Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

Working Paper 161

A NOTE ON THE REAL COST OF TRACTORS IN THE 20s AND 30s

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Giannini Foundation of Agricultural Economics
February 1981

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That tractors became better and cheaper throughout the 20s and 30s has never been much of an item of contention among economists, at least since Griliches computed the value of the capital stock of farm machinery in 1960. The exact amount by which the price of tractors decreased during these decades remains somewhat of a mystery because of the sketchy nature of the data available and because Griliches himself only discovered the methods of hedonic regression after he had undertaken his research on farm machinery. By using this method of hedonic regression, it is possible to produce a price for horsepower curve for tractors for 1923, 1930, and 1934. These curves show that the price of tractors of given horsepower did indeed decline over this slightly longer than a decade period and that the price decline was more marked for larger tractors than for smaller ones.

Indeed the choice of the years 1923, 1930, and 1934 must seem strange to the reader. These years were the only years for which price data was available to this author for a large enough cross section of tractors to perform the indicated regression. The data come from a hand-typed price list for 1934; for 1930, the data are from a price card circulated by the Chilton tractor index in an apparent attempt to make price fixing easier; and for 1923, the data are also from the Chilton tractor index, but there it was published. These data appear at least grossly consistent with those in the Federal Trade Commission (FTC) report on the agricultural implement and machinery industry (document number 702, 75th Congress 3rd Session, Table 30 on page 1084, at least for the early years). For 1934, the FTC report

suggests adjusting the price of the smaller tractors downward to take account of prevalent discounting. Thus, the smaller tractors have had their price reduced in that year to 85.5 percent of the quoted price. Of course, these price lists are tenuous at best, and two other possible methods of finding prices exist. The first is that the FTC report itself contained a survey of farmers. Since hedonic regression was not widely known (although it had been previously invented by Waugh) in 1938, the FTC commissioners were not able to make use of the diversity of information available to them. Should the original data for this report still exist, a price series could be constructed from it. The second other possible source is the official tractor and farm equipment manual from farm equipment retailing in St. Louis, Missouri, but the first issue of this is that the author can find is in 1952. Presumably, Griliches had access to earlier versions of this or similar work to construct his series. But, alas no traces of it remain.

A second serious problem with the hedonic regression is a great difficulty in matching the prices and the true characteristics of the tractors. Indeed the price lists give the price for a particular model but add ons alterations and the like were not uncommon so that the tractors actually tested in Nebraska in the Nebraska Tractor tests may not have been exactly those tractors for which prices were quoted. The author did his best to match the price list to the Nebraska Tractor tests. The tractor test was used for tractor characteristics because the manufacturers did not state the truth about belt or drawbar horsepower.

The assumption underlying the hedonic regression is that the cost of producing tractors would be proportional to some power of the horsepower and

possibly some power of the fuel efficiency. Both the constants of proportionality and the powers would be expected to decline over time because of technical progress. Preliminary investigations showed that fuel efficiency which was horsepower hours per gallon of fuel used was not significant in any regression nor were their significant changes in the constants over time periods. This led us to specify Equation 1.

$$(1) \qquad \text{Ln}\ \frac{\text{Price}}{\text{WPI}} = \underset{(24.00)}{4.36} + \underset{(15.19)}{(1.49} - \underset{(4.12)}{.00924\ \text{year})}\ \text{Ln(HP)} \quad \underset{(.18)}{\qquad} \quad \underset{(.098)}{\qquad} \quad \underset{(.002)}{\qquad}$$

$$R^2 = .84$$

$$N = 83 \text{ observations}$$

where

price is the manufactures list price adjusted for discounts by the FTC report on Agricultural Implements;

WPI is the wholesale price index;

year is the calendar year;

and

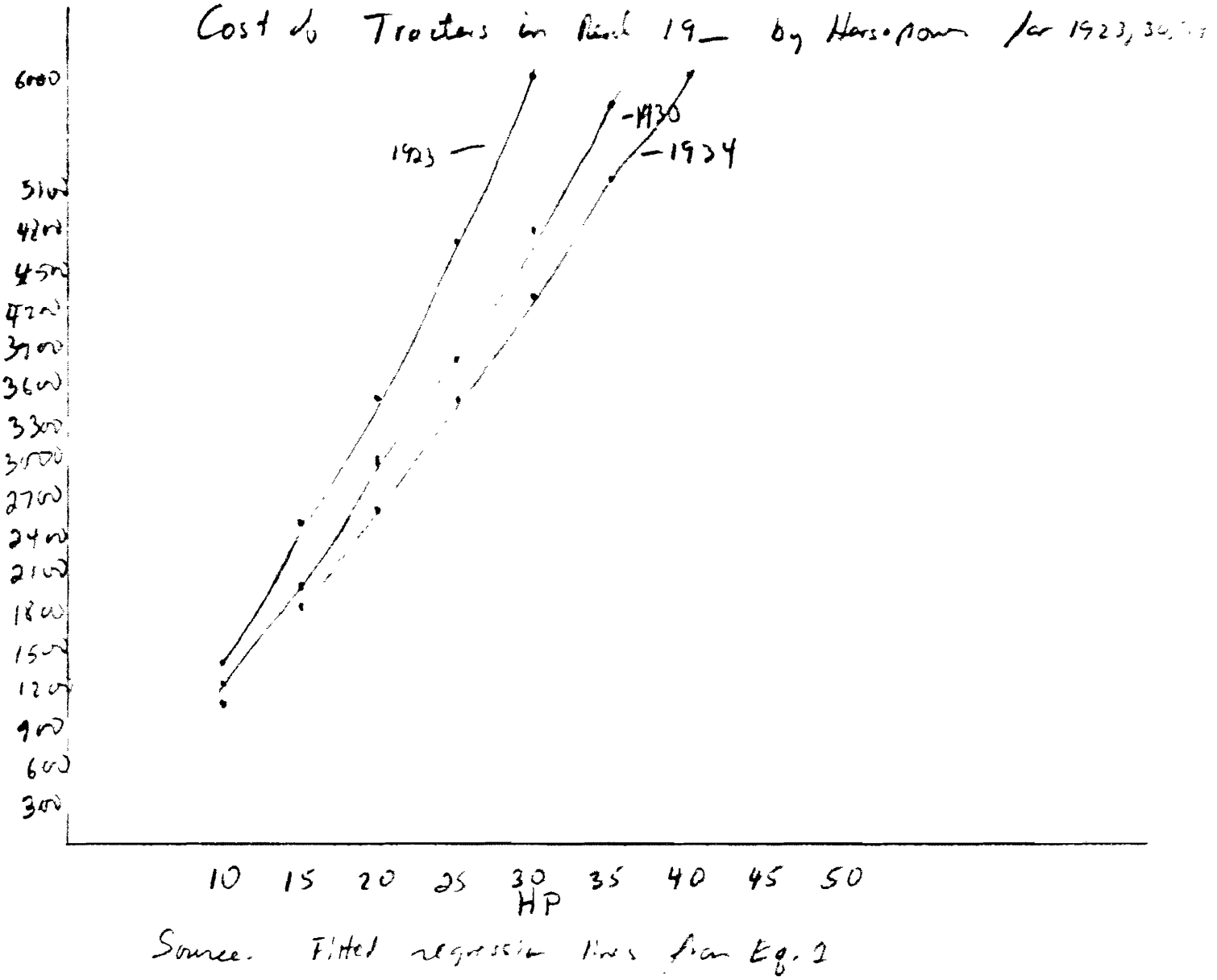
HP is horsepower from the Nebraska Tractor tests.

Equation 1 fits with a quite acceptable R^2 of 84 percent; and as each of its variables are signicant at the .01 percent level, it shows that the price horsepower curve becomes flatter as a result of technical progress. The test performed on this regession were first to regress each of the time periods 1920 through 1930 and 1934 separately, and then to test the hypothesis that each time period has the same intersect term and the coefficients declined in a linear fashion. An F test showed this to be true at the .01 level of significance.

Perhaps the best way to see what happened to the price of tractors in the decade between 1923 and 1934 is to look at Figure 1. The figure gives the price of tractors in real dollars by horsepower for these three years. It shows that the price of small tractors declined by much less than the price of large tractors across the decade. For instance, the price of a 10-horsepower tractor became 79 percent of its 1923 price in 1934, while a 40-horsepower tractor in 1934 price was only 68 percent of the 1923 price. Thus, one sure effect of progress in tractors was to make larger machines cheaper relative to smaller machines. The importance of this effect will be seen below.

One last comment before leaving the construction of a cost of tractor series, the regression run reflects only drawbar horsepower which is the ability to pull plows or implements and fuel efficiency which is found to be insignificant. During this decade, there were other advances as well. The most notable of which was the introduction of general purpose tractors. General purpose tractors, unlike there forebearers, were higher and more maneuverable. Thus, these tractors could be used for the cultivation of row crops and for other more delicate work. At the end of the period, approximately 1934, rubber tires filled with water were introduced. This innovation made the moving of tractors from one field to another much easier as well as increasingly drawbar horsepower for a given size of engine. The latter of these innovations comes after the period of our study, and the former of them is most important to the growing of crops whose fields are entered during the growing season. Wheat is not among these crops, so for the purposes of wheat farming, this cost index is likely to be reasonably accurate.

FIGURE 1.



Source. Fitted regression lines from Eq. 1