Inflation

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INFLATION AND PRODUCTIVITY*

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Inflation and productivity are the most persistent economic problems confronting the U.S. economy. Both represent a serious threat to the position of the United States in the world economy and in world polity. Both are serious obstacles to achievement of a degree of equity in the quality of life which has come to be taken as a major goal of domestic economic policy. The central thesis of this paper is the dialectical interaction between inflation and productivity. Inflation dampens productivity growth and slower productivity growth contributes to inflation.

The National Economy

The rate of inflation has gradually risen from 2 percent per year or less in the 1950s and early 1960s; to the 4-6 percent range in the late 1960s and early 1970s; and to the 6-10 percent range in the mid and late 1970s (Figure 1). The inability of the old macro-economics to provide effective and acceptable guides to economic policy has induced the emergence of a

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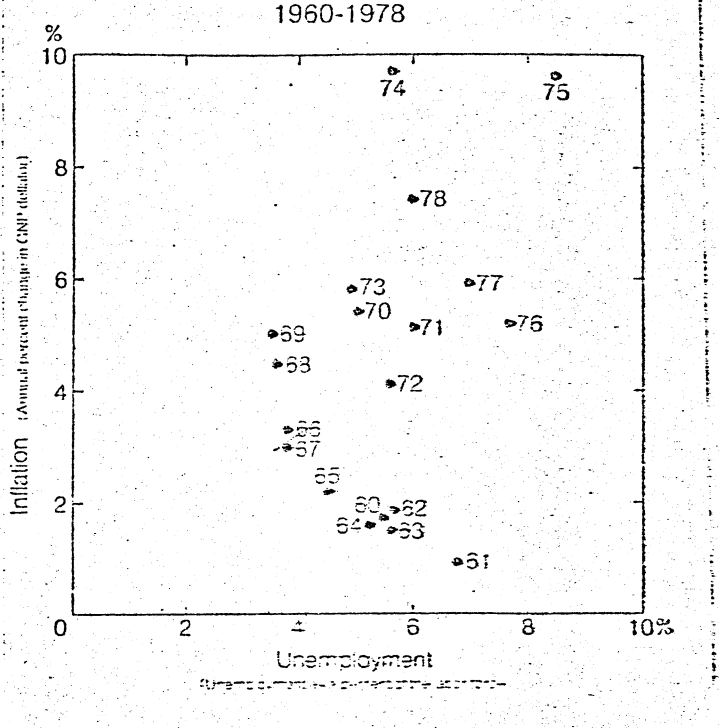
Figure 1. Inflation and Unemployment
1960-1978



Source: Federal Reserve Bank of Minneapolis, "Eliminating Policy Surprises: An Inexpensive Way to Beat Inflation." 1978 Annual Report, Minneapolis: 1979, p. 6.

new "rational expectations" approach to economic policy. The operating hypothesis of this school is that, in the presence of a public which is continually trying to outguess the government, monetary and fiscal policy interventions in response to cyclical changes in economic indicators can only assure continued high rates of both inflation and unemployment.

The leading exponents of the rational expectations school, barricaded behind the portals of the Federal Reserve Bank of Minneapolis, prescribe a policy of gradually slowing money growth and reducing the federal deficit. The approach must, they insist, be sufficiently gradual to avoid pathological withdrawal symptoms--but of sufficient magnitude and consistency to lead to expectations on the part of consumers, labor and business that the policy will be continued (Federal Reserve Bank of Minneapolis, 1978, 1979; Lucas and Sargent, 1979).

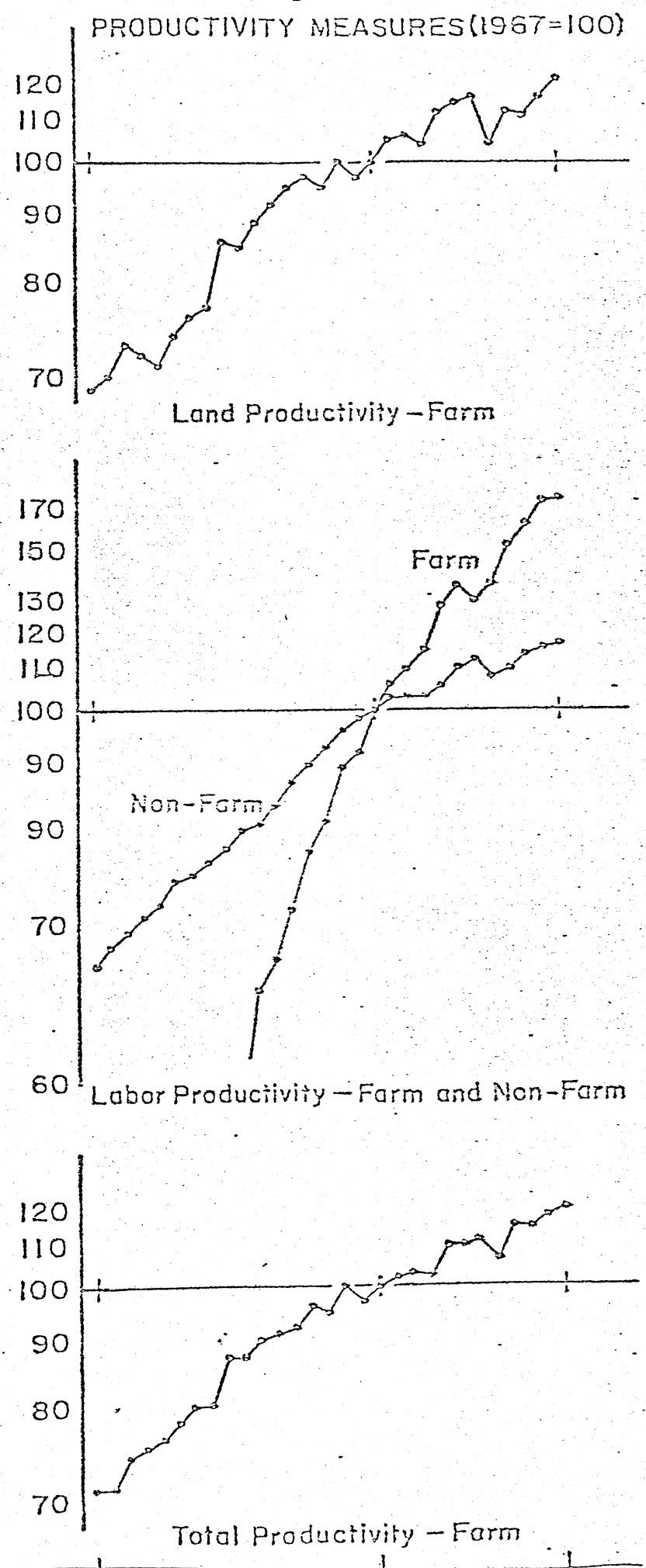
Concern about lagging productivity in the American economy is of somewhat more recent vintage than concern about inflation. Changes in the rate of inflation can be measured in terms of directly observed ratios that are more apparent to the individual consumer and producer than the implicit GNP deflator--the cost of a market basket at the grocery store relative to a weekly or monthly paycheck or by the prices paid for farm inputs relative to the prices received for farm production. Productivity is a somewhat more abstract--even arcane--concept. It is measured in terms of changes in a physical input-output ratio such as change in output per unit of labor or in terms of changes in output per unit of total input. Its impact on the individual worker, on the firm, or on the total economy is often obscured by more transient sources of change. It must be interpreted to the citizen and to policy makers by a special breed of technicians--the growth accountants--who have not yet been able to agree on how productivity should be measured.

It is clear that the rate of productivity growth has declined in the private non-farm sectors of the American economy (Figure 2). The Council of Economic Advisors noted in its 1979 report "Between 1948 and 1965 (labor) productivity growth in the private non-farm sector averaged 2.6 percent per year. . . . Since 1973, private non-farm productivity growth has averaged less than 1.0 percent per year." (p. 67) A number of factors have been identified as accounting for a measurable share of the decline in productivity: (a) reduction in the rate of growth in capital investment per worker; (b) exhaustion of the backlog of technological knowledge that had emerged during the depression and World War II; (c) demographic changes, particularly the increase in younger workers and women, in the labor force; (d) increased regulation to reduce the disposal of residuals into the environment and to protect the health and safety of the labor force; and (e) increases in illegal activity.

What is the impact of inflation on productivity? Milton Friedman, in his Nobel lecture, argues that inflation leads to inefficiency, because it makes market prices a less efficient system for coordinating economic activity. Its impact is particularly corrosive on the functioning of capital markets. It contributes to a decline in the rate of savings and to the distortion of investment patterns. A consequence of inflation which appears to have been overlooked is the erosion of the capacity of public sector institutions to provide the services needed to enhance productivity in the private sector. Edward Denison, our most careful analyst of the sources of productivity growth, after reviewing the literature on the effects of inflation on productivity, concludes "that inflation impairs productivity seems certain. But I have no idea how much it may have done so from 1973 to 1976."

What is the impact of the decline in productivity on inflation? Clearly an economy in which labor productivity is increasing at 1.0 percent per year

Figure 2.



Source: Robert E. Evenson, Paul Waggoner and Vernon W. Ruttan "The Economic Benefit from Research: An Example from Agriculture." Science, in press 1979. Productivity measures for the agricultural sectors from Durost and Black (1978). Productivity data for the non-farm business sector are from the Council of Economic Advisors (1979, p. 226).

can provide its citizens with smaller annual increases in real income than an economy in which labor productivity is rising at between 2.0 and 3.0 percent per year. If labor, management and government come to accept productivity growth in the 1.0 percent range as "normal" there is no reason why low productivity should represent a source of inflation. However, if workers expect real wage increments in the 3.0 percent range--on top of wage adjustments necessary to compensate for anticipated inflation--a decline in the rate of growth in productivity can represent a significant source of inflation. The importance of lagging productivity as a source of inflation, particularly in the short run when structural rigidities impose severe limitations on the flexibility of prices and wages, will depend on how expectations about both productivity and inflation enter into the complex economic and political bargaining among workers, management and government.

The rational expectations school would presumably argue that in the presence of correct and consistent policy with respect to money supply, budget deficit and exchange rates, any inflationary impact of a downward shift in the rate of productivity growth would be temporary. In a world characterized by substantial structural rigidity, I would expect that a continuation of the low productivity growth rates of the last several years will lead to intensified stress between workers, management and consumers over the partitioning of the limited growth dividends that become available.

The Agricultural Sector

The same general forces that have operated to influence productivity growth and inflation in the national economy have also impinged on the agricultural sector.

Some intuitive insight regarding the short-run effects of inflation on the agricultural sector may be generated by examining the behavior of the

series on prices received by farmers for commodities, prices paid by farmers for inputs and the "parity" index. In general the index of prices received rises more rapidly than the index of prices paid during very rapid inflation. However, when the general price level is rising at a more moderate rate, prices paid tend to rise more rapidly than prices received.

The only rigorous empirical examination of the effects of inflation on prices received and paid by farmers with which I am familiar is the series of papers by Luther Tweeten and his associate of Oklahoma State University (Tweeten and Griffin, 1976). Tweeten's empirical estimates indicate that the effect of a 1 percent increase in the general price level is to raise the index of prices paid by farmers by 1 percent and to leave the prices received by farmers essentially unchanged. I personally have some difficulty accepting Tweeten's result that a 1 percent increase in the general price level has almost no effect on prices received. He arrives at this conclusion by an estimate that the increase in farm level demand that would otherwise be generated by inflation is approximately offset by increases in the cost of marketing services associated with inflation, leaving prices at the farm level essentially unchanged.

While the impact of inflation on current account is negative, the impact on capital account remains ambiguous. No one has, to my knowledge, successfully separated the impact (a) of land productivity increasing biological technology; (b) of labor productivity increasing mechanical technology; (c) of competition between agricultural and non-agricultural uses for land; and (d) of general inflation on changes in the price of land. The most successful efforts to untangle these interrelated forces have been made in a series of papers by Melichar (1978 a & b). Conventional wisdom, based on comparisons of the increase in farm land prices with increases in farm

operators' income, suggests a decline in the return earned from land ownership. Melichar points out, however, that during the 1950-70 period a combination of productivity growth, farm price programs, and changing land/labor and capital/labor ratios modified the historical relationship between land prices and farm operator income. During this period the rate of return to land ownership, even on current account, increased substantially. Since 1970, however, agriculture has experienced a land market boom in which anticipated capital gains have been used to finance current cash flow requirements. And the ratio of debt service costs to earnings on farm assets have exceeded the heights that preceded the land market crash of the early 1920s.

The high debt service to earnings ratio would not be particularly serious if real and nominal interest rates were still in the traditional 4-6 percent range. With nominal interest rates averaging near 12 percent, a modest decline in the rate of cash flow can have very serious repercussions in the farm real estate market. The only thing that would be worse than continued inflation would be deflation! A major source of uncertainty for those who must do outlook work is whether the same set of political forces will be generated to validate inflated land market prices again in the early 1980s as in the mid-1970s.

Productivity growth in the agricultural sector, measured in either partial (i.e., labor) or multi-factor terms, continues at a more rapid rate than in the private non-farm sector (Figure 2). I do not know why the difference continues. Given the adjustments that have occurred in the agricultural sector of the 1920-1970 period, I would have expected greater convergence. I would also have expected the level of capital intensity that has emerged in the agricultural sector, significantly higher than in the industrial sector, to act as a factor dampening productivity growth.

Several hypotheses commend themselves to further investigation. Ben-Zion and I have shown that investment in R and D in the private non-agricultural sector is quite responsive to economic fluctuations. The supply of technology to the agricultural sector may be less influenced by fluctuations in economic activity than in the industrial sector. Public sector research and development remains the primary source of agricultural technology, particularly the biological technology which has expanded the capacity of crops and animals to respond to higher levels of industrial inputs. The demand for technological change in agriculture continues to be driven by the product market and land market treadmill phenomenon.

The continued high rate of productivity growth in the agricultural sector cannot obscure, however, the fact that the rate of productivity growth in agriculture has slowed down over the last decade. While debate over measurement and the dating of turning points continues, I see no way to interpret the data plotted in Figure 2 than to conclude that the rate of productivity growth in agriculture has fallen below the level that prevailed over the first two decades after World War II. It may not be a coincidence that the timing of the decline coincides with the rapid expansion of agricultural exports in the late 1960s (Schuh, 1974).

Some Emerging Issues

In the closing sections of this paper I address three additional issues related to productivity in American agriculture. First, I raise the question of whether American agriculture is as productive today as we have become accustomed to believe. Second, I raise the question of whether we are continuing to make the investments required to release the technical constraints on agricultural productivity. Third, I raise some questions about the institutional constraints on productivity growth in American agriculture.

How efficient is American agriculture?--In 1947, Professor T. W. Schultz argued that the agriculture of the United States "did not come anywhere near meeting the standard of efficiency set by the American economy" (p. 646). A few years later, Byron Shaw, then Director of the Agricultural Research Service (USDA), called attention to the narrowing gap between crop yield and livestock efficiency ratios realized by farmers and the results obtained from experiments and performance tests.

These concerns were largely forgotten in the 1950s and the 1960s. American agriculture was the wonder of the world--capable of meeting the food and fiber demands of the American economy, of filling the gap arising from rapid population growth in the developing countries, and of meeting the demand for feed-grain-based livestock production in Western Europe, Japan and in the higher income socialist countries. By the mid-1970s, however, we were again being confronted with a new series of challenges regarding both the technical and institutional efficiency of the system of agricultural production that had emerged in the United States over the last half century.

Comparative historical evidence suggests that the capacity of the American agricultural system to meet domestic and foreign food and fiber requirements has been based at least as much on slow growth of demand for agricultural commodities by American consumers as on high rates of productivity growth. Output per hectare of a number of individual crops, maize in particular, is high relative to other countries. But average agricultural output per hectare of cropland remains low relative to the levels that prevail in many other developed and developing countries. The rate of growth of agricultural output since 1950 has averaged little more than 1.7 percent per year--well below the 2-4 percent "modern" growth rates achieved by many developed and developing countries.

The serious issues confronting U.S. agricultural performance in the future are (a) whether the U.S. agricultural research system is maintaining its capacity to support productivity growth and (b) whether the institutional constraints which condition the structure of American agriculture are becoming an increasing burden on productivity growth?

How strong is the scientific and technical basis for agricultural productivity growth?--This question, like the previous one, is not easily answered. Clearly, research at the state agricultural experiment stations and related institutions within the U.S. Department of Agriculture and in the private sector has failed during the 1970s to maintain the momentum for growth that characterized the 1950s or 1960s or that was expected at the time of the joint Department of Agriculture-State Experiment Station study of research needs in the 1970s (USDA, 1966). Research budgets have shown no real growth when measured against growth in the GNP deflator and have declined when measured against an index of costs of scientific manpower. Research expenditure, as a percent of sales, has declined sharply for field crops, declined modestly for horticultural crops, and has risen significantly for livestock. And the mission of the agricultural research system has been broadened to include a range of environmental and consumer protection and enhancement roles that did not exist a decade and a half ago.

Agricultural research is clearly undervalued in the United States. Marginal rates of return in the range of 25-50 percent per year have been estimated for a large number of commodities and for the research system as a whole (Evenson, Waggoner and Ruttan, 1979). Rates of return in this range induce a warm glow of self-satisfaction in the hearts of agricultural research administrators. When taken seriously they indicate substantial underinvestment in agricultural research.

Several hypotheses can be suggested for the failure to push research investment closer to an equilibrium. At the state level the spillover of the impact of research on productivity into other states, estimated to be in this 50 percent range, seems clearly to be a factor limiting state expenditures on agricultural research. At the federal level it seems apparent that the slippage in research support has been at least in part a result of the expediency of budget making in an inflationary environment rather than a conscious decision to cut back on either public or private investment in agricultural research. At the federal level the substitution of a bureaucratic objective function for a social welfare function also appears to play a significant role. While productivity growth leading to a relative decline in the price of farm output can result in both higher net income to farmers and lower food costs to consumers, it also, under the price programs that have prevailed since the 1930s, imposes budget costs on the Treasury. The effect is to translate a social benefit into cost when viewed narrowly from the Office of Budget and Management or the Office of the Secretary of Agriculture. A rate of productivity growth just sufficient to keep commodity prices from rising is preferable from a bureaucratic perspective to the higher rate of productivity growth that would optimize the social rate of return to agricultural research.

Institutional constraints on productivity growth.--In addition to these built-in biases toward underinvestment in agricultural research, there have been a number of institutional changes in the economy which appear to have a negative impact both on the productivity of our agricultural research effort, as measured by the rates of return to agricultural research, and on the productivity of the agricultural sector, as measured by the rate of productivity growth.

We have, during the years since World War II, erected an incentive structure in American agriculture that has induced inefficient substitution of material inputs (capital and operating expenses) for land and labor. The constraints imposed on land use during most of the 1950s and 1960s led to excessive substitution of chemical inputs for land. The tendency was reinforced by institutional factors that failed to communicate the externalities resulting from increased levels of chemical inputs in terms of costs to farm producers. By the mid-1960s, the set of inefficient incentives for chemical-land substitution was supplemented by a tax policy that has had the effect of inducing inefficient substitution of capital for labor. We have also built a set of institutional constraints that impinge on the productive use of agricultural resources. One of the more obvious cases is the impact of market regulation on the shift of milk production from low to high-cost locations. Efforts to more efficiently manage the spillover costs of chemical technology are in some cases having a substantial negative impact on R & D productivity, particularly in the pesticide, herbicide and animal drug fields.

Perspective

In closing, I would like to come back to the issue of the interaction between productivity and inflation. During the half century between 1920 and 1970, the focusing device that directed productivity growth in American agriculture was the declining real price of energy. The declining prices of energy induced the substitutions of mechanical power for animal power and labor, and substitution of yield increasing and yield protection chemical technology for land (Hayami and Ruttan; Binswanger and Ruttan).

Since the early 1970s, the price of energy has risen relative to most other inputs. I do not know whether energy prices will continue to rise relative to other inputs during the coming decades. However, it is very

difficult for me to believe that they will decline as during the 1920-70 period. This means that the focusing device for scientific and technical effort that we have relied on for more than half a century is obsolete. A new focusing device will have to be found.

This leads me to anticipate a period of relatively slow growth in total productivity. In many respects the next several decades could parallel the lag in productivity in U.S. agriculture between 1895 and 1925. At that time the closing of the land frontier induced a new land-saving biological and chemical technology. During the next decade I expect that we will be devoting increasing effort to the search for new energy-saving technologies.

What does this mean for the American economy? It means that it is unlikely that the economy can depend, as it has in the recent past, on productivity growth in the agricultural sector to dampen the impact of inflation on food prices (Schuh). If in addition to slow productivity growth, export demand remains strong, the effect of competition between foreign and domestic consumers on food prices will become more intense. The U.S. economy is past the era when transfer of resources from the agricultural to the non-agricultural sector, through either the labor market or the product market, can significantly enhance national productivity growth. And the nation may find great difficulty, if efficient new sources of productivity growth in agriculture are not found, in avoiding substantial resource transfers from the non-agricultural to the agricultural sector. The signals that such a transfer is under way will be masked for a considerable period by the slow growth of domestic demand for farm products, the large share of production that now moves into export, and the heavy absorption of grain production by the domestic livestock sector.

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