

The Impact of Monetary Policy on Agriculture

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I was delighted when Bert Greenwalt invited me to speak at this conference. The topic of the impact of monetary policy on agriculture is an old one, and one subject to a lot of misinformation. Most of my speech will be about the nonmonetary influences shaping the industry. The reason is not that I'm dodging the issue, but that most of what goes on in agriculture has nothing to do with monetary policy. By discussing the fundamental forces shaping the industry, I hope to convince you that most of what we observe in the behavior of agricultural prices and output is a consequence of nonmonetary forces. My main message is that trying to change these outcomes through monetary policy is an invitation to messing up monetary policy without fixing problems in agriculture. In fact, messing up monetary policy will only make agricultural conditions more difficult.

Before proceeding, I want to emphasize that the views I express here are mine and do not necessarily reflect official positions of the Federal Reserve System. Kevin Kliesen of the St. Louis Fed is a co-author of this speech. I appreciate his contribution and thank other colleagues at the Federal Reserve Bank of St. Louis for their comments. However, I retain full responsibility for errors.

I'm going to proceed in the only way a former professor of economics can proceed—by organizing my remarks around the supply and demand conditions in agriculture. I'll start with a few facts about income volatility in agriculture, before moving on to analyze supply and then demand conditions. Next, I will put the two together to

discuss outcomes for price and output. I will also compare agriculture briefly with computer manufacturing, another industry characterized by rapid productivity growth and falling prices.

Only after discussing the fundamentals of agriculture will I get to monetary policy. My main message is this: The Federal Reserve needs to concentrate on its primary responsibility of keeping inflation low and stable. Achieving sustained low inflation requires that interest rates sometimes rise and sometimes fall. I know that interest rate fluctuations can cause problems in agriculture. But there is no other known way to keep inflation low and stable; furthermore, compromising monetary policy objectives will not in the end help agriculture, but will actually make things worse by generating instability in the inflation rate, interest rates, and the level of economic activity.

INCOME VOLATILITY IN AGRICULTURE

As nearly everyone knows—including everyone without exception in this audience—the United States is currently in the midst of a record-breaking business expansion: 107 months and counting. Nearly as remarkable, the current expansion follows on the heels of the 92-month-long expansion in 1982-90. Moreover, the two expansions were separated by one of the mildest recessions in U.S. history. Professor John Taylor, a distinguished economist at Stanford University, has dubbed the 17-year period since 1982 "The Long Boom." Since 1982, the output of U.S. final goods and services—or real GDP—has nearly

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doubled, growing at an average annual rate of almost 3¾ percent per year.

I believe that improved monetary policy has played an important role, though certainly not the only role, in achieving this long period of sustained economic growth at a healthy pace. Whatever else might have been going on, the rate of CPI inflation could not have declined from more than 13 percent in 1980 to 2.7 percent over the 12 months ending December of last year if the Federal Reserve had not concentrated its efforts on controlling inflation. By sharply reducing the rate of price inflation and establishing firm expectations in the marketplace that inflation would remain low, monetary policy has contributed to higher productivity growth and enhanced the economy's stability.

Even though the U.S. unemployment rate has fallen from about 11 percent at the end of 1982 to 4 percent today, we know that some members of our society have been left behind. I suspect that many in this audience will respond to these words by thinking, "Yes, many of us in agriculture have been left behind." Indeed, the last couple of years have been rough for U.S. agriculture.

Agriculture has always been a risky and uncertain business. In ancient times, farmers suffered from droughts and locusts. Today, farmers still suffer from droughts and locusts. I don't know my ancient history very well, but I suspect that several thousand years ago farmers suffered not only from natural hazards but also from market disruptions brought on by war, the edicts of emperors, and other man-made problems. I'll leave it to you to tell me if farmers today feel any better knowing their kinship with *all* farmers over *all* ages and *all* parts of the world.

Let's take a minute to look at some recent data for U.S. farmers and ranchers. After rising to a 21-year high of \$54.9 billion in 1996, real, or inflation-adjusted, net farm income subsequently fell 13 percent in 1997 and roughly another 10½ percent in 1998. Although the latest projections from the U.S. Department of Agriculture (USDA) suggest that some improvement occurred in 1999, this upswing will most likely have stemmed entirely

from a nearly \$11 billion jump in government income transfers to farmers. For a longer-term perspective, consider that real net farm income averaged \$47.7 billion between 1990 and 1998, roughly 20 percent more than the \$39.8 billion annual average seen during the 1980s.

The early 1990s, then, were not so bad, but farm income during those years pales next to the \$62.6 billion average real net farm income during the 1970s. The tumultuous 1970s, frankly, were an unusual decade. Some of agriculture's good fortune of that period was purchased at the cost of severe problems in the 1980s. Although farm incomes during the 1970s rose rather sharply for a few years—real net farm income jumped from \$52 billion in 1971 to \$108 billion only two years later—this surge was the result of several unsustainable factors, such as the United States allowing the Soviets to enter the U.S. market to buy every bushel of corn, wheat, and soybeans they could get their hands on. But by 1980, against the backdrop of high and rising inflation, high and rising interest rates, and a depreciating dollar, real farm income had plummeted to \$29 billion. Just three years later, it plunged another 27 percent to \$21 billion. By 1983, real net farm income was more than 80 percent lower than it had been just a decade earlier and even lower than the \$25 billion low point reached during the depths of the Depression in 1932.

Many specific factors accounted for the sharp swings in farm income I've outlined. These have been well documented and I won't repeat them here. My point is merely to state that farming is an inherently risky business. Swings in farm incomes over time can be, have been, and probably will continue to be quite dramatic.

What I'm going to do now is to analyze the basic characteristics of agricultural product markets; then I'll discuss the role of monetary policy. I'll examine supply conditions first, then demand conditions, and finally the interaction of supply and demand that determines prices and quantities of agricultural products.

SUPPLY CONDITIONS IN AGRICULTURE

In terms of sheer producing power per unit of input, American agriculture ranks as an unqualified success. The average U.S. farmer is growing and harvesting more now than he has at any time in history—and he’s doing it, in the aggregate, with fewer inputs. Indeed, for 100 years or more, U.S. agriculture has been characterized by fantastic productivity advances. A closer look at this productivity explosion reveals some startling statistics. During the past 75 years, the number of acres harvested for corn grain has declined by 16 percent while production has increased five-fold. Similarly, while cotton production in recent years is little changed from 1926, when cotton acreage peaked at just under 45 million acres, yields per acre have more than tripled while the number of acres harvested has fallen by more than two-thirds. And it’s not just crop producers who have become more productive. The number of cattle and calves peaked at around 132 million in 1975. Since then, the cattle inventory has dropped by about a quarter while meat production has increased 11½ percent. Likewise, the number of pounds per broiler produced has risen from roughly three in 1950 to nearly five today.

In the aggregate, accordingly, the amount of output produced by each farmer, including farm employees, has risen from almost \$2,300 in 1910 to roughly \$35,600 in 1998—or a little more than 3 percent a year. (These figures, including the real net farm income measure cited earlier, are in constant dollars, with a base year of 1996.) Much of this increase has occurred since 1973, a period when productivity in the nonfarm sector began to slow dramatically. From 1973 to 1998, the amount of farm output per worker rose at an average annual rate of nearly 5 percent per year. In contrast, the productivity growth in the nonfarm business sector during this period measured 1½ percent a year.

That the industry has been able to increase production with fewer farmers and ranchers is testament to the tremendous benefits gleaned from

technological innovations. *Doane’s Agricultural Report*, a trade publication many of you are undoubtedly familiar with, recently ranked those innovations that have contributed to agriculture’s tremendous productivity advances during the 20th century. In *Doane’s* view, research and education, mechanization, hybrid seed corn, commercial fertilizers, and chemical pesticides were the top five improvements. Most economists would probably concur with these assessments. But just as the new technologies associated with the computer, the Internet, lasers, and telecommunications have revolutionized many aspects of the nonagricultural economy, more innovations are on the way which, if developed properly, promise even greater advances in agricultural productivity in the future.

The advent of genetically modified organisms in many crops, which follows the advances in genetic improvements applied to livestock production, promises both increased production and reduced reliance on pesticides. Likewise, the use of satellite technology to better apportion fertilizer and other soil nutrients, combined with the increased usage of low-till farming, offer the promise of increased production with reduced chemical fertilizer applications.

Some of these technological innovations are controversial—no doubt about it. But these controversies are a whole other subject. What I want to emphasize here today is that productivity improvement in agriculture is a great American triumph, and understanding it is essential to understanding the basics of agricultural markets.

If I had a chalkboard behind me, I would summarize this discussion by drawing the usual upward-sloping supply curve with a big arrow on it, pointing to the right, to indicate that the entire supply curve is shifting out rapidly over time as productivity improvements accumulate. I would also draw a couple of dashed supply curves parallel to the solid one to indicate that supply bounces around from year to year depending on growing conditions—the droughts and the locusts.

DEMAND CONDITIONS IN AGRICULTURE

When you add a demand curve into the diagram, the curve, of course, slopes down. But how steep is it and how does it move over time?

Let's start with the movement over time. The demand for food rises as the population rises and as the average income of consumers rises. The effect of rising income has been understood for a long time. In the mid-19th century, Prussian economist Ernst Engel put forth the proposition that the more income you have, the smaller the fraction of your income spent on food. This proposition was so well established that it became known as "Engel's law." The demand for food products increases about proportionately with population, but beyond that increases more slowly than does per capita income. For example, if per capita income rises by 3 percent in real terms, the percentage increase in demand for food products would be considerably less—perhaps only 1 percent. In the United States and other high-income countries, we observe the consistent pattern that expenditures on farm commodities grow more slowly than total expenditures. Thus, expenditures on farm commodities decline relative to the economy as a whole. For a long-term perspective, expenditures on food as a share of total consumption expenditures fell from about 25 percent in 1929 to 14 percent by 1999.

The market for U.S. agricultural production is not, of course, limited to U.S. consumers. The United States, by virtue of its abundant natural resources and plentiful supply of capital, enjoys a distinct comparative advantage in agriculture production relative to most other countries. Given the limited upside to boosting the domestic demand for farm products, one way to increase sales of U.S. farm products is to make them available to consumers in other parts of the world. And in fact, the share of U.S. farm production that is exported has steadily trended up over time. From 1935 to 1954, U.S. farm exports averaged 8½ percent of total farm output. This share reached a high of 28 percent in 1980 and has averaged roughly 25 percent since 1988. As important as

exports are to U.S. producers, the reality is that food demand around the world is subject to Engel's law, which means that world demand for U.S. farm output is unlikely to grow rapidly. Moreover, as the recent Asian crisis showed, unexpected demand disturbances from foreign markets are a fact of life. It is probably true that export demand, welcome though it certainly is, is more volatile than domestic demand.

What about the shape of the demand curve for food? This analysis can be very brief. We don't consume very much more food when its price declines, or very much less when its price increases. Thus, the demand curve is pretty steep—inelastic, in economists' lingo.

We can summarize the demand conditions this way: The demand curve for agricultural products is quite steep, shifts out only gradually over time, and is somewhat volatile because export demand is volatile. That is the demand curve on my imaginary chalkboard.

SUPPLY AND DEMAND TOGETHER—PRICE AND OUTPUT TRENDS IN AGRICULTURE

In any market, price and quantity are determined by the interaction of supply and demand. The long-run outcome in agriculture is dominated by the fact that the supply curve, driven by rapid productivity improvement, is shifting out more rapidly than the demand curve. Thus, agricultural prices relative to prices in general have been trending down. Indeed, farm prices have been falling relative to nonfarm prices for as long as we can measure them. From 1909 to 1941, farm price increases trailed aggregate price increases by about ¾ of a percentage point a year. That margin doesn't sound very large, but maintained for 30 years, it cuts the relative price of agricultural prices by 21 percent. During World War II and its immediate aftermath, farm prices shot up dramatically: From 1941 to 1948, farm prices advanced at roughly 14½ percent a year, while aggregate prices rose a little more than 7½ percent a year.

Farm prices subsequently resumed their downward trend, as the waves of technological innovations ramped up production. Although U.S. living standards rose in the aftermath of World War II, Engel's law remained in force and food demand grew relatively slowly. From 1948 to 1998, relative farm prices declined by roughly 3 percent a year; by 1998, the relative price of food was 78 percent below its 1948 level. Falling relative farm prices, in turn, caused farm income to grow more slowly than nonfarm income.

Output has been growing in absolute terms, but less rapidly than output of all goods taken together. Modest output growth is a direct outcome of the fact that the U.S. population has been pretty well fed for a long time, and does not choose to eat that much more even when the price of food goes lower. The bottom line, in terms of long-term trends, is that agricultural prices have been falling and total output rising only modestly.

The inevitable outcome of rapid technological advance and slow growth of total demand is that the demand for workers in agriculture declines. It seems somehow unfair that a particularly innovative and productive sector such as agriculture tends to generate low incomes. Indeed, income prospects are especially bleak for those in agriculture who fall behind the cutting edge of technological improvement. In the words of the economist Hendrik Houthakker, "The greater the increase in farm productivity, the greater the imbalance between supply and demand of farm products which has to be corrected by an outflow of labor or by lower farm prices." Moreover, Houthakker notes that "unless the outflow of labor from farming is fast enough, an increase in farm productivity leads only to lower farm prices and lower farm incomes." How low incomes go depends on how rapidly workers move out of agriculture to industries with better income prospects. Low incomes in agriculture may seem unfair—and this analysis may seem rather brutal—but the fact is that low incomes are driven by the inexorable economic forces of high productivity growth, slow demand growth, and insufficiently rapid exit of workers from agriculture.

Let me put a few numbers into the analysis. From 1910 to 1932, U.S. farm employment declined modestly, from 13.6 million to 12.8 million, or about 0.25 percent per year. During the 1930s, labor outflows accelerated markedly and continued largely unabated until roughly 1987, when farm employment totaled just under 3 million, or about a quarter of what it was 50 years earlier. In 1999, farm employment was about 2 percent of total employment, whereas in 1929 about one-fifth of civilian employees were engaged in farm employment.

It appears that the major adjustment in the number of agricultural workers is now over. Since 1987, farm employment has stabilized, and even risen slightly. Of course, farm employment continues to fall as a share of total employment, but the most difficult period in which a large absolute decline occurred is now past.

According to the USDA, the index of total farm output increased by roughly 135 percent from 1948 to 1996 (the latest observation). Over this period, though, the index of total farm *input*—a measure designed to capture the influence of intermediate inputs like fertilizer, fuel, labor and capital—actually declined. What is interesting is that nearly all of this decline in input stems from reductions in labor input. Whereas inputs of intermediate products rose 84 percent and capital input rose 33 percent, labor input dropped 70 percent.

Although farm output has increased substantially over time, it has not kept pace with growth in the nonfarm sector of the economy. From 1889 to 1966, real farm output as a percent of total GDP declined from nearly 8½ percent to about 1¼ percent. Since then, it has remained fairly constant, implying that the rate of return to agriculture has more or less stabilized at its long run rate. The continued existence of small, inefficient farms, though, suggests that other factors are keeping some resources in the industry that might well earn a higher return elsewhere.

I've discussed long-run trends in agricultural prices and outputs, and earlier I discussed the volatility that characterizes this industry. Now I need the image of a chalkboard in motion. The supply and demand curves are dancing around,

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sometimes creating large and painful declines in prices, and sometimes delightful increases in prices—delightful for producers, anyway. The dance sometimes yields painful declines in output—the years of droughts and locusts—and sometimes enormous bumper crops. And these fluctuations occur on top of long-run trends characterized by declining prices and modestly rising output.

AGRICULTURE AND COMPUTER INDUSTRIES COMPARED

It is interesting to compare agriculture, just briefly, with another industry—computers—characterized by high productivity growth. Though the two industries are vastly different in terms of their output, the qualitative nature of their labor input and the production processes they employ, the computer and agriculture industries do share a couple of key characteristics. First, the two are both capital intensive. Second, the prices of their outputs continue to fall relative to the prices of all other goods and services. In fact, unlike farm prices, personal computer prices have actually fallen in absolute terms since they entered the marketplace. Since 1978, computer prices have fallen by an average of 17 percent per year, while prices for all output, as measured by the GDP chain price deflator have risen by $3\frac{3}{4}$ percent per year. Thus, the relative price of computers has declined by more than 20 percent per year—much more, recall, than the 3 percent per year drop in relative agricultural commodity prices. Why are computer firms getting rich while farmers face the threat of bankruptcy?

In both agriculture and computer manufacturing, supply conditions are dominated by rapid productivity improvement. But demand conditions in the two industries are very different. While the demand for farm commodities is relatively insensitive to price and income changes, the demand for personal computers is not. The computer demand curve on the imaginary chalkboard behind me is shifting rapidly to the right, as income rises, and has a relatively flat slope. Busi-

ness demand for computers is rising rapidly as well because computers so enhance the productivity of production processes of all sorts of goods, including agricultural goods.

Thus, rising real personal incomes and increasing business use of computers propel the computer demand curve outward, and declining computer prices driven by the outward shift in supply stimulates higher purchases as we slide down the relatively flat demand curve. The outcome is that computer production is exploding. Since 1959, output of computer and office equipment has increased at an average annual rate of 21 percent per year, whereas total factory output and real GDP both rose only about $3\frac{1}{2}$ percent per year.

If only farmers could find a way to stimulate demand for a bushel of corn on every desktop... but I'll not pursue that whimsical notion any further!

MONETARY POLICY AND AGRICULTURE

From time to time, every central bank finds that it must change interest rates to maintain low and steady inflation. Let's take a moment to understand why.

Suppose there were some way for the central bank to achieve low inflation without acting directly on interest rates. For example, suppose the central bank controlled money growth directly—indeed, there is an extensive literature arguing that this policy is the one central banks should pursue. The Federal Reserve might raise and lower money growth as needed to achieve its objective of low and steady inflation. Interest rates would fluctuate freely in the marketplace. Even when the Fed maintained rock steady money growth, interest rates might rise or fall. In particular, when the economy boomed, rates would tend to rise as households and firms bid for funds to finance spending on new investment, on houses, on cars, and all the other things people commonly finance by borrowing. Similarly, when the economy slowed, interest rates would tend to fall,

even if the Fed did nothing but maintain steady money growth.

That a strong economy tends to push interest rates up and a weak economy tends to push interest rates down is illustrated nicely by recent Japanese experience. Most are aware that Japanese growth has been somewhere between anemic and non-existent for a good number of years—in fact, for the whole of the decade of the 1990s. Interest rates on short-term Japanese government securities have been at or near zero percent for the last year, and still the economy is stumbling along.

The Federal Reserve, along with almost all other central banks, conducts monetary policy by adjusting its target for the interest rate on short-term interbank borrowing, known in the United States as the federal funds rate. The Fed calls this target the “intended federal funds rate.” What the Fed tries to do is to mimic, in broad outline, how the federal funds rate would fluctuate if the Fed could set the rate of inflation directly, or through some other policy tool such as money growth. If the Fed fails to adjust the intended federal funds rate appropriately, it will fail in its mission to achieve low and steady inflation.

When the Fed raises the intended federal funds rate, other interest rates typically follow. In fact, other rates not infrequently lead the intended rate, as the market anticipates what the Fed is going to do. Everyone who has borrowed funds using short maturity loans and therefore expects to pay higher rates on those borrowings in the future, everyone in the process of borrowing funds, and everyone thinking about borrowing in the future feels hurt by the increase in interest rates. And since almost everyone in the country either has borrowed, is in the process of borrowing, or expects to borrow in the future, that means that there is almost universal pain when interest rates rise.

But what is the choice? If interest rates don't rise in a timely fashion, then sooner or later inflation will begin to rise. When that happens, investors will put additional upward pressure on interest rates, to protect their capital from being eroded by inflation. So, a central bank that delays raising rates does not in the end avoid rate

increases, but instead imposes both higher inflation and, eventually, even higher interest rates on society.

Because the lessons that flow from procrastination in monetary policy were learned so painfully in the 1970s, and because Fed policy has been so successful since 1982, when the inflation of the 1970s was finally conquered, complaints about periods during which interest rates rise have been relatively muted. But I have to put the emphasis on “relatively.”

When interest rates rise, farmers, agricultural implement manufacturers and dealers, and other related businesses often complain. So also do home builders, whose industry is especially interest sensitive. So do car manufacturers and dealers, and many others.

Sometimes the argument is a bit different. When agriculture, or any other industry, is going through a difficult period, pleas for assistance are understandable. Why can't the Fed lower interest rates a bit to help in such situations? For example, when the Asian economic crisis hit in mid-1997, U.S. agricultural exports were especially hard hit. The crisis deepened in mid-1998 with the Russian default. The Fed did lower interest rates in the fall of 1998, to prevent the financial disruption from spilling over to affect the stability of the U.S. economy. As financial conditions returned to normal last year, the Fed raised the intended fed funds rate, and market rates rose as well. But the effects of the Asian problems on the farm economy lingered, and linger to this day.

Now, I'm not suggesting that Fed policy *should* be unaccountable. Indeed, Fed policy should be examined and reexamined continuously in vigorous public debate, and it is. The Fed needs to defend and explain its policy decisions, and I do my best to contribute to that process.

Many people do not understand, however, that as powerful as monetary policy is, a central bank has essentially only one policy instrument. I like to think of that instrument as the rate of money growth—or, more generally, the provision of liquidity to the economy—over the long run. In the short run, the Fed implements its control over the growth of liquidity by setting the intended

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federal funds rate. With only one policy instrument, the central bank can at best achieve only one policy objective. That objective is a low and stable rate of inflation. If the Fed tries to pursue other objectives, it may lose control over the rate of inflation.

Our experience in the 1970s drove home with stark clarity the consequences of losing control over the rate of inflation. The economy suffered from high and unstable interest rates, rapid swings in the international value of the dollar, and increased instability of employment and output. The recessions of 1973-75 and 1981-82 were among the most severe downturns in U.S. history. The instabilities of this period added to the burdens suffered by agriculture, homebuilders, and other industries.

The U.S. economy is dynamic and rapidly changing. At any given time, certain industrial and geographic sectors are bound to lag the overall economy, while others do better than the overall economy. Monetary policy can do little to help the lagging sectors—there are no policy instruments at the Fed's disposal that have sector-specific effects. Our responsibility is to maintain low and stable inflation and, to the extent possible within this basic objective, to smooth temporary disturbances.

A FINAL WORD

My message today is simple. U.S. agriculture is a spectacular success story of high productivity growth maintained over an amazingly long period

of time. Most U.S. success stories can be characterized as enjoying a period of rapid growth and innovation followed in a relatively few years by a mature stage of slow growth. Think of railroads, automobiles, and steel. U.S. agriculture, on the other hand, is characterized even today by exciting gains in productivity; it is not yet a mature industry. Agriculture today suffers from the same problems it has always suffered from: droughts, locusts, and market disruptions. It is a risky enterprise, and I have great respect for those who cope and prosper in this business.

The contribution monetary policy can make to agriculture is to maintain low and steady inflation. Those of you in agriculture should ask the Fed to keep its eye on the inflation ball. Criticize us when we are going off track, but define "off track" by the economy as a whole and not by conditions in agriculture alone. Do not underestimate the importance to agriculture of a stable overall U.S. economy. Low inflation, stable inflation expectations, relatively low interest rates on the average, high and stable employment, all contribute to stability of the agricultural economy. The Fed can do nothing about the fundamental economic forces controlling the destiny of agriculture: high productivity growth, the hazards of nature, the low price and income elasticities of demand, and the instability of conditions in important export markets. But the Fed will do its best to maintain a stable domestic economy. If the Fed can continue to be successful in tempering that important historical source of instability to U.S. agriculture, the Fed will have done its job.