Farmers as Entrepreneurs: Regulation and Innovation in American Agriculture during the Twentieth Century

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For the last half-century American agriculture has been one of the most regulated, yet most successful, sectors of the American economy. The federal government administers programs to restrict production, control prices, and provide special credit for farmers. Still, what is striking about this regulation is that its introduction in the 1930s coincided with the start of a revolution in agricultural productivity: in the three decades prior to 1930, total factor productivity in the farm sector increased at a mere 0.5 percent annual rate. By contrast, between 1935 and 1975 farm productivity increased at a 3.0 percent annual rate -- a performance that surpassed rates achieved in all but two industries of the manufacturing sector. So great were the gains in agricultural productivity that by 1980 one farmer fed 76 Americans on average, or 8 times the number fed in 1930 [3, p. 366; 4, p. 161; 5, p. 565; 7, p. 63].

My intent in writing this dissertation is to assess the relationship between government regulation and farmers' revolution in productivity. In recent years Americans have become increasingly disenchanted with regulation. Critics frequently charge that regulation reduces efficiency because it fixes prices above or below levels that would prevail in a free market. In my own study I take exception with this negative perspective. Rather than focus on short-term changes in prices, I ask how regulation affected farmers' long-term investment calculus. In particular, I test the proposition that regulation actually accelerated the rate of productivity growth because it mitigated certain risks inherent in farmers' commodity markets so as to create a new climate for investment. My analysis is divided into two parts: the first part examines how regulation stimulated investment and encouraged higher rates of productivity growth; the second part considers the effects of government intervention in the decades since the Great Depression.

In the first part, I begin with the notion that it is not intuitively evident that New Deal regulation contributed to farmers' revolution in productivity. One could argue, for instance, that in the years prior to 1930 farmers reported few gains in productivity simply because scientists and engineers had not introduced

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productivity-enhancing technology. Or, one could argue that even if farmers had encountered barriers to investment prior to 1930, regulation may never have treated the problems or risks which farmers encountered. The effectiveness of regulation, then, turns on answers to three questions: First, did farmers adopt technology at a slow pace prior to the introduction of regulation? Second, if farmers shunned technology, why did they do so? Third, did regulation solve farmers' investment problems?

I address these questions in a detailed study of the evolution of one region, the Corn Belt, in the years immediately before and after regulation took effect (approximately from 1920 to 1940). I chose the Corn Belt because it was one region in which three important inventions were introduced during the interwar years: the tractor, the mechanical corn picker, and hybrid corn. Of the three inventions, the tractor was the most important. It was introduced during the 1920s, whereas the other two inventions were introduced during the 1930s. Thus, it is the pattern of diffusion of the tractor that allows us to answer the first question --namely, whether prior to the coming of regulation farmers were reluctant to innovate despite their intensely competitive market.

The case of the tractor indicated that during the 1920s farmers had delayed investments. I estimate, based simply on the tractor's cost savings relative to that of a team of horses, that more than half of all farmers in the Corn Belt could have reduced their cost of production by adopting the mechanical invention. In reality, however, only a quarter of the farmers made investments. This conservative behavior is important because it translated into fewer gains in labor productivity. During the 1920s the tractor provided nearly all gains in labor productivity. I calculate that if those farmers who could have reduced costs by investing in a tractor had done so, then labor productivity would have risen from 8 percent for the decade to 12 percent. In other words, farmers would have achieved a 50 percent increase in their rate of growth of labor productivity had they based investments simply on cost savings.

Farmers delayed investments, I argue, because technology posed a conflict between safety and productivity. Farmers' concern for safety arose out of the unstable nature of commodity markets. Because prices were volatile, farmers faced the risk that in any random year prices could fall short of their average cost of production -- turning profits into losses. To contain the risk of ruinous prices, farmers developed a simple strategy: they relied on resources they never paid for in cash but instead obtained from their farm. Farmers could opt for this strategy because they rarely paid cash for their two most important items -- labor and horses. Farmers obtained labor from themselves and their families. Similarly, horses were raised, fed, and pastured on the farm itself. As farmers avoided cash expenses they reduced the risk that even if prices fell sharply they would actually lose money.

This strategy clearly gave farmers greater security, but it nevertheless contained its own hidden penalty. The strategy implicitly made farmers judge

technology on the basis of an invention's cash demands rather than on the basis of an invention's efficiency. Some inventions, like hybrid seed or chemical fertilizers, required small sums of cash. They created modest increases in cash budgets. Capital equipment, however, was often very expensive. Because this second type of invention imposed a large financial risk, it forced farmers to select between safety and productivity. To the extent that farmers chose safety, they reduced the rate of diffusion and slowed the rate of productivity growth.

The tractor represented precisely the kind of invention which demanded large cash payments. The machine consumed $350 in cash each year, requiring an average 25 percent increase in farmers' cash budgets from $1,400 to $1,750. In a quantitative study of farmers in Illinois and Iowa counties, I assess the effect of the tractor's cash demands on the pace of the machine's diffusion. The analysis indicated that in counties where the tractor imposed a relatively larger percentage increase in cash expenses, proportionately more farmers put off investments. Indeed, the rate of diffusion of the tractor was closely associated with the percentage increase in farmers' cash budgets. By placing safety ahead of productivity, then, farmers often delayed investments and slowed the rate of productivity growth.

Aside from this investment dilemma many farmers faced a second problem -- debts they had acquired during World War I. For those farmers who had mortgaged their land, and roughly 40 percent had done so, interest payments might consume what cash was available to purchase expensive equipment. Moreover, after the Crash of 1929, payments became extraordinarily burdensome. Not only did debts preclude new investments, but they also ruined thousands of farmers. In 1932 and again in 1933 nearly 8 percent of indebted farmers in the Midwest declared bankruptcy [6, p. 30].

In 1933, with the hope of ending the farm crisis, New Deal politicians created three regulatory agencies: the Agricultural Adjustment Administration, the Commodity Credit Corporation, and the Farm Credit Administration. The agencies were instructed to shore up prices and to reduce farm loans. Yet, in carrying out these relief missions, I argue that two regulatory agencies also resolved much of farmers' conflict between safety and productivity. The first agency, the Commodity Credit Corporation (CCC), dealt with the financial conflict posed by expensive technology like the tractor. The CCC was created in the fall of 1933. Fearing that farmers would not have enough money to see them through the coming months, the CCC was designed to put cash in farmers' pockets immediately. The agency operated as follows: farmers borrowed a sum of cash equal to the amount of corn put up as collateral times a fixed price per bushel. This fixed price, or loan rate as it was known, acted as a minimum price. If the CCC set the loan rate high enough, then it would guarantee farmers their cost of production on a cash basis. Indeed, this is what happened. During the 1930s the CCC set its minimum price at a level that guaranteed farmers 85 to 95 percent of their cost of production where all costs (land and labor included) were assessed

at their cash or market value. Because the CCC guaranteed the average cost of production, farmers no longer needed to choose technology that conserved cash. They were free to choose technology simply on the basis of its efficiency.

While the Commodity Credit Corporation removed much of the risk posed by expensive technology, the second agency, the Farm Credit Administration (FCA), reduced the burden of debts. Between 1933 and 1936 the FCA offered a series of emergency loans intended to shrink the size of debts, cut interest rates, and extend the term of loans. These FCA loans, along with refinancing efforts of private lenders, served to cut the burden of interest payments from more than 9 percent of farmers' cash income in 1929 to less than 5 percent after 1935 [2, p. 33].

By the second half of the 1930s, then, the New Deal regulatory agencies had created a new climate for farm investment. Farmers, no longer threatened by unstable prices or burdened by large debts, responded by investing in the productivity-enhancing technology. Tractor sales recovered from their depressed years of 1932 and 1933 and rose to levels well above those achieved in the late 1920s [1, p. 2]. Moreover, as farmers bought tractors they substantially closed the gap between the rate of investment predicted simply by cost savings and their actual rate of investment. That is, as of 1939 roughly 50 percent of farmers should have invested in tractors simply on the basis of cost savings, and nearly 45 percent had done so.

Aside from the tractor, midwestern farmers also invested in the other two inventions -- hybrid corn and the mechanical corn picker. Hybrid corn offered roughly a 200 percent return on investment with little risk of actually losing money. The seed was introduced in the mid-1930s and by the end of the decade farmers had planted it in nearly two-thirds of all corn fields. In the case of hybrid corn, I conclude that farmers invested in the seed because it was so cheap; regulation most likely played little role in the seed's rapid diffusion. As to the mechanical corn picker, it is impossible to determine whether regulation caused farmers to invest in this invention because the invention become profitable in the mid-1930s, or at the same time that the regulatory programs were introduced. Still, it is possible that farmers could have clung to their conservative strategy, ignoring the safer investment climate and delaying investments. But this did not happen. Within three years after the mechanical corn picker become profitable, roughly three-fourths of farmers who should have used it did so. Overall, during the Great Depression farmers in the Corn Belt doubled their rate of growth of labor productivity over that of the 1920s. I estimate that regulation was associated with perhaps one-third to one-half the gains.

In the second part of the dissertation, I examine the effects of regulation for the farm sector as a whole in the period since 1930. Legislators originally designed the Commodity Credit Corporation to prevent prices from falling and assumed that in the event that prices met the intended goal (that is, if prices rose), the agency would play no role. This policy, while intended to counter low

prices in the Great Depression, had ironic results when it was employed after World War II. In the 1950s and 1960s, as increases in supply pushed prices lower, the CCC placed strong supports under prices. The agency not only stabilized prices, but it also subsidized farm income and farm investment. Moreover, as regulation stimulated higher rates of investment, it accelerated gains in productivity and by implication accelerated the decline in the number of farms. Regulation, however, had much different consequences when in the 1970s the demand for corn, cotton, and wheat sent these crop prices to high levels. With this new prosperity, the CCC was instructed not to raise its loan rate. The agency, therefore, was unable to slow the decline in prices once prices fell back to lower levels. Thus, I conclude that for several decades regulation had stimulated extraordinarily high rates of investment, only to leave farmers vulnerable to a credit crisis in the 1980s.

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