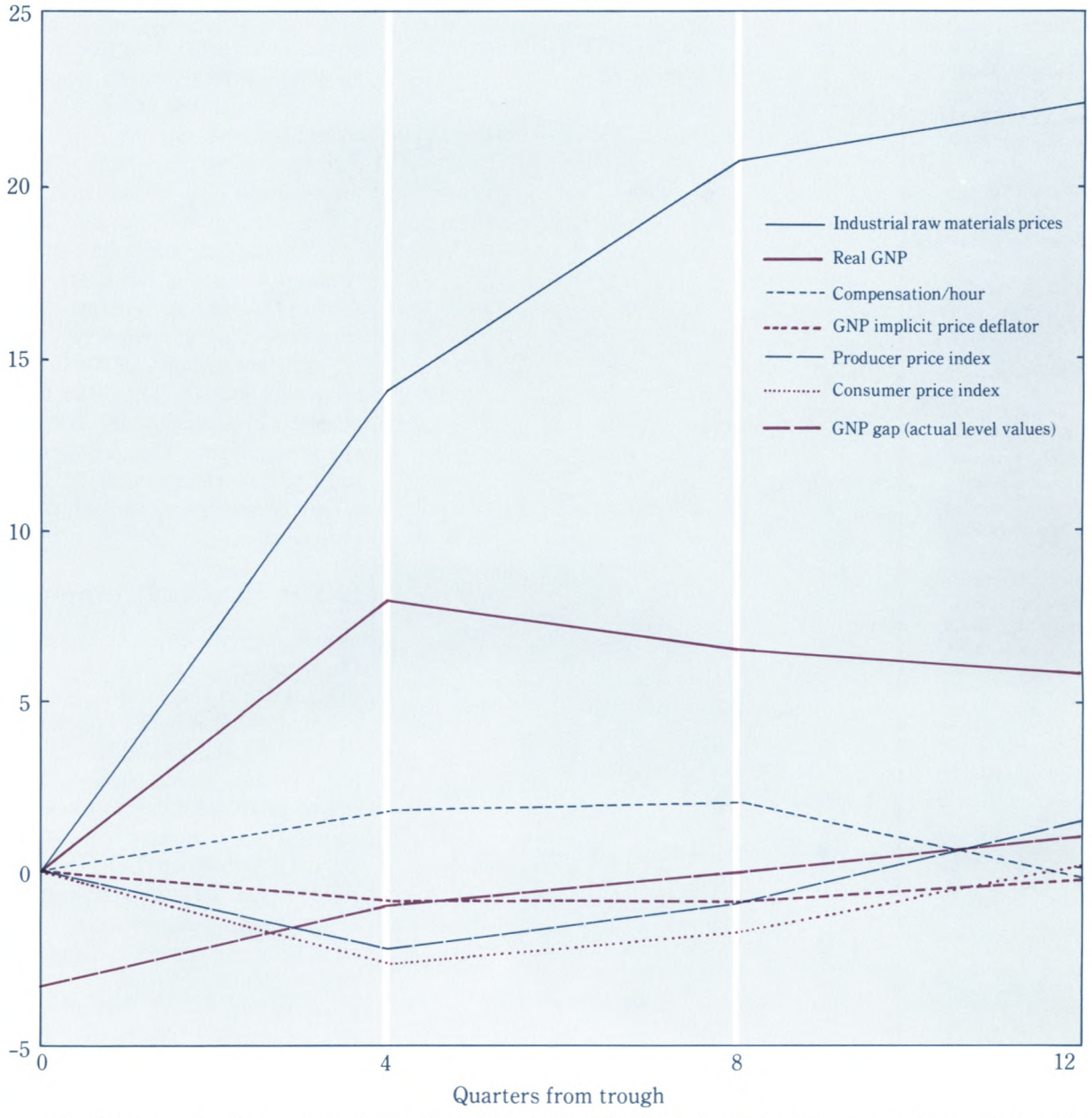
2. Gordon, p. 517.

3. The multiplicity of markets suggests that, as a practical matter, it would be cumbersome and expensive for firms selling non-auction goods to adjust prices continuously to changes in demand in all markets.

the first two years of recovery. Compensation per hour and the prices for industrial raw materials demonstrate far less restraint over the recovery phase of the cycle. On average, prices of spot industrial raw materials accelerate concurrently with real economic growth,

Fig. 1 Prices, Wages, and Output in Post-1953 Recoveries

Change in growth rates from trough[a]



a. Growth rates at trough are four-quarter growth rates ending in the trough quarter. Growth rates after trough are four-quarter growth rates ending four, eight, and twelve quarters after trough.

rising about 14 percentage points faster than their trough rate of increase. Compensation per hour in the nonfarm business sector also accelerates on average during the first two years of recovery, although at much slower rates of increase than the prices of raw industrial materials.

How do current price movements compare with those of past recoveries? From the early stages of processing through consumer markets, product price advances have been more moderate than in either of the recoveries of 1970 or 1975 (see figure 2). Consumer prices rose 3.1 percent between the November 1982 business cycle trough and December 1983, compared with growth rates of 6.4 percent over a similar period in 1975 and 3.9 percent in 1971. About 40 percent of the 1975 price increases in excess of 1983 price data is associated with the energy and food components of the respective indexes. Yet, even after adjusting for food and energy shortages, the 1983 price data strongly indicate a more subdued and pervasive pace for consumer market prices in the current recovery than during either of the recovery periods in the 1970s.

A look at earlier processing stages leads to the same conclusion, as the pace of current price advances remains below 1975 and 1971 recovery price patterns. For example, finished goods prices at the wholesale level are currently 0.9 percent higher than at the business cycle trough, whereas they rose 6.5 percent and 3.3 percent by this stage of the 1975 and 1971 recovery periods, respectively. At the intermediate stage of processing, prices rose 1.9 percent since November 1982, compared with 4.4 percent in 1975 and in 1971. Crude materials prices show the greatest moderation from past experience, rising 4.6 percent from the November 1982 business cycle trough, compared with 11.9 percent 13 months following the 1975 trough and 6.2 percent 13 months following the 1970 trough. Moreover, because of an unprecedented deceleration in wage advances, recent movements in unit labor costs are also below the two earlier periods (currently 1.3 percent, compared with 2.3 percent in 1975 and 2.0 percent in 1971).

Unlike the product and labor markets, materials markets are showing price advances in excess of those in the past. Volatile industrial materials prices rose 21.4 percent over the past 13 recovery months, on a par with the 1950 and 1960 recovery patterns but well above the experiences in the 1970s (10.2 percent in 1975 and -1.8 percent in 1971).

Average past experience shows that product price inflation should not be expected to increase during the first two years of recovery. Since the 1983 experience was at least qualitatively consistent with past experience, we might conclude that product price inflation in the second year of recovery, i.e., 1984, would be, at least qualitatively, consistent with past experience. Given the better than average experience of 1983, one might expect better than average price behavior in 1984.

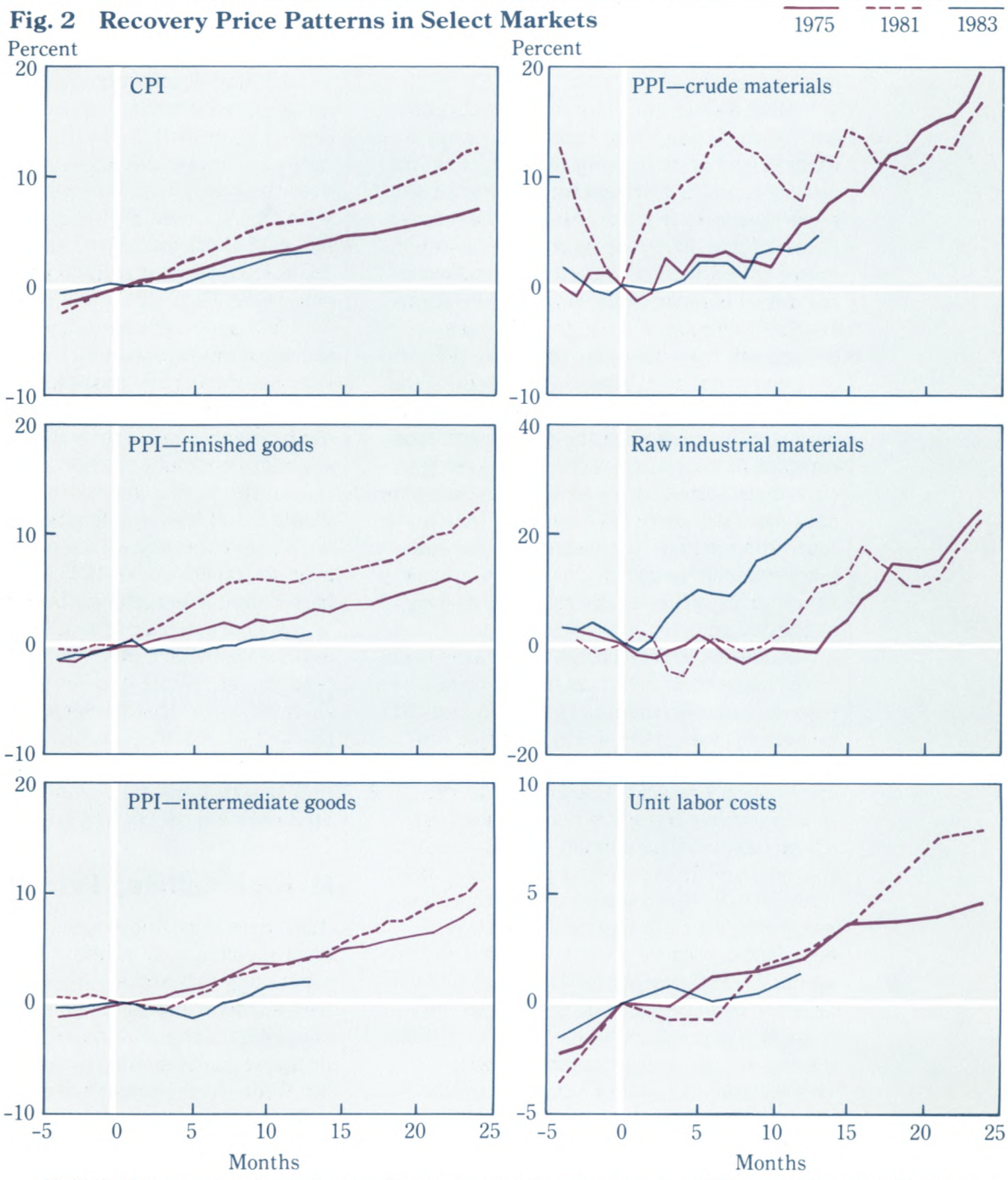
It is one matter to *describe* how prices and wages behave over short periods of time (and longer), while it is yet another to *explain* their behavior. History repeats itself only if the factors that determined that history recur. That is to say, the outlook for price inflation in 1984 and beyond must be evaluated with a model of price determination.

II. Rationalizing Price Behavior

Aggregate price and wage movements result from the actions of millions of buyers and sellers of goods and services, in product as well as factor markets. Thus, an explanation of aggregate behavior should be grounded in theoretically sound microeconomic behavior. While economists have devoted considerable effort, especially since the late 1960s, to attempting to strengthen the linkages between the microfoundations and aggregate price behavior, they have met with limited

success. Such linkages are crucial because the price models of every school of thought—Keynesian, Monetarist, New Classical—have failed to explain price movements accu-

Fig. 2 Recovery Price Patterns in Select Markets



SOURCES: U.S. Departments of Labor and Commerce. Data plotted as cumulative percent changes from NBER reference cycle trough. CPI data for urban wage earners and clerical workers. Unit labor costs plotted quarterly.

rately. In this article we do not claim to have found the *missing link*; we instead rationalize aggregate prices and wage behavior with a variety of arguments that seem to point us in the appropriate direction.

The law of supply and demand helps put later points in perspective. Consumers demand goods and services that give them satisfaction, or *utility*. The amount of any good or service that a consumer demands depends to a large extent on the *price* of the good or service and the consumer's income. All else constant, the higher the price, the lower the amount demanded. Firms supply goods and services that yield profits. The amount of any good or service that a firm is willing to supply depends on the difference between the selling price and the additional cost of provision. Generally speaking, the higher the selling price, the higher the unit profit and the greater the amount supplied. Transactions between the demanders and suppliers determine the equilibrium selling price and the equilibrium quantity of the good or service sold. When the amount demanded is greater (or less) than that supplied, the price rises (or falls) until the two quantities are balanced.

This simple paradigm omits many important details; indeed, the mechanisms of the law of supply and demand differ in different markets.[1] Generally, we can distinguish between two kinds of markets in which goods are sold—auction markets and customer markets. A key distinguishing feature of these markets is that prices are adjusted more frequently in auction markets than in customer markets.

In the archetypical auction market, a supply of an item is announced for sale in its market and is sold at whatever price the market will bear. In reality, the precise mechanics of price adjustment vary across auction markets. In some markets, such as those for industrial raw materials or raw agricultural commodities, market prices vary literally from one minute to the next as new information and new buyers and sellers enter the market.

In customer markets, where most intermediate and final output goods are sold, suppliers announce and maintain prices until they determine that prices must change to achieve market equilibrium. Sometimes suppliers determine very quickly that prices must change, meaning that price adjustments are sometimes frequent in these markets. Often, however, price adjustments occur slowly. Such prices are best described as *sticky*, that is, established and maintained despite market disequilibrium.

Why do some prices adjust very quickly to imbalances between supply and demand, while others do not? Gordon (1981), among others, cites the "*pervasive heterogeneity* in types and quality of products, and in the location and timing of transactions."[2] Auction goods are relatively homogeneous, or at least easily distinguishable by quality; non-auction goods typically have a number of close substitutes in terms of both quality and style. Unlike auction markets, of which there are very few for any one auction good, there are thousands of markets across the United States, and possibly the world, for non-auction intermediate and final output goods.

This heterogeneity confers a temporary monopoly advantage of price-setting to firms selling non-auction goods.[3] The existence of many substitute goods sold by competitor firms creates severe short-run information problems for customers. To make rational decisions, customers need to learn the price/quality/style trade-offs available for every good they buy, but the necessary comparison shopping is costly. Customers will do only a limited amount of shopping in the short run, balancing the shopping costs against the benefits of additional information. However, incomplete searches allow firms to charge

prices in the short run that are inconsistent with long-run market equilibrium. Okun (1981) argues that shopping costs represent a surplus that can be split between the customer and the seller. By entering into an implicit contract with sellers, customers are willing to pay somewhat higher prices for goods in return for more certainty about the availability and prices of the goods they wish to buy. Such contracts help in building firm/customer relationships.

This temporary monopoly advantage cannot explain price stickiness, because it says nothing about how monopolists change prices in response to changes in marginal revenue or marginal cost.[4] Gordon (1981) completes the argument by suggesting that firms know their revenues but do not know their current production costs with certainty.[5] Because supplier firms influence costs, changes in demand (revenues) may say nothing about how costs are changing. When firms experience demand shocks, they respond by partially changing price and partially changing quantity sold. The better a firm is at identifying cost changes in the short run, the more frequent will be price changes.

Okun also proposes a production cost explanation of price stickiness. He argues that the implicit contract between customers and sellers includes a clause that only permits price increases resulting from permanent cost increases and not from transitory cost increases or from desires to boost profit margins.[6] According to Gordon (1981), "Okun's model shifts the locus of attention from 'price rigidity' to 'mark-up rigidity' and thus requires an auxiliary model of wage stickiness to explain why costs are not completely responsive to demand changes."[7] Okun, among many others, first argues that this temporary monopoly power, combined with the costs of continually adjusting prices, leads many firms to set prices by marking up their unit production costs measured at *normal*, or average, rates of production. The markup is the firm's target profit margin, calculated so that the price is competitive with those set by other firms selling similar goods, and the stockholders earn a competitive return on their investments. Unit production costs include raw materials, capital depreciation, energy usage, taxes, and unit labor costs, the latter typically being the largest component for most finished goods. Firms measure unit costs at normal rates of production because of the expense involved in monitoring actual daily production costs, especially in large or complex manufacturing plants and because unanticipated production fluctuations average out over time. Indeed, since unit costs usually rise as output falls, markups over *actual* costs would generate higher prices in periods of slack demand than in periods of strong demand.

Okun theorizes that unit labor costs are inflexible in the short run because of implicit and explicit labor contracts between firms and workers. He argues that, as in product markets, the market for labor services can be divided roughly into two types—one for *casual workers* and one for *career workers*. The *casual labor market* "attract[s] workers with short horizons and any others who are not willing to make the sacrifice of taking substandard novice pay to develop the long attachment [to a particular firm], and also workers who lack the skills to meet stringent screening requirements."[8] Their wage rates tend to be lower and more variable than those for career workers, although there is likely to be a floor to these wages provided by the minimum wage laws.

Career workers, however, constitute the vast majority of the work force in the United States. The career labor market is much like the customer market for products in that heterogeneity in labor services and skills, and in jobs, creates information gaps

4. Recall that monopolists maximize their profits by setting prices and outputs, using the condition that marginal revenue equals marginal cost.

5. Gordon also distinguishes between local, *or market-specific, information and* aggregate, *or economy-wide, information, assuming that firms do not know aggregate information when pricing decisions are made.*

6. Customers have the ability to monitor supplier pricing decisions by periodically comparison shopping and by reading advertisements.

7. Gordon, p. 516.

8. Okun (1981), p. 81.

9. Azariadis (1975), Baily (1974), and Gordon (1974) show that wage stickiness can result from different risk preferences of employers and of employees.

and adjustment costs. These imperfections, in addition to firm-specific on-the-job training, give career workers temporary monopoly power, which they use to negotiate *fair* relative and real wages. Career workers are conscious of the wages paid to their counterparts employed at other firms and seek equal pay for equal work. They perceive real wage erosion during periods of inflation and attempt to protect themselves by negotiating explicit and automatic cost-of-living adjustments (COLAs) or implicit COLAs that accord with their expectations of the course of inflation over the life of their wage contract. They are also more sensitive to issues concerning job security. Employers, on the other hand, seek high-quality workmanship and loyalty to the firm, especially during periods of *tight* labor markets, to minimize the costs of training, production below peak efficiency, and missed deadlines. Relative and real wage standards in career labor markets thus underlie the bargain over performance and working conditions set between employers and workers.

These standards are essentially set in implicit or explicit labor contracts that usually extend over several years. Multi-year contracts are often used because wage negotiations are costly, although the length of a contract may also depend on product market conditions and the degree of uncertainty about future economic activity.[9] The important implication of multi-year contracts is that they impart a significant degree of inertia to career wages; hence, a large share of production costs is insensitive to the imbalance between labor supply and demand in the short run.[10] Under these conditions, the upward wage pressure from excess labor demand is resisted by an increase in overtime hours and employment of casual workers. Should the excess demand continue for a longer time period, real wages are increased as firms attempt to prevent employees from migrating to competitors.[11] Conversely, downward wage pressure from excess labor supply is met with a reduction in overtime hours, the indefinite layoff of career workers, and temporary layoffs of career workers. Only persistent excess labor supply will lead to significant wage concessions by the career labor force. However, the amount and duration of slack in labor markets required to obtain wage concessions may be quite large. The relatively high total compensation rates (wages and benefits) granted to career workers in some very depressed industries over the past three years clearly demonstrate the insensitivity of wages to conditions of excess supply.

In the short run, unit cost and markup stickiness yield non-auction prices that do not respond as quickly or as completely as do auction prices to imbalances in demand. Prices are announced and maintained in the short run, transmitting the initial impact of market forces to production rates and inventory levels. It is important to realize that this inertia does not continue in the long run; non-auction prices eventually adjust. Like auction markets, if the demand price in the longer run does not cover at least the unit production costs, the good will not be supplied; if demand persistently exceeds supply, prices will rise first with the ultimate price response being determined by the long-run supply response.[12]

The inertia of wages and prices is evident in figure 3. Shown here are growth rates, measured over the previous four quarters, of the GNP implicit price deflator and compensation per hour in the nonfarm business sector for the period 1955:IQ through

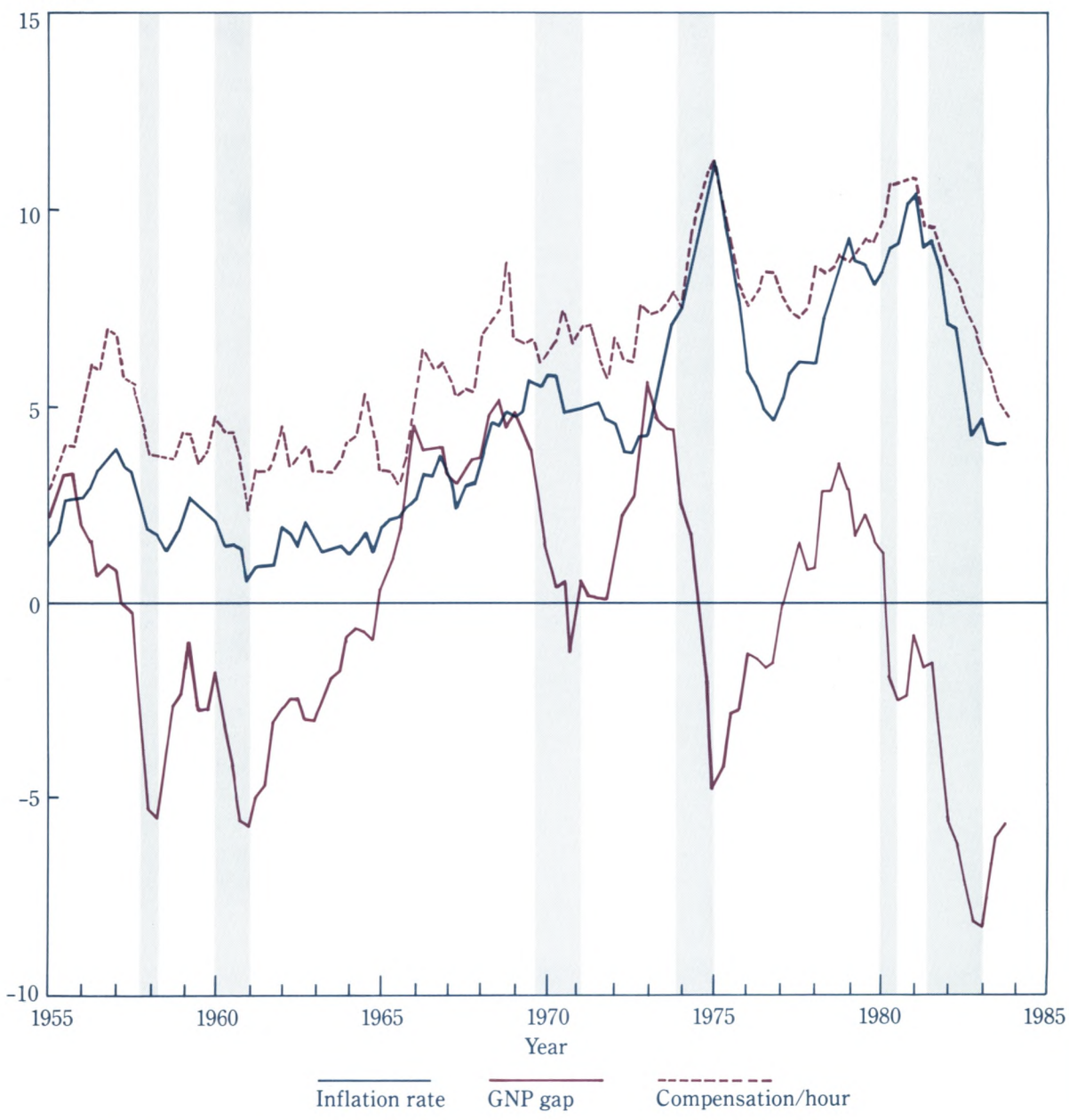
10. Fischer (1977), Taylor (1979, 1980), and McCallum (1982) also use multi-period labor contracts to rationalize sticky prices. Also see Azariadis and Stiglitz (1983) for a review of implicit contract work. Kahn (1983) argues that increased use of explicit long-term contracts in the post-World War II era has magnified the observed inertia or stickiness in wages.

11. In recoveries from recession, compensation per hour typically accelerates because the re-employment of higher wage workers raises total compensation faster than total hours worked.

12. There are other possible explanations for price inertia. For example, Heal (1983) shows that increasing returns to scale in production can lead to "prices which are stable, yet which do not clear all markets." Blinder (1982) suggests that inventories act as buffers against random shocks to demand, absorbing some pressure to change prices in the short run. Phelps and Taylor (1977) assume that firms consider average profitability and set prices in advance of the period in which the goods are sold.

1983:IVQ.[13] Recessions are associated with declines in price and wage *growth rates* rather than with general declines in price and wage *levels*. Contrary to the auction market story

Fig. 3 Inflation, Wages, and GNP



Note: Shaded areas indicate periods of recession as defined by the National Bureau of Economic Research.

of price adjustment, most prices and wage levels do not fall in periods of excess supply; instead, they only grow more slowly. Relative prices and wages adjust in the context of differences in growth rates.[14]

Recessions are not the only periods when conditions of excess supply prevail. In fact, recessions might also be defined as periods when the economy is moving toward greater amounts of excess supply. A crude summary measure of the imbalance between demand and supply in all markets in the economy at any time is given by the GNP gap. The *GNP gap* is the difference between aggregate demand and potential output expressed as a percentage of potential output; positive gaps imply excess demand, and negative gaps imply excess supply. Aggregate demand in any quarter is represented by the actual value of real GNP in that quarter. Potential output is measured here as the maximum value of real GNP that the economy could produce consistent with no change in the inflation rate.[15]

The relationship between the GNP gap and change in price and wage inflation rates is unmistakable; periods of excess demand (1955–56, 1965–69, 1971–74, 1977–79) have been associated with accelerating prices and wages; periods of excess supply (1957–1964, 1970, 1975–76, 1980–83) have been associated with decelerating prices and wages. The same degree of excess demand or supply (that is, the same value of the GNP gap) is associated with different wage and price inflation rates. The point is again made: the inertia component of wage and price growth, which includes the COLA inflation expectations component, is stronger in the short run than the component that results from the imbalance between aggregate demand and supply.[16]

However, the imbalance between supply and demand becomes more important when a longer time period is examined. The trend increase in wage and price inflation rates since 1964 might be attributed to the prevalence of excess demand in 12 out of the last 18 years. Arguably, if the opposite had been true, the trends in price and wage inflation probably would have been much lower. In other words, short-run variations in nominal GNP typically show larger real GNP increases than inflation-rate variations; short-run increases in output can be *purchased* with little immediate price pressure. However, once the GNP gap is closed, the price component typically assumes a larger share of a nominal GNP increase; in the long run, there may be no trade-off between inflation and real output above potential.[17]

III. The Inflation Outlook

The model outlined in the previous section highlights wages and other production costs, excess demand, productivity, and expectations of inflation as fundamental determinants of prices. The outlook for inflation depends on these factors. In addition, price indexes such as the CPI can be affected by temporary changes in relative prices; these changes need to be considered as well.

The unpredictable behavior of supply shocks makes it difficult to speculate about the continuing moderation of these price increases. Given the current state of the oil markets, seemingly abundant world crop production, and a persistently high foreign exchange rate, there appears to be little immediate concern for a serious supply shock price increase. By their very nature, supply shocks are generally unforeseen events, and the possibility of another shock in the near future cannot be discounted.

13. Four-quarter growth rates are used to average the temporary random disturbances that affect wages and prices, allowing the underlying trends to appear more clearly.

14. Some of the observed price inertia is probably purely statistical. For example, Stigler and Kindahl (1970) argue that prices are substantially more flexible than they appear in official statistics. However, the use of official price statistics for COLAs of labor contracts and social security payments builds inertia into production costs and, in turn, prices.

15. This measure was first proposed by Okun (1963). The measure of potential output used in figures 1 and 2 derives from Clark (1982). Estimates of potential output depend on estimates of the nonaccelerating inflation rate of unemployment (NAIRU). The potential output estimate used in figures 1 and 2 assumes that the NAIRU has risen from 4.5 percent in the early 1950s to 7 percent by 1976 and thereafter.

NOTE: footnotes 16 and 17 appear on page 16.

16. The issue of asymmetric price response is not yet resolved. That is, it is not clear whether prices rise faster in periods of excess demand than they fall in periods of excess supply. Kuran (1983) demonstrates that the prices of monopolistic firms facing a non-increasing price elasticity of demand and nondecreasing marginal costs can be relatively more rigid downward than upward. He also shows that such firms raise their prices to a greater extent than they lower them when they expect equivalent deflation. However, there is little strong empirical evidence of this asymmetry.

17. This does not mean that price and wage inflation rates do not rise and fall temporarily over short periods of time. The quarterly growth rates of wages and prices exhibit considerable variability. They do so because of a variety of temporary, random, unpredictable developments in particular product and labor markets; but these are mostly temporary movements around a markedly resilient inertia component.

The key to a noninflationary recovery, not achieved in either the 1970–73 or 1975–79 periods, is a continuing moderation in unit production costs. The future behavior of this price determinant initially would be affected by continuing success in maintaining wage demands in line with price advances and productivity, and over time by the rate of capital accumulation. The likelihood that these two developments would improve from past recoveries is highly uncertain.

Real business fixed investment (BFI) in the 1981–82 recession declined at an annual rate of 6.2 percent (peak to trough), about the same rate of decline as in the 1969–70 recession (6.0 percent) and about one-half the rate of decline in the 1973–75 recession (11.5 percent). So far in this recovery, real BFI growth exceeds that of the 1971 and 1975 periods when investment growth did not develop meaningful strength until well into the second year of expansion. Key ingredients are currently in place to sustain an above-average accumulation of business investment. Rates of return on capital have improved since 1980, a trend that should continue as profits rise. Given a normal cyclical expansion in profit margins and capacity usage rates, the expansion in corporate profits should continue in 1984.

Postwar recessions in the United States typically have been associated with labor cost slowdowns and, to a lesser extent, concessionary union contracts. Some evident differences in the 1981–82 recession have given rise to speculation regarding a slow building of wage pressures during this expansion. But the current evidence does not *conclusively* demonstrate that damaging inflationary expectations have been altered from an average of past behavior.

Although forecasters generally expect the national unemployment rate to remain above 7 percent through the end of 1984, continued high rates of unemployment may not be a major drag on wages as in previous recoveries (see table 1). The natural rate of unemployment (also known as the NAIRU, or *non-accelerating inflation rate of unemployment*) may be higher than during past expansions (about 7 percent). The differential between expected unemployment and the NAIRU for 1984 is not significantly different from previous recoveries. Concession bargaining at the level of 1981–82 is not likely to be as pronounced in 1984—concessions are repeated very rarely in subsequent contracts, and affected unions quickly return to a policy of pay maximization instead of employment maximization. Nevertheless, the amount of concession activity in the past two years was relatively large, especially in terms of the number and percent of workers influenced. Thus, it would be reasonable to expect previous concessions to provide a temporary drag on labor contracts. Likewise, the erosion of pattern bargaining may promise some temporary relief. Inertia (affected by concessions) and imitation (affected by pattern bargaining) are two important forces that make wage-setting unresponsive to firm, industry, and economic conditions. The cycle-related changes in these two forces, however, promise only temporary (two or three extra quarters) additional wage stability.

The 1981–82 recession was characterized by a more dramatic decline in the pace of wages than any postwar downturn except that of 1953–54. Hourly earnings for private nonfarm workers rose just 4.4 percent in the 12 months ending in May 1983. Manufacturing compensation per hour increased 5.6 percent (annual rate) from 1982:IIIQ to 1983:IQ, well below the record pace of 13.8 percent in 1980 and the smallest increase since 1972 (during the latter part of Nixon's wage-price controls). The recent labor cost slowdown was also more widespread across industrial, occupational, and union/nonunion classifications than in any recession in recent history. Finally, we have seen highly visible and pattern-setting labor contracts incorporating concessions at a record rate, indicating some reduction in contract inertia and less contract imitation.

There have been expectations by market analysts that the current recovery would be associated with a longer period of wage stability before the next cyclical rise in wages because of the psychological influence of dramatic price index declines, continued high unemployment rates, concession bargaining, and the erosion of pattern bargaining. In a survey of consumer attitudes by the University of Michigan, the mean expected price increase during the 12 months following the survey fell from 12.1 percent in January 1980 to 4.6 percent in June 1983—roughly the same magnitude of the Consumer Price Index plummet over the same period. But past experience clearly shows that inflationary expectations can accelerate with as much speed as they decline. In fact, the mean expected 12-month inflation rate moved upward from 4.3 percent to 4.6 percent during the second quarter, partial evidence that inflationary expectations are already on the rise.

Policy Expectations and Future Inflation

A necessary condition for a disinflationary recovery is the avoidance of both excess demand and the expectation that excess demand will occur. Federal government fiscal and monetary policies are crucial determinants of the balance between aggregate supply and demand and, in turn, inflation and its expectations. Taxes, transfers, purchases of goods and services, loan guarantees, and interest rates, for example, can affect aggregate demand by altering various relative prices, disposable incomes, costs of credit, wealth positions, and tax incentives to save and spend. While such policies may also affect potential output by altering the attractiveness of saving and productive capital accumulation, the short-run impact is not large because the incremental increase or decrease in net investment has little effect on total productivity. Prudent economic policies thus are necessary to achieve a disinflationary recovery.

The impact of a change to any one or any subset of fiscal and/or monetary policies can be examined over different horizons but cannot be understood without knowing what the remaining policy settings are and what the GNP gap is before and after the change is enacted.[18] The existence of sticky prices means that stimulative policies to boost nominal output result in larger short-run increases in real output than in prices. The difference between the real output and prices outcomes depends on how much slack is in the economy. The greater the amount of slack in the economy, the larger will be the real outcome. Stimulative policies that do not create excess demand also result in relatively larger real outcomes, both in the short run and in the long run.

Currently, fiscal policy is projected to add significantly to aggregate demand over the next three years. The *latest* Congressional Budget Office estimates show the federal unified budget on a standardized 6 percent unemployment rate basis averaging 2.4 percent of cyclically adjusted GNP in fiscal year 1984, 3.3 percent in fiscal year 1985, and 3.8 percent in fiscal year 1986.[19] Compared with the actual 1982 value of 0.9 percent and an average value of 1.0 percent since the late 1950s, these figures suggest that, without budgetary changes, the stimulus to aggregate demand provided during the next three years will be large for a recovery period.

Many analysts worry that large federal budget deficits will *crowd out* private capital investment and hence potential output growth. Few analysts think that this crowding out will be *real* in the sense that there are too few resources to spread around. The important issue, should Congress decide not to cut back this fiscal stimulus, is the financing of these deficits. The Treasury always sells enough bills, notes, and bonds to cover a deficit, but the fraction of these new

18. For an informative theoretical discussion of short-run and long-run impacts of fiscal and monetary policies, see Tobin and Buiter (1980).

19. The Economic Outlook, *Congressional Budget Office, February 1984.*

issues that is held by the domestic private sector depends on the fraction purchased by foreign investors and the fraction purchased by the Federal Reserve System (FRS).

The course of interest rates depends on the state of the economy and on who purchases this new debt, directly through flows of funds and indirectly through expectations. All else constant, relatively large purchases by foreign investors or by the FRS will lower real interest rates (nominal interest rates minus their inflation premia) in the short run. However, foreign capital is not a steady long-term source of financing, and all else is never constant. Inflation expectations and, in turn, uncertainty about future policy actions may change and raise real long-term interest rates, crowding out some private capital formation and possibly slowing potential output growth. Relatively large purchases by the domestic private sector would raise short-term interest rates but may raise or lower long-term interest rates, depending on how expectations and uncertainty are affected. To lower the probability of excess demand and a reacceleration of inflation, the private domestic sector would have to absorb much of the new debt.

Table 1 GNP Gap Revisions
Billions of 1972 dollars

	Gap estimates			Differences				
				Actual GNP value 1977 minus 1982	Potential GNP estimates		Gap estimates	
Year	1977	1982	1982 (7% NAIRU)		1982 minus 1977	1982 (7% NAIRU) minus 1977	1982 minus 1977	1982 (7% NAIRU) minus 1977
1	2	3	4	5	6	7	8	9
1952	-13.6	-19.3	-26.8	-2.3	-3.4	-10.9	-5.7	-13.2
1953	-13.6	-20.9	-28.6	-1.8	-5.5	-13.2	-7.3	-15.0
1954	16.0	8.6	0.6	-2.4	-5.0	-13.0	-7.4	-15.4
1955	-3.4	-10.0	-18.2	-2.7	-3.9	-12.1	-6.6	-14.8
1956	5.1	-0.5	-9.0	-2.8	-2.8	-11.3	-5.6	-14.1
1957	16.3	11.8	3.0	-2.9	-1.6	-10.4	-4.5	-13.3
1958	41.8	40.1	31.0	-1.4	-0.3	-9.4	-1.7	-10.8
1959	25.8	25.6	16.2	-1.3	1.1	-8.3	-0.2	-9.6
1960	35.1	37.3	27.7	-0.4	2.6	-7.0	2.2	-7.4
1961	43.3	46.2	36.2	-1.3	4.2	-5.8	2.9	-7.1
1962	27.3	31.8	21.5	-1.2	5.7	-4.6	4.5	-5.8
1963	26.4	29.9	19.3	-1.8	5.3	-5.3	3.5	-7.1
1964	15.9	17.5	6.5	-2.0	3.6	-7.4	1.6	-9.4
1965	-0.9	-2.6	-14.5	-3.4	1.7	-10.2	-1.7	-13.6
1966	-20.2	-23.5	-38.6	-3.8	0.5	-14.6	-3.3	-18.4
1967	-11.4	-14.1	-32.8	-3.7	1.0	-17.7	-2.7	-21.4
1968	-20.1	-23.4	-46.1	-6.3	3.0	-19.7	-3.3	-26.0
1969	-10.5	-14.2	-41.0	-8.8	5.1	-21.7	-3.7	-30.5
1970	30.9	28.0	-3.2	-10.3	7.4	-23.8	-2.9	-34.1
1971	38.0	33.9	-2.0	-13.9	9.8	-26.1	-4.1	-40.0
1972	15.0	12.6	-28.2	-14.8	12.4	-28.4	-2.4	-43.2
1973	-6.8	-10.9	-57.0	-19.3	15.2	-30.9	-4.1	-50.2
1974	57.7	40.3	-9.7	-32.3	14.9	-35.1	-13.4	-67.4
1975	125.2	93.6	44.6	-39.9	12.3	-40.7	-27.6	-80.6
1976	98.6	75.0	18.9	-33.2	9.6	-46.5	-23.6	-79.7

SOURCES: *Economic Report of the President*, U.S. Government Printing Office, January 1977; and Peter K. Clark, "Okun's Law and Potential GNP," Manuscript. Board of Governors of the Federal Reserve System, October 1982.

Errors in Potential Output Estimates

A remaining uncertainty is exactly how much noninflationary excess capacity exists in the economy today. Comparisons of past and current GNP gap estimates show large revisions, not only from inevitable revisions in the historical GNP data but also from unforeseen shifts in the determinants of potential output. The economy thus may not be where we perceive it to be.

Every potential output estimate is constructed using essentially two relationships, one relating certain production inputs to total output and the other relating these inputs to excess demand pressures and hence inflation. The first relationship is an aggregate production function for the economy as a whole, and the second relationship estimates the input levels (employment levels, plant capacity) associated with nonaccelerating inflation. Both relationships are inferred with statistical methods and historical time series data. Even if we knew the true functional forms of these relationships and the data were never revised, there still would be unavoidable errors in our potential output estimates, although the estimates would be correct on average.

Since the early 1970s, however, we have become less certain about the true functional forms of the relationships. It appears to many that the aggregate production function has shifted downward unexpectedly, meaning that less output is produced for given levels of inputs. The main reason for this adverse shift appears to be an unexplained decline in productivity growth since 1973. To see this, we can use the identity that (potential) output growth equals the sum of the (potential) growth rates of output per hour, average hours worked per worker, and the size of the labor force.

Data revisions and changes in the assumptions affect not only the growth rate of potential output but also the gap between potential and actual output. Examples of such revisions are shown in the accompanying table. In the second column of the table are estimates of the GNP gap, by the Council of Economic Advisors (CEA) in 1976. The third column shows more recent estimates, using essentially the same assumptions but revised data. The difference between these two gap estimates (shown in the eighth column) can be expressed as the sum of the revision to potential output (sixth column) and the revision to the GNP data (fifth column). The differences in the gap estimates before 1973 are not large, since the bulk of the revisions to the GNP data had been made; it is curious that the latest potential output estimates are smaller than the previous estimates between 1952 and 1958 and larger after 1958. After 1973, however, the gap differences are relatively large because of the more recent and large GNP revisions. In fact, the GNP data revisions account for much of the gap differences after 1973. Note that in 1975, at the trough of the 1973–75 recession, the GNP gap was revised downward by $27.6 billion.

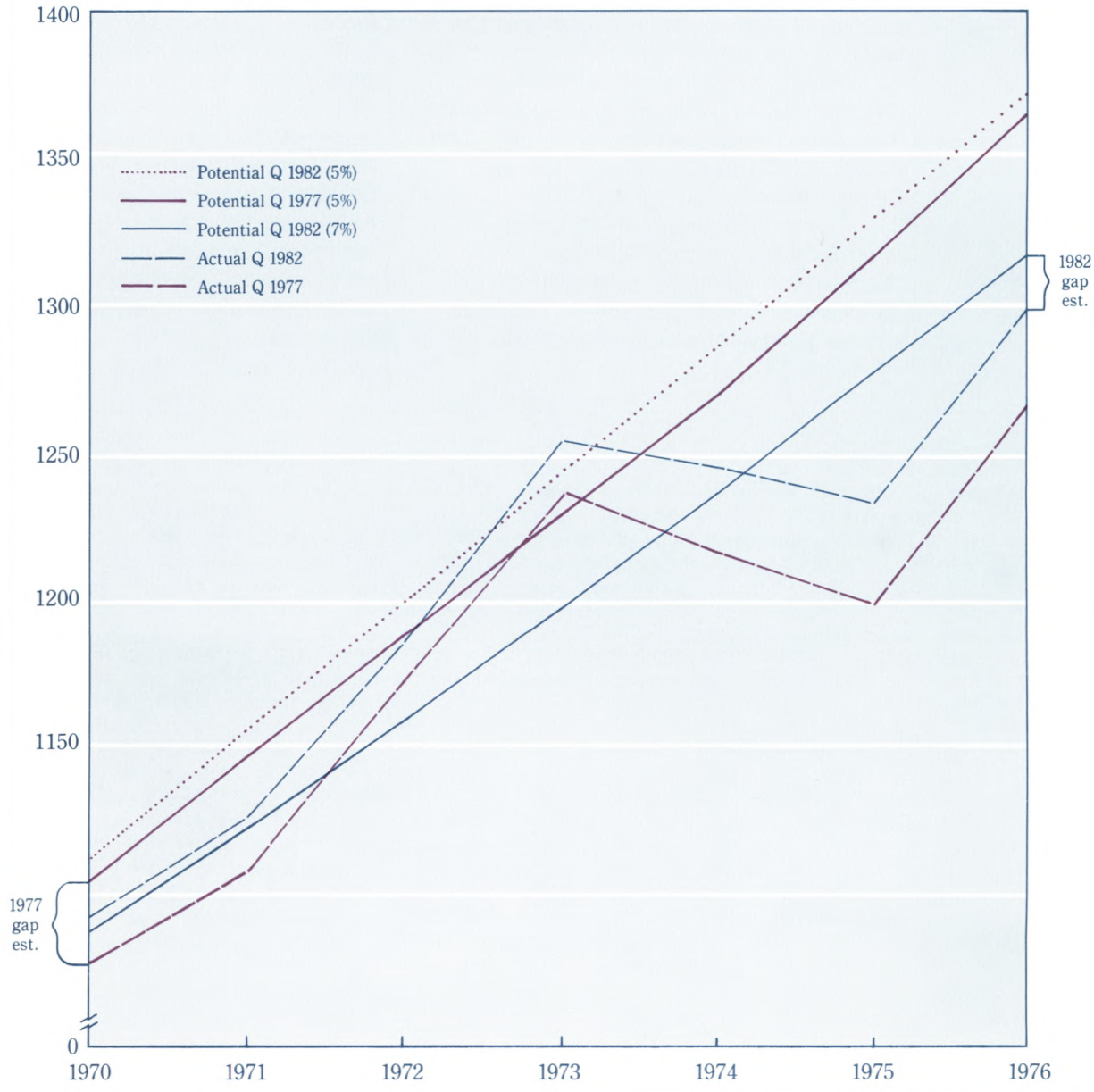
The gap differences are even greater when an increase in the NAIRU is assumed. The CEA estimates assume an upward trend in the NAIRU from 4.0 percent in 1955 to 5.1 percent in 1976. If, as some analysts believe, the NAIRU rose from 4.5 percent in 1955 to 6.9 percent in 1976 and after, different GNP gap estimates (fourth column) are produced. Note the dramatic differences: instead of a $98.6-billion gap as first estimated in 1976, for example, the most recent estimates with a higher NAIRU show only an $18.9-billion gap. Note also that the different labor-market assumption accounts for the majority of the differences in the gap estimates since 1952, and that the latest potential output estimates are uniformly lower than the previous estimates. Figure 4 shows the changes in GNP and potential GNP from 1970 to 1976.

These data can be used to estimate the possible error in the current 1983 gap. In particular, we use the revisions of the 1974–76 period, because they are probably most similar to the errors in our current figures. Expressed as a percentage of potential output, the changes in the gap figures without assuming an increase in the NAIRU are 1.4 percent, 2.2 percent, and 1.8 percent for 1974 through 1976, respectively, averaging 1.8 percent. Thus, our current 1983 gap estimate of –6.6 percent may be about 2 percentage points too low. In the unlikely event that the NAIRU is above 7 percent, the error in our current 1983 gap figure may be close to 5.7 percent, implying that the *true* GNP gap is only –0.9 percent in 1983. Given the inevitability of some data revision, it may be prudent to use a 3 percentage-point confidence interval around our current and projected near-term gap figures until we are more certain of the underlying trends determining potential output growth.

From 1962 to 1970, the trend, or potential growth, in productivity stayed around 2.5 percent per year, labor force growth was about 1.5 percent per year, and average hours worked per worker fell about 0.25 percent per year; potential output grew about 3.75 percent per year. By 1970, the trend growth rates of both labor force and productivity were thought to be about 0.25 percentage points higher, and potential output growth as high as 4.25 per-

Fig. 4 GNP and Potential GNP Revisions: 1970–76

Billions of 1972 dollars



cent per year. Because the stability of these trends provided a remarkably useful and accurate guide for judging the need for economic policy actions to prevent excess demand or supply, policy in the early 1970s was determined with these estimates in mind.

After 1970, unfortunately, it became apparent that a shift in these trends may have occurred. Potential labor force growth accelerated to about 2.5 percent per year as the baby-boom generation came of (working) age and the participation rate of women and teenagers rose; yet productivity growth fell to about a 1.0 percent trend rate. These shifts unexpectedly slowed potential output growth to about 3.25 percent per year and raised the NAIRU above 4.0 percent to over 5.0 percent in the early 1970s and to 7 percent by 1976.[20]

Inevitable data revisions also confound the estimation of potential output. Quarterly GNP figures currently are revised at least six times as additional source data become available. These revisions affect measures of output and capital stock levels, because the revisions differ by component of GNP. The capacity utilization rate and the labor input measures used in some potential output calculations also are revised periodically as additional source data become available and new estimation techniques are employed. Thus, it is an inevitable and unavoidable fact that we usually are not where we think we are. This thinking affects all empirical economic research as well as potential output estimates.

IV. Conclusion and Summary

Can we have an economic recovery without reaccelerating inflation? Casual evidence of past wage and price behavior suggests that there is little cause for worry about an immediate acceleration of prices. Unfortunately, the empirical evidence of the past 20 years shows little precedent for maintaining price restraints indefinitely.

This does not mean that moderate inflation rates beyond 1984 are impossible. In theory, we can have nonaccelerating inflationary recoveries. Lower inflation expectations, faster productivity growth, and wage demands in line with productivity growth can help put inflation on an unprecedented downward trend. However, a necessary condition for this to occur is the avoidance of prolonged exposure to excess aggregate demand, which is to say that economic policymakers must be cautious in their actions. Fiscal actions of taxing and spending and monetary actions of monetary base growth taken today affect economic activity in future years. Prudent actions now will avoid squandering the progress we made on the inflation front or pushing the economy into recession, while helping to lower inflation expectations and uncertainty about future economic activity.

20. See Gordon (1982) and Englander and Los (1983). Not all economists agree that these trend shifts were so severe; see, for example, Klein (1983).

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