MONETARY POLICY IN A WORLD OF UNCERTAIN PRODUCTIVITY GROWTH

Robert L. Hetzel
Vice President
Federal Reserve Bank of Richmond
robert.hetzel@rich.frb.org

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Five years ago, newspapers regularly published jeremiads lamenting that for the first time in history children would not experience a higher standard of living than their parents. Secular stagnation in the growth of real wages supposedly had created a permanently impoverished working underclass. Five years later, with the start of the new millennium, newspaper headlines proclaimed the birth of the new economy. Even the *Wall Street Journal* (1/1/2000, p. R31) talked about an unprecedented era of abundance in a world that had repealed the laws of supply and demand.

The rise in the rate of productivity growth highlighted in these newspaper accounts has engendered significant debate over monetary policy. At present, the FOMC (Federal Open Market Committee of the Federal Reserve System) must make monetary policy in an environment of uncertainty over trend productivity growth. Each time monetary policymakers set a target for the funds rate, they make a conditional inflation forecast. Variable productivity growth adds uncertainty to those forecasts.

This paper considers inflation forecasts for 2001 under two different assumptions about productivity growth. One assumption, the optimistic one, is that productivity growth has risen above its long-run historical average and that 2001 will see near price stability. The other, the pessimistic one, is that monetary policy itself has been a major factor influencing productivity growth. Accordingly, productivity growth is likely to fall to its long-run historical average and 2001 will see moderate inflation.

The first section provides a perspective on current monetary policy procedures by comparing them to past procedures. The second section asks to what extent monetary policy itself influences productivity growth over considerable periods of time. The next section asks whether monetary policy is currently expansionary. The following section contrasts the inflation forecasts that arise from differing assumptions about productivity growth and monetary policy. A concluding section offers some reflections on productivity growth.

Evolution in FOMC Procedures

To assess how policymakers have responded to the current uncertainty over productivity growth, it is useful to have a longer-run perspective on the evolution of monetary policy procedures. How have they changed over time?

Stop-Go Monetary Policy

Monetary policy became activist in the mid-1960s. That activism rested on the intellectual assumption that the price system works poorly to maintain macroeconomic equilibrium. Policymakers attempted to identify the economy's level of resource utilization and to use monetary policy to maintain that level at its full employment level. In the language of the Walter Heller Council of Economic Advisors of President Kennedy, policy aimed at eliminating the output gap.

The second intellectual assumption of the time was that the price level is a nonmonetary phenomenon. Nonmonetary explanations of inflation offer a taxonomy of causes for inflation: demand-pull, cost-push and expectational. The Phillips curve appeared to give operational content to this taxonomy. It explained the demand-pull part of inflation. The remainder was cost-push or expectational.

With a negative output gap, the central bank could safely run an expansionary monetary policy because demand-pull inflation would not arise. Any inflation that did occur would necessarily be of the cost-push or expectational variety. The socially optimal way to control the latter kind of inflation was through direct government intervention to restrain price rises in particular markets and industries.

In sum, policymakers organized their procedures around the systematic control of the level of unutilized resources in the economy—the output gap. An activist policy promised to reduce the variability of the output gap. Control of inflation required getting the average value of the output gap right. A zero output gap, identified with 4 percent unemployment, would leave only a moderate amount of cost-push or expectational inflation, which was not the responsibility of the central bank.

Expected Inflation Targeting

After mid 1979, the Fed accepted responsibility for inflation—period. The FOMC moved away from setting its interest rate peg based on an estimate of the economy's unutilized resources. Instead, it followed a two-part strategy. The FOMC assigned priority to aligning the public's expectation of inflation (as inferred from the behavior of the government bond rate) with its implicit target for inflation. (After 1982, this target was approximately 4 percent and after 1988 approximately 2 percent.) The FOMC pushed up the funds rate whenever bond rates rose sharply (Goodfriend 1993, Hetzel 1986, and Mehra 1999 and 2000a).

Having mastered inflationary expectations, the FOMC altered the funds rate in response to an estimated growth-rate gap: the difference between the contemporaneous rate of output growth and an estimate of the economy's sustainable rate of output growth (Mehra 2000b). The FOMC formed a benchmark estimate of the latter as the sum of labor force growth and estimated

trend productivity growth. It conducted a running check on the reliability of the estimated growth-rate gap by observing measures of resource utilization. Especially, a positive growth-rate gap should produce a declining unemployment rate. Similarly, vendor delivery times from the NAPM survey should rise, and so on.

From mid-1979 through 1994, the bond market vigilantes enforced these procedures. When financial market participants saw real output growth rise strongly, they attached some probability to a rise in inflation and they pushed up bond rates. A concern for inflationary expectations then caused the FOMC to raise the funds rate. This heightened sensitivity to the inflationary concerns of financial markets caused the FOMC to remove much of the inertia in short-term rates relative to changes in economic activity that had characterized the pre-1980 period.

A monetary policy process that stabilized expected inflation and that moved the interest rate instrument responsively as economic activity strengthened and weakened caused the FOMC to track the economy's equilibrium interest rate. In that way, it avoided the monetary emissions and absorptions that had created inflation and destabilized the economy in the prior period of stop-go monetary policy. As long as trend productivity growth remained steady, so did real output growth. The practical result was that monetary policy approximated a rule for targeting nominal output growth. Milton Friedman lost the tactical skirmishes, but he won the war. Monetary policy approximated a k-percent rule not for money, but for the growth rate of aggregate nominal demand.

Variations on a Theme of Nominal Output Targeting

The above discussion extracts how monetary policy in the sense of a strategy changed in the post-1979 period. In another sense of the term, monetary policy refers to the rate of growth of

aggregate nominal demand (the public's dollar expenditure) produced by the actions of the FOMC. In this sense, monetary policy exhibited moderate fluctuations in the two-decade period since mid-1979. Figure 1 shows a rough measure of the extent to which the stance of monetary policy was expansionary or contractionary.

Figure 1 plots the funds rate and the growth rate of nominal GDP. Divergences in the lines constitute a rough measure of the thrust of monetary policy. Note that nominal GDP growth consists of two elements: the growth rate of real output and the inflation rate. The interest rate also consists of two elements: the real interest rate and an inflation premium for expected inflation. One can draw a correspondence between these elements.

The growth rate of real output can serve as a rough proxy for the growth rate of expected output. Economists commonly employ the latter as the primary determinant of the real interest rate. Furthermore, if the central bank does not possess complete credibility, the actual inflation rate influences the expected inflation rate. Fluctuations in the growth rate of nominal expenditure then capture fluctuations in the economy's equilibrium interest rate.

Figure 1 shows the funds rate and nominal output growth moving roughly together until early 1987. Over this period, preoccupied with an international banking and debt crisis, the FOMC attempted primarily to defend the reduction in inflation from double-digit rates to the 4 percent achieved in 1983. In early 1987, nominal output growth rose with little change in the funds rate. In this period, world wide, monetary policy became expansionary in response to the Louvre Accord. The FOMC was reluctant to raise rates while the United States was encouraging other countries to pursue expansionary aggregate demand policies. The uncertainty created by the October 1987 stock market crash reinforced the move toward expansionary monetary policy.

In 1988, with the adoption of the soft-landing strategy, the FOMC moved to lower the inflation rate from its contemporaneous level of 4 percent and to resist the incipient rise in inflation produced by the prior moderately expansionary monetary policy. With little change in nominal GDP growth, the FOMC raised the funds rate to almost 10 percent in mid-1989. Following the July 1990 peak in the business cycle, the FOMC continued with its policy of lowering inflation. The FOMC lowered the funds rate only cautiously in response to the fall in nominal output growth.

After working the funds peg down to 3 percent in fall 1992, the FOMC maintained it unchanged while nominal GDP growth rose. However, following the FOMC's earlier caution in lowering the funds rate from its near 10 percent peak, the level of nominal GDP growth remained modest for an economic recovery. Given the prevailing inflation rate, that nominal GDP growth rate allowed only modest real output growth. In early 1994, the economy began to grow strongly and bond rates rose. The FOMC then raised the funds rate sharply. Finally, as discussed below, monetary policy became expansionary after mid-1997 in response to the Asia crisis.

Wringing Out Inflation in the 1990s

The decade of the 1990s began with recession and the "jobless recovery." The halting, weak character of the recovery made business reluctant to add workers. Figure 2 offers a summary of how monetary policy "kept the lid on" and squeezed inflation out. It plots the growth rate of nominal expenditure (final sales to domestic purchasers) and its real growth-inflation decomposition.

The striking feature of Figure 2 is the stability of nominal expenditure growth at about 5.5 percent for the years 1990 through 1998, with the exception of the recession year 1991.

Given the 4 percent inflation prevailing at the beginning of the decade, this growth rate of nominal expenditure initially allowed for little real growth. The story of monetary policy through most of the 1990s is how the FOMC forced inflation down by maintaining modest nominal demand growth. As inflation fell, real growth rose.

However, this process occurred only slowly. In no year before 1998 did real growth approach the level normal in economic recovery. In the last part of 1993, the economy began to grow vigorously. However, because monetary policy was not yet fully credible, bond rates rose. Furthermore, employers who had postponed the hiring normal in economic recovery and instead concentrated on downsizing found themselves short of labor. As a result, the economy exhibited signs of overheating, and the FOMC pushed the funds rate up sharply in 1994.

Figure 3 shows how in the decade of the 1990s the mix of nominal growth changed toward real growth and away from inflation. Figure 4 shows the decline in the inflation rate from almost 4 percent in 1990 and 1991 to the near price stability of about 1 percent in 1998.

The Asian Crisis

As described above, the lean-against-the-wind procedures of the FOMC required it to raise the funds rate when real growth exceeded its estimated sustainable value or when bond rates rose significantly. The last FOMC meeting that fits this description easily was in March 1997. Thereafter, international considerations impinged on FOMC decisionmaking.

The Asian crisis began in Thailand in July 1997 and then spread to Indonesia. In October 1997, the turmoil in Asia unsettled U.S. financial markets and the stock market tumbled. Concern for financial stability militated against interest rate increases to counter strong U.S. growth. In December 1997 Korean financial markets crashed.

In 1998, concern for the foreign exchange strength of the dollar and the corresponding weakness of Asian currencies discouraged rate hikes. The Russian crisis in August 1998 led to fears of deflation and recession that would spread to the United States. The FOMC lowered the funds rate by ¾ of a percentage point in fall 1998 to counter both anticipated future economic weakness and capital flight from risky markets, especially emerging market economies.

A New Economy?

Until 1999, the consensus in the forecasting community held that the economy could grow at around 2 ½ percent per year due to 1 percent labor force growth and 1 ½ percent productivity growth. However, the economy grew at somewhat above 4 percent in 1996, 1997, and 1998 and at 5 percent in 1999 and the first half of 2000. Furthermore, that growth occurred with minimal inflation. Policymakers did not see inflation rise when the unemployment rate fell to 4 percent—two percentage points below the commonly accepted value that hitherto had flashed an inflation alert. In time for the start of the millennium, newspapers overflowed with talk of a new paradigm—rapid productivity growth driven by an IT revolution.

How did monetary policy change in response to increased uncertainty over the rate of productivity growth and its influence over inflation? In 1979, the FOMC had lost its sense of the level of the trend line fit to real output, but retained a sense of its slope. In 1999, it further lost a sense of the slope. Monetary policy since 1998 suggests a judgmental balancing of two countervailing forces.

One force is a rate of growth of output that continues to increase resource utilization rates. Figure 5 shows the sustained fall in the unemployment rate from a cyclical peak of 7.5 percent in 1992 to 4 percent in 2000. This rise in the domestic rate of resource utilization has occurred despite the safety valve offered by a rising current account deficit. Figure 6 shows how

imports reduced the demands placed on domestic production by the strength in domestic demand. In 1998 and 1999 growth in domestic demand outpaced growth in domestic output by somewhat more than a percentage point.

The opposing force is high productivity growth. A technology-driven increase in productivity growth augurs well for the maintenance of low inflation. Figure 2 shows a rise in the growth rate of nominal expenditure, especially after 1998. That rise is consistent with low inflation as long as the trend rate of productivity growth has risen. Many policymakers also see rapid productivity growth as a force restraining inflation through its depressing effect on the rise in unit labor costs.

For example, in 2000Q2, (in the nonfarm business sector) compensation increased at an annualized 5.3 percent rate. However, a 5.7 percent rise in productivity produced a fall in unit labor costs of -.4 percent. Figure 7 shows that a rise in worker productivity has offset a strong rise in real compensation costs for business. The press release following the June 28, 2000 FOMC meeting highlighted the two opposing forces referred to above: “[C]ontinuing rapid advances in productivity have been containing costs and holding down underlying price pressures. Nevertheless . . . the utilization of the pool of available workers remains at an unusually high level."

The overall impression one receives of the monetary policy process is of ongoing judgment. There is no consensus over a level of the NAIRU—a bright line beyond which inflationary pressures build in labor markets. There is similarly no consensus over the economy’s speed limit—the trend rate of output growth. Since its June 1999 meeting, the FOMC has raised the funds rate in response to rising resource the utilization rates, but cautiously in the absence of actual evidence of a rise in underlying inflation.

The economics profession has had little advice to offer to policymakers in this situation. Growth models predict a positive relationship between the real rate of interest and productivity growth. The interest rate is the price paid for impatience. The faster one's income grows the greater the incentive to bring the relative abundance of the future forward to the present and the greater the need for the price system to limit the demand for available resources. However, economists have yet to combine this insight with quantitative models that provide credible interest rate predictions.

Explaining Productivity Growth

From 1996 through 2000, productivity growth surged. A number of factors point to an increase in trend rather than cyclical productivity. These increases in productivity came long after the commencement of the economic recovery phase of the business cycle. Atypically, productivity surged with high rates of utilization of the labor force.

Also, the decade of the 1990s experienced an investment boom. In 1999, real equipment investment as a percent of GDP rose to over 10 percent from an average of 6 percent in the 1980s. The information processing and software component rose to 6 percent of GDP. A fall in the price of computing power unrelated to the cyclical behavior of the economy can explain this investment boom. Indirect evidence for a continued rise in productivity comes from persistent high corporate earnings growth despite this high level of investment. Surveys of institutional analysts conducted by Primark (part of Thomas Corporation) show that the median estimate of growth in corporate earnings has risen from 11 percent per year in 1995 to 16 percent in 2000.

Not all the evidence suggests that the post-1995 productivity surge derived from the IT revolution. A source of productivity gains from IT is a reduction in redundancies in the

production process made possible by better information. With better information, firms need fewer extra workers and inventories to avoid work stoppages. Figure 8 plots a measure of inventories. It is true that the inventory/sales ratio reached a historic low in 2000. However, the decline began in the early 1980s. That start date indicates that the high productivity growth is the payoff to a lengthy restructuring process begun in the 1980s.

The post-1995 increase in productivity growth could also represent a catch up that restores the longer-run average. Figure 9 shows the long-run average. It fits a trend line through real output per capita over the period 1870 through 1999 (real GNP divided by the total U.S. population). On average, the trend line rises at an annual rate of 2.1 percent. With somewhat different data, Figure 10 shows the same trend productivity rise for 1950 through the present. (Figure 10 plots output in the nonfarm business sector divided by total hours worked.) This graph suggests that a catching up to the longer-run trend can explain the turn of the century productivity surge.

It is also possible that the behavior of monetary policy in the 1990s can explain productivity gains. Monetary policy remained focused on the reduction of inflation through 1996, but became moderately expansionary with the Asian crisis. The initial weakness and then strength in productivity growth in the 1990s tracks these shifts in monetary policy. Over the entire decade, weak productivity growth in the first half and strong productivity growth in the second half yielded a decennial average of 1.9 percent almost equal to the historical trend rate. (See Figure 11. The trend lines drawn in Figure 11 begin and end with business cycle peaks to eliminate cyclical influences on productivity.)

In general, monetary policy has exercised a significant influence on the post-War pattern of slow and rapid productivity growth. As shown in Figure 11, little productivity growth

occurred in the period from mid-1955 through 1961. The attempt by the Eisenhower administration to eliminate upward drift in the price level dominates this period. The two recessions of 1957-1958 and 1960 eliminated inflation and inflationary expectations.

The combination of an environment of expected price stability and the expansionary monetary policy that began in 1964 stimulated growth and productivity. Later, in the early 1970s, an expansionary monetary policy combined with price and wage controls again stimulated growth and productivity. Figure 11 shows annualized productivity growth of 2.8 percent between the two cyclical peak dates 1960Q2 and 1973Q4.

Little productivity growth occurred between 1978 and 1982. Inflation surged in 1978 and in response monetary policy became restrictive by year's end. As in the Eisenhower administration, the Reagan administration experienced two back-to-back recessions: 1980 and 1981-1982. Restrictive monetary policy brought inflation from double digits in the early 1980s to 4 percent in 1983. In 1988, the FOMC moved to finish the task of restoring price stability through its soft-landing strategy of maintaining moderate, below trend real growth. The 1990 recession and a weak economic recovery followed. Productivity growth remained below average from 1988 through 1995. Figure 12 shows the abnormally low rate of productivity growth during the economic recovery following the 1990 recession.

The issue then arises of whether the strong productivity growth that started in 1996 reflects the behavior of monetary policy. There are parallels between the 1960s and the 1990s. The monetary stringency of 1989-1990 and 1994 echo the back-to-back recessions in 1957-1958 and 1960. The monetary stimulus precipitated by the Asia crisis, especially starting in fall 1998, echoes the monetary expansion of the mid-1960s, albeit at a milder pace. The rapid productivity growth marking the end of the 20th century could then reflect both a rebound from the earlier

low productivity growth associated with lowering inflation and a boost from a subsequently expansionary monetary policy.

The source of the elevated turn of the century productivity growth possesses implications for its sustainability. Proponents of the view that the IT revolution has raised productivity growth assume that higher productivity growth will continue and will keep inflation in check. Figure 13, which displays the unemployment rate and growth in real labor compensation, shows that the growth rate of labor costs has increased since 1992. The historically low unemployment rate of 4 percent in 2000 presages a continued rise in labor compensation. Despite rising compensation gains, strong productivity growth has restrained the growth rate of unit labor costs (see Figure 14). As a result, rising labor costs have not exerted pressure on businesses to raise prices to maintain profits.

Is Monetary Policy Expansionary?

Inflation emerges as the difference between nominal and real output growth. Monetary policy determines trend nominal output growth. Real factors (growth of the labor force and productivity) determine real output growth. The major uncertainties over the outlook for inflation concern the effect of monetary policy on nominal output growth and the trend rate of productivity growth on real output growth. This section asks whether monetary policy is expansionary, neutral or contractionary. The first part looks at real rates of interest. The next part looks at money.

Real Rates--Are They High?

Are real rates of interest high or low by historical standards? Figure 15 shows a measure of monthly observations of the one-year (constant-maturity Treasury) real rate of interest rate.

From January 1995 through July 1999, it averaged 3.2 percent. (At the end of 1998, after the ¾ percentage point reduction in the funds rate that began in September of that year, the real rate fell to about 2.5 percent.) From August 1999 through August 2000, it averaged 4.2 percent. For comparison, it averaged 4.9 percent from December 1980 through August 1990.

Figure 16 shows a measure of quarterly observations of the ten-year (constant-maturity Treasury) real rate of interest. From 1995Q2 through 1998Q2, it averaged 3.2 percent, close to the one-year real rate. (In 1998Q4, it fell to 2.3 percent). It then rose to 4.1 percent in 2000Q1 and Q2. However, in 2000Q3, it fell back to 3.3 percent. Are these rates high or low?

Growth models predict a positive association between the real rate of interest and productivity growth. High productivity growth means high future income and high current wealth. A high level of wealth engenders high current consumption. The need to bring the resulting aggregate demand for resources into line with the available supply creates the need for a high real rate of interest. Therefore, the high rates of productivity growth in the last half of the 1990s suggest historically high real rates of interest.

The level of wealth relative to income is at a historically high value. Figure 17 shows the ratio of wealth (household net worth) to income. From the mid 1980s to the mid 1990s, the ratio fluctuates around a value near 4.5. It then rises dramatically to almost 5.5 by the end of the decade.

A rise in the value of equity powered this rise in wealth. The value of stocks traded on the New York Stock Exchange went from about $4.5 trillion at the end of 1994 to $11.8 trillion at the end of 2000Q2. (At the end of 2000Q2, the value of the NYSE was 67 percent of the three major exchanges, the NYSE, the American Stock Exchange, and the Nasdaq. The market cap of

the Amex was .14 trillion and Nasdaq 5.6 trillion.) Relative to the size of the U.S. economy, that market capitalization is unprecedented.

As shown in Figure 18, the ratio of the market value of stocks traded on the NYSE to GDP averaged 30 percent from 1946 through 1953. The ratio then rose to about 60 percent through 1973. Perhaps, the rise came about because the failure of depression to reappear boosted optimism about the future earnings of U.S. corporations. This ratio fell to 40 percent with the double-digit inflation of the 1970s. However, it rose again to about 50 percent with the noninflationary growth of the 1980s. The ratio began to climb moderately in the early 1990s and then dramatically after 1994. It reached 120 percent in 2000—2 ½ times the average ratio that prevailed from 1946 to 1995.

It is striking how little short-term and long-term real interest rates have risen given the massive wealth creation in the last half of the 1990s. That fact suggests an expansionary monetary policy. However, strong inflows of capital from the rest of the world could have kept the equilibrium interest rate low in the United States. In that event, money growth would be moderate.

Money Growth--Is It Moderate?

The behavior of M2 indicates moderately expansionary monetary policy from 1998 onward with a strong fillip in 1998. M2 grew (4th quarter to 4th quarter) at 4.5 percent in 1996, 5.6 percent in 1997, 8.5 percent in 1998, 6.2 percent in 1999, and an annualized 6.0 percent over the first two quarters of 2000. Figure 19 shows M2 growth relative to the former Humphrey-Hawkins target ranges.

What growth rate of nominal expenditure does money growth imply? The answer to that question depends upon the behavior of velocity. Figure 20 shows M2 velocity (GDP divided by M2). Over the period 1995 through mid 2000, M2 velocity has remained stable.

One reason for that stability is the stability over this period until June 1999 of the financial market opportunity cost of holding M2 (defined as the commercial paper rate minus the own rate of return on M2, which is a weighted average of the rates paid on the components of M2). Figure 21 shows M2 velocity along with the opportunity cost of holding it. The graph ends in 1990, which begins the five-year rise in M2 velocity produced by the contraction in the banking system that set off a flight of small time deposits into assets not part of M2 (Darin and Hetzel 1994). As the figure shows, M2 velocity (the inverse of real M2 demand) is interest sensitive.

Econometric estimation indicates that a one percentage point change in the opportunity cost of holding M2 produces a 2.2 percent change in real M2 demand or velocity (see Hetzel and Mehra, 1989, Table 1). One can construct an indicator variable for nominal expenditure as the sum of two components: the percentage change in M2 and the percentage change in velocity produced by the change in the cost of holding M2 (see Hetzel 1992). Figure 22 shows annual observations of nominal expenditure growth both actual and predicted by this indicator variable.

This indicator offers an independent estimate of nominal expenditure growth as its components comprise variables distinct from nominal expenditure. As Figure 22 shows, the indicator predicts reasonably well. However, it does not capture all the cyclicality of downturns, and it underpredicts nominal expenditure during the velocity shift of the first half of the 1990s.

From 1997Q4 through 2000Q2, M2 grew at an annualized rate of 7.2 percent. Over this period, nominal expenditure (final sales to domestic purchasers) grew at an annualized rate of 7.6

percent. The somewhat lower M2 growth rate relative to expenditure reflected the rise in the cost of holding M2. M2 growth moderated to about 5.5 percent over the twelve-month period ending August 2000. That moderation reflected the rise in the financial market opportunity cost of holding M2. Adjusted for predicted velocity changes, M2 growth does not indicate any significant slowing in nominal expenditure.

Although money growth (velocity adjusted as in Figure 22) can serve as an indicator of monetary policy, FOMC *Minutes* indicate almost no interest among FOMC members in money as an indicator. Unlike nominal expenditure (output), quarterly variations in money growth offer little information on changes in the economy's equilibrium interest rate. Quarterly movements in money include large amounts of noise. Ex post revisions in seasonal factors often alter significantly the behavior of intra-year seasonally adjusted money. The liquidity represented by a broad aggregate like M2 undoubtedly varies with compositional changes.

In addition, the Fed defends funds rate changes to the public in terms of the contemporaneous behavior of the economy. M2 is a nuisance in this respect. Especially because of its interest sensitivity, M2 can give signals about the appropriate level of interest rates that are at variance with incoming information on the economy. When the economy strengthens and interest rates rise, an increase in the financial market opportunity cost of holding M2 depresses M2 demand and M2 growth. M2 growth then moderates when the FOMC needs to explain increases in the funds rate.

Although this problem would disappear with the appropriate adjustment for the interest sensitivity of M2 demand, such an adjustment involves an econometric exercise such as the one incorporated in Figure 22. That exercise is difficult to explain and subject to debate. Nevertheless, money remains an important indicator for two reasons. As Figure 23 shows,

inflation arises from excess money growth relative to trend growth in real output. Even with uncertainty over the value of trend output growth, the central bank can prevent significant inflation by maintaining moderate trend money growth.

Furthermore, exclusive reliance on data on the economy as indicators provides a misleading impression of monetary policy to the public. When the central bank successfully stabilizes inflation, all the information in such data is from real variables. Manipulation of the funds rate target exclusively in response to real economic activity creates the impression that the central bank can systematically control real activity. Especially, it creates the impression that the central bank controls inflation by controlling the rate of growth of real economic activity.

Having money (velocity adjusted) as an indicator is a useful way to remind the public that what the central bank controls is money creation. The central bank controls inflation by controlling the amount of money creation relative to real growth. Although it may use an interest rate as its instrument, the influence of the central bank derives from the way its procedures create and destroy money. On the one hand, unanticipated destruction of money can create havoc. On the other hand, excessive creation of money leads to inflation. The ability of the central bank to do good is limited by the fact that it creates nothing of intrinsic value, just pieces of paper.

Predicting Inflation

What inflation rate will 2001 see? In late summer 2000, year-over-year CPI inflation was about 3.5 percent. However, the financial markets were more optimistic about longer-run inflation. According to the Philadelphia Fed Livingston Survey (August 2000), forecasters saw CPI inflation returning to the more moderate value of 2.5 percent in 2001.

The behavior of core (ex food and energy) CPI inflation suggested that inflation would decline from the 3.5 percent level. From January through July 2000, core CPI inflation rose at an annual rate of 2.6 percent (compared with 1.9 percent over the comparable period in 1999). However, omitting energy price rises can mislead in the event of a rise in the underlying inflation rate. When increases in energy prices recede, consumers will have additional income to spend on other goods and services. The prices of those items may then rise.

At times in the past when trend inflation rose, the core CPI understated the initial rise. From 1972Q1 through 1972Q3, CPI and core CPI inflation both rose at about a 3 percent annualized rate. Over the next 3 quarters, 1972Q4 through 1973Q2, core CPI inflation was only slightly higher at 3.3 percent, while CPI inflation was 6.4 percent. Over the 5 quarters 1973Q1 through 1974Q1, CPI inflation exceeded core CPI inflation on average by 3.9 percentage points. Core CPI inflation then rose to double-digit rates for the remaining three quarters of 1974.

So what will happen to trend inflation in 2000? To arrive at a prediction for inflation, one can forecast trend nominal output (GDP) growth and subtract trend real output (GDP) growth. What about the first factor? Over the period 1997Q4 through 2000Q2, nominal expenditure (final sales to domestic purchasers) growth was at an annualized rate of 7.6 percent. The rise in the current account deficit (net exports) lowered nominal output (GDP) growth relative to nominal expenditure growth over this period by one percentage point to 6.6 percent. (At 4 percent of GDP, the current account deficit is at an historical high. That fact suggests it cannot continue to increase. However, such prediction is problematic as one must forecast the eagerness of the rest of the world to invest in the United States.)

Is monetary policy expansionary, neutral or contractionary? That is, will it raise, maintain unchanged or lower nominal expenditure and output growth? The increase in the funds rate

target from 4.75 percent to 6.5 percent over the period June 1999 to March 2000 should moderate growth in nominal expenditure and output. However, the discussion in Section III does not suggest that real interest rates are high given the amount of wealth creation that occurred in the last half of the 1990s. Similarly, the discussion does not suggest that money growth adjusted for likely velocity changes has become less expansionary.

I therefore assume continued nominal output (GDP) growth of 6.5 percent. Predicted inflation is then this figure minus trend real output growth. The latter depends upon trend real productivity growth. That is *the* number to divine these days! Is it the historical average of 2 percent or something higher like 3 percent? With 1 percent labor force growth, this range of numbers yields implies real output growth between 3 and 4 percent. Those numbers in turn imply inflation between 2.5 and 3.5 percent. This range does not include price stability. Nevertheless, to be debating numbers of this low magnitude does represent a remarkable change from two decades ago.

Concluding Reflections on Productivity Growth

Has the country entered upon an era of productivity growth higher than the historical trend? Are the synergies that come from the combined forces of the computer and telecommunications revolutions more powerful than the other forces that gave the United States long-run two-percent productivity growth?

Those forces include the mass migrations from rural to urban areas and the concomitant shift from an agricultural to an industrial society. Also, rising educational levels lifted workers from an elementary school to a high school education in the 1920s and from a high school to a college education in the 1960s and 1970s. The quality of schools improved with the

disappearance of the one-room schoolhouse. Political instability in Europe produced a steady stream of genius to the United States.

The 20th century saw stunning advancements in the technology of transportation. The invention of the automobile along with the construction of good roads and the use first of trains and then airplanes dramatically reduced travel times. Advances in health care significantly increased life expectancy and improved the health of workers in the latter part of the 19th century and the 20th century. Rapid technological change has been the hallmark of the twentieth century. If one looks at innovation, the entire century is dazzling.

The wellspring of innovation is a reliable system of property rights and free entry into markets. The resulting wide-open competition drives innovation. In a competitive market, unusual profits come from being first to market with a new product or lowering production costs below those of competitors. Although free entry renders those profits evanescent, they drive innovation.

The history of the industrial revolution is a history of secular reductions in the cost of competing spatially. For two centuries, the costs of transportation and communication have fallen steadily. The computer-telecommunications revolution continues that progress. The combination of this revolution and the fall of the iron curtain of Communism could create a single, worldwide competitive marketplace. The competition created by such a market could raise the pace of innovation that began with the Industrial Revolution. A sustained rise in productivity growth could emerge. (Governments must still allow that productivity growth to occur by standing back and maintaining free and open international markets.)

What are the implications for monetary policy? Although productivity growth may have risen, identifying changes in productivity growth within the time horizon relevant for policy is

problematic. Monetary policy itself can for extended periods produce apparent changes in the rate of productivity growth. Discretion based on an effort to identify changes in productivity growth is likely to become a source of instability.

When uncertainty besets estimates of trend real growth, the most conservative policy for the Fed is to use the long-run value of trend productivity growth of 2 percent. With labor force growth of 1 percent, predicted trend real output growth is then 3 percent. A rule for monetary policy that makes nominal GDP grow at 3 percent would then yield an amount of inflation or deflation that depended upon the shortfall or excess of trend productivity growth over two percent. The FOMC would raise its target for nominal GDP growth after observing deflation for a considerable period. For example, if the price level fell by one percent over the course of a year, it would raise the target for nominal output growth to 4 percent, and conversely in the event of inflation.

Anyone designing a rule must make a basic decision. Does he want primarily to allow the price system to function fully and to prevent monetary policy from itself from becoming a source of disturbance? Alternatively, does he want to improve on the working of the price system and use monetary policy actively to improve the performance of the economy? The rule suggested above would meet the criteria of the first sort of rule, but not the second.

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