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Productivity and Monetary Policy

Remarks by

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President Santomero promised you my "perspectives on monetary policy." That is an open-ended topic, and I thought it might be useful to focus on one factor that has been critical in making policy since the mid-1990s--the behavior of productivity. It was about that time that the underlying growth of labor productivity turned up. And productivity has risen even more rapidly over the past few years, when the economy has been through recession and modest recovery. Indeed, in the second quarter of this year nonfarm business productivity increased at an astounding 6-3/4 percent rate.

My focus will not be on the reasons for the changed behavior of productivity--though they will inevitably be an important part of the story. Instead, I thought I would concentrate on one aspect of the acceleration of productivity: its consequences for aggregate demand. That relationship is of obvious interest to monetary policymakers, who are constantly assessing the balance of aggregate demand and potential supply as we pursue our legislated goals of maximum employment and stable prices. I think that the relationship should also be of interest to teachers of economics as a real-world illustration of some of the complications that we face in the policy process. Movements in potential GDP affect how interest rates and aggregate demand relate in product-market equilibrium--and not in entirely straightforward ways.

The topic seems particularly timely now in light of the behavior of productivity over the most recent business cycle. We can all agree that faster productivity growth benefits U.S. residents over the long-run; it is the foundation for rising standards of living. But its cyclical effects may differ--or be perceived to differ--over time. In the late 1990s, the pickup in productivity fueled a powerful surge in output that resulted in a drop in the unemployment rate. Eventually, a rise in interest rates was required to align aggregate demand with potential output to avoid a pickup in inflation. More recently, rapid productivity growth has been associated with

the "jobless recovery" and a period of unusually low interest rates to stimulate aggregate demand.

I have some thoughts on these issues but no definitive answers. And, I stress, they are my thoughts and do not necessarily reflect the views of my colleagues on the Federal Open Market Committee or its staff.[1] We will really know the answers only *ex post*, after the final chapter is written on the current business cycle and after numerous data revisions provide us with a better fix on the behavior of productivity. As policymakers, of course, we don't have the luxury of waiting for the outcomes and revisions. We are weighing probabilities in the here-and-now, given incomplete information. That is what makes policy so much of a challenge--and so much fun--at least for an economist.

Productivity and Monetary Policy: The Theory

In standard models, at a given real interest rate, a sustained increase in the growth rate of productivity should boost demand even more than it does potential supply in the long run. Or, to put the same thing another way--market interest rates eventually must rise after an upturn in productivity growth to equate demand and supply. The extra pressure on demand comes from several sources once the long-run growth of supply notches higher and is recognized by

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[1]Flint Brayton of the Board's staff provided considerable advice and comments in the preparation of this talk.

economic agents. To keep the growth of the capital stock in line with the now-elevated growth of output, investment needs to rise substantially. The principal incentive for this rise comes through the marginal product of capital, which will increase if the capital stock does not keep up with output. Consumption also should rise relative to income because workers revise up their expectations of permanent income and, unless interest rates do rise promptly, because wealth tends to move higher with the increase in the expected rate of growth of profits and dividends.

In the short run, whether demand exceeds or falls short of potential supply and whether interest rates need to rise are ambiguous. The answer will depend on such factors as how quickly households revise up their expectations of permanent income and whether the increase in productivity itself requires higher investment for it to be realized--for example, whether it flows from new technology necessarily embodied in new capital equipment. Indeed, if the recognition of these developments by households lags considerably and if growth in the capital stock need not pick up right away, interest rates might even have to fall for a time to boost demand to the higher level of potential. This short-run ambiguity presents a challenge to monetary policy. Because of the lags in the response of the economy, policymakers must not only analyze the existing situation but also form a judgment about how demand and supply are likely to evolve over the next several years.

The Late 1990s

It took some time to recognize the upturn in productivity growth in the late 1990s and to understand the effects it was having on the economy. What we observed was very strong growth in output accompanied by a decline in the unemployment rate, but that decline was smaller than would have been anticipated based on previous estimates of the rate of increase in the economy's

potential. We also saw that the response of prices to the drop in the unemployment rate was considerably more damped than might have been expected given historical relationships; in fact, some measures of inflation decreased in circumstances in which previous statistical regularities suggested that they ought to have been moving higher. Of course many things were going on at the time, but one hypothetical change that seemed to solve a number of these puzzles was a rise in the trend rate of productivity growth. It explained the slow pace of the drop in the unemployment rate. Moreover, it made the behavior of inflation more understandable because the productivity gains seemed to take a while to feed through to higher growth of labor compensation in labor markets and thus lowered business costs initially.

As indicated by the drop in the unemployment rate, the response of demand was rapid and strong and exceeded the pickup in supply. Steep decreases in the prices of high-tech equipment contributed to a boom in investment as companies acquired new capital equipment to make use of new technology. Consumption was boosted by a rising stock market when investors built in higher growth of expected corporate earnings as well as by upward revisions to permanent incomes. The strength in activity was all the more remarkable when one considers that a sharp rise in tax payments associated with capital gains on equity and increases in income damped the rise in disposable income. Moreover, a portion of the pickup in demand was deflected to other countries by a surge in imports when foreign investment attracted to the United States by new profit opportunities strengthened the dollar.

With increases in demand outrunning gains in potential output, it seemed evident that interest rates were going to have to rise at some point. The timing of that increase was influenced by several considerations. Financial and economic crises in East Asia beginning in

1997 followed by the financial market turmoil after the Russian debt default in 1998 damped global demand. In the latter event, the Federal Reserve actually eased policy to counter the potential threat to stability in financial markets and the economy. In addition, as I pointed out earlier, the inflationary effects of excess demand were held in check by the productivity gain itself, which lowered business costs and raised profits, with the subsequent price competition reducing inflation. In that environment, the unemployment rate fell a little below 4 percent without material effect on the rate of inflation. This high level of labor utilization probably could not have persisted indefinitely--at some point compensation might well have begun to accelerate beyond even that justified by the faster growth of labor productivity. But, in the interim, the absence of increasing inflation pressures meant that the Federal Reserve did not need to tighten to bring demand back in line with the potential as soon as it otherwise might have needed to. All this is clearer in retrospect. At the time, we could only observe outcomes that did not fit with preconceptions; try to find rationales that explained what we were seeing; and in the process, derive implications about the future that could be used to guide a forward-looking monetary policy.

It also is now evident that demand became even stronger than was justified by the increase in potential. Something real definitely happened--productivity growth turned up--but, not surprisingly, private agents had a hard time evaluating this change and calibrating its implications for profits, incomes, and wealth. As a consequence, capital was overbuilt, especially in some sectors, and equity markets became overvalued. These miscalculations became evident only later, and the resulting corrections have roiled both product and financial markets in the past few years. Nonetheless, overshooting and correction do not invalidate the

basic story I outlined above--that underlying productivity growth did increase and over time such an increase in trend productivity boosted demand at least as much as supply--a pattern consistent with economic theory.

Recent Years

In the past few years we have witnessed a very different macroeconomic configuration. Productivity growth has remained quite strong, but demand has been inadequate to keep the economy expanding fast enough to create jobs. The question is whether these circumstances are related--whether, as is often implied, the rapid productivity growth causes the weak employment. In an arithmetic sense the relationship looks plausible--for a given path of demand, the more rapid the productivity growth, the weaker the labor market. But the arithmetic explanation does not comport with economic theory relating demand and supply over the longer run or with the experience of the late 1990s.

The facts are clear. The actual increase in productivity has been remarkable in the past few years. For productivity to accelerate early in a recovery is not unusual. But that surge typically follows a period of very weak productivity growth or even outright decline during recession when businesses lag in cutting back on labor. Most often, the pickup in productivity is also associated with a very rapid increase in demand and activity, which businesses may not have anticipated in their hiring and which they meet in part by correcting some inefficiencies that built up earlier when the economy had unexpectedly weakened. The current cycle saw neither a decline in productivity during the downturn nor a rapid rebound in output once recovery began. Instead, we have observed persistent strong productivity gains through the recession and even stronger increases in the modest recovery since then. Nonfarm business productivity rose 3-1/4

percent in the recession year of 2001, 4-1/2 percent in 2002 and at a 4-1/2 percent rate so far this year. From 1996 through 2000, it rose at a rate of 2-1/2 percent.

It is also evident that despite rapid productivity growth, demand has been tepid. Moreover, the weakness has been led by business investment, which in our story ought to respond strongly to rising productivity. Demand has been sufficiently weak that jobs have continued to decline, opening up economic slack and putting further downward pressure on an already low inflation rate.

Surely one important explanation for the weakness in demand is that the economy has been paying the price for previous over-exuberance. Anticipating greater profits and sales than they ultimately realized, businesses acquired more capital equipment than they could usefully employ, at least for a time. This was especially the case in telecommunications but likely pertained to equipment in some other sectors as well. As a consequence, beginning in late 2000, investment fell sharply as firms worked to align increases in capital stocks with now-lower longer-term expectations for growth in sales and earnings. Similarly, as equity prices fell, households needed to raise saving rates to achieve life-cycle objectives for wealth accumulation. The associated restraint on spending was compounded by multiplier-accelerator effects that followed the initial cutbacks. In sum, just as an increase in expected productivity growth tends to cause spending to rise, a downward adjustment in expected productivity growth, even if from unrealistic levels, will tend to bring with it a reduction in demand.

It was not only capital spending and equity prices that seemed to overshoot in the late 1990s; credit was provided with undue optimism about prospects for repayment. With the realization that borrowers were riskier than had been earlier thought, yield spreads widened

dramatically. Then, in mid-2002, both debt and equity markets reacted strongly to revelations that in some cases lenders and investors had been relying on incomplete and misleading corporate reporting. In an environment of very skittish financial markets, where the cost of capital to many private firms was increasing and access to funding could be impaired quickly and unexpectedly, businesses decided they had to conserve cash by further slashing capital spending and hiring.

These corrections explain part of the weakness in demand, but they do not help us understand why productivity has been so rapid or why the productivity growth has not elicited a stronger response in demand.

A clue is provided by the observation that the source of the productivity gains has shifted since the late 1990s. Productivity was boosted importantly by high investment earlier but not more recently. From a growth accounting perspective, capital deepening--the amount of capital for each worker--has become much less important as a contributor to productivity growth since 2000, with most of the increases attributed to rising multifactor productivity. Lags between the introduction of new technology and its full effects on productivity have been evident in history, and perhaps we are now seeing a version of these lags with respect to information technology. In the second half of the 1990s, the cost of high-tech equipment was falling so quickly and applications for it were spreading so rapidly that businesses found that they could raise productivity substantially by buying large amounts of this new equipment and other capital goods geared to working with it. In recent years, businesses have concentrated on reorganizing and rationalizing production processes to more fully realize the efficiencies inherent in the new equipment and the changing skills of the workforce. Obviously, productivity growth generated

through this rationalization process will not have the direct demand-augmenting effect of productivity increases realized through more rapid investment spending.

The shifts in the relationship between demand and productivity and in the source of productivity growth probably have been accentuated by the changing economic and financial environment. The rapid growth of output, the high profits, and the elevated share prices of the second half of the 1990s seemed to lead businesses to concentrate on expanding and on acquiring the latest technology rather than on wringing all they could out of the capital they were buying. The drop in profits, the heightened caution in financial markets, and the slower growth of demand in the past few years have reduced incentives to expand and have put considerable pressure on businesses to damp spending and cut costs. To the extent that the productivity increases of the past few years are resulting from businesses learning how to use existing technologies and capital more effectively and from more intense pressure to realize cost savings, productivity gains in the future may not be as large as those experienced recently. If private agents hold this view, expectations of future income and profits would be damped relative to the outsized productivity gains of late, curtailing the indirect effects of those gains on demand.

In addition, the perceptions of households and firms about the growth of future income and profits may be heavily influenced by their recent experience, perhaps even more than by the longer-term trends in productivity and potential output that figure so prominently in our economic models. Just as households and businesses may have extrapolated earlier very rapid, but unsustainable, economic growth, it would not be surprising if the recent economic weakness may have led them to expect smaller increases in output and income than will turn out to be justified by underlying trends. Businesses in particular appear to have been quite restrained in

their projections of future sales, likely further damping demand over the past few years. Moreover, the attacks of September 11, 2001, and subsequent geopolitical uncertainties, reflected in part in energy prices and in volatile financial markets, have given businesses added reasons to be guarded about the outlook and cautious in making the commitments for the future inherent in purchases of capital goods and expanding the workforce.

The combination of high productivity growth and weak demand has presented some interesting issues for monetary policy. An ongoing challenge has been to analyze developments, as we have been doing this evening, and infer their implications. Because this cycle has been unusual, historical precedents or patterns have not provided much guidance about the future. Sorting out the possible reasons for the continuing weakness in investment, which has played a key role in this episode, and hence predicting its likely persistence has been especially difficult. Estimates of capital overhangs are problematic at best; and by their nature, the effects of one-time factors extraneous to the cycle--such as geopolitical risks--cannot be reliably quantified. In such circumstances, the policymaker has little choice but to pay particularly close attention to incoming data but also to remain mindful of the difficulty separating signal from noise in high-frequency information.

As events have unfolded, surprisingly rapid productivity growth that did not feed through immediately to demand has had important implications for the stance of policy. With a very high pace of output growth needed just to keep margins of slack from rising but substantial restraints on demand, policy has had to be more accommodative for longer than it would otherwise have been. The real federal funds rate has been in the neighborhood of zero since late 2001--even longer than in the jobless recovery of the early 1990s. Nonetheless, growth has not yet

strengthened sufficiently long enough to stabilize the job market, much less to begin to eat into the considerable margins of excess labor and capital capacity.

I want to emphasize that the problem has not been productivity growth *per se*. The difficulty for policymakers has been anticipating how demand would evolve relative to the productivity-enhanced path of potential supply. Because productivity increases are not raising demand as much as might have been expected and may even have been delaying the recovery of investment by enabling businesses to increase output without expanding physical capacity, and because other forces also are holding back demand, the size of the task facing macroeconomic policies in promoting high employment has been all the greater.

The reasons for pursuing an unusually easy policy to speed a return to higher levels of resource utilization have been bolstered by the effects of rapid productivity growth on inflation. Gains in efficiency have damped prices directly by holding down costs and indirectly to the extent they have made the tendency toward slack in labor markets greater. Inflation has been quite low--to the point of meeting Chairman Greenspan's definition of price stability as a situation in which expected price increases do not affect the decisions of households and businesses. In that circumstance, further declines in inflation will not increase economic efficiency; indeed, they could complicate the future conduct of policy if they resulted in inflation and nominal interest rates so low that the monetary authority had inadequate scope to counter downward shocks to demand with its usual policy instrument of the short-term interest rate. As the Committee's minutes relate, the desirability of forestalling significant additional declines in inflation has been a factor in the Federal Reserve's aggressive easing of policy in recent years and in its judgment that accommodative policy will be required for a "considerable period."

Going Forward

Long-term trends in productivity are extraordinarily difficult to forecast, as we learned in the 1970s and the 1990s. Nonetheless, I do not think I am too far out on a limb in predicting that the underlying growth in productivity over the next several years is likely to be less than the extraordinarily rapid gains of the past year or so but to remain considerably in excess of the weak growth of the 1970s and 1980s. As I noted, some of the very recent increases reflect efforts by firms to realize more fully the efficiencies inherent in the capital stock they had previously acquired. And some may be temporary responses to a high level of business caution. Still, the persistent outsized increases in productivity testify to the continuing potential for using new technologies to achieve greater efficiencies, and we have no reason to think that they have been fully exploited. We are on an "S"curve from one state of technology to another but very likely only part way up that curve.

The rise in productivity is unambiguously beneficial over the long run. And over time, demand should strengthen at least enough to match potential supply. In particular, businesses will want to begin adding to capital stocks to keep pace with continuing growth in sales. Further declines in the relative prices of high-tech capital goods will reinforce the incentives to make these additions. The resumption of growth in capital implies a considerable rebound in investment.

Such a strengthening will require that businesses feel comfortable with their current level of capital and more confident that demand for their products will grow in the future. In recent months, we have seen some encouraging signs of a pickup in business spending on capital equipment. Most of this demand is probably for replacement and modernization rather than

expansion, but the stepping-up of such purchases after a long period in which replacement cycles had been stretched out does suggest that the sense of gloom is lifting, even if it has not been replaced yet by optimism about the growth of future sales. Businesses are being helped by stronger cash flows as profits revive and much more resilient financial positions after the balance sheet restructuring of recent years. They are also finding financial markets more receptive. As credit difficulties have begun to ease, much of the run-up in spreads since 2000 has been reversed. A substantial rise in equity prices since late last year has also evidenced greater confidence by investors and has helped to strengthen household balance sheets.

But these are just early signs that the process of adjustment is ebbing and the extra degree of caution is receding. It will be a while before we can be sure that a self-sustaining expansion is underway of sufficient strength and persistence to put the economy back on a path toward full employment. Continued business caution is especially evident in spending on inventories and on hiring. Firms seemingly have not run out of ways to expand output without adding to their capital base or their labor force. As a consequence, labor markets remain quite weak, and slack, if anything, has increased despite what many economists are estimating to be quite vigorous growth in the third quarter. Our challenge as economists and policymakers remains to analyze these ongoing developments and to judge the likely course of productivity and economic potential and its interaction with demand. In my view, however, even if demand does continue to strengthen, the low level of inflation together with continued solid gains in labor productivity and the considerable margin of slack in resource utilization that has built up suggest that monetary policy can remain focused on fostering further robust expansion and limiting disinflation.