What Explains The Rising Popularity of Cash Renting?

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ABSTRACT

Over the past twenty years the ratio of cash rent to cropshare contracts across the United States has more than doubled. Predictably, some economists attribute this to ad hoc changes in the relative risk preferences of farmer and landowners. We suggest that it is the result of changes in cultivation practices. The switch from conventional to conservation tillage brought about by changes in herbicide technologies, fuel costs, and knowledge of the benefits of soil micro-organisms, has reduced the ability of farmers to exploit soil attributes. This removes the major incentive of cropsharing and makes cash renting more attractive. Using USDA field level data from across the United States, we find strong support for this hypothesis.

Warning: Paper more than preliminary! Read at own risk.

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1. Introduction

After decades of relative stability, the fraction of cash rent agricultural contracts in modern North American agriculture began to rise relative to cropshare contracts about fifteen to twenty years ago. The increase is found across most crops and regions, but with considerable variation. To the extent that agricultural economists have noticed this trend, they have attributed it to changes in the relative risk preferences of landowners and farmers; that is, landowners have become more risk averse relative to farmers at turning of the third millennium.[1]

Arguments based on changes in risk preferences are not directly testable, and become very implausible when trying to explain differences in contract choice across crops, land quality, and regions. Here we provide an alternative and more compelling explanation. Over the past twenty years there has been a continual increase in the amount of conservation cultivation through the use of "no-till" techniques. These practices, as the name suggests, limit the amount of manipulation done to the soil during planting. This in turn regenerates the soil, enhances moisture levels, and protects the soil from erosion. Not only does no-till enhance soil quality, by its very nature it limits the farmer's ability to exploit the soil to his short term advantage over the landowner.

Following the model of Allen and Lueck (1992), we argue that no-tillage practices play to the advantage of cash rent contracting. The purpose of cropshare contracts is not to manage risk, but to discourage soil exploitation. Once this temptation has been removed or mitigated, the cropshare contract loses its attractiveness because these contracts require some type of output monitoring. Hence, the transition to cash rent contracts is based on a well known transaction cost model which explains much of the variation in cash rent growth.

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[1] Huffman and Just (2004) argue that landowners in developed countries tend to be old, conservative, and risk averse. They claim that as farms in the U.S. have increased in size and an excess supply of farmers has developed, and landowners choose less risk averse farmers to rent their land too. Hence, the switch to cash renting has been driven by a switch in the relative risk aversion of farmers and landowners.

2. The Growth of Cash Renting

Figure 1 shows a simple plot of the ratio of the percentage of cash rent contracts to the percentage of cropshare contracts by acres, across all U.S. regions, from 1997 to 2011. From the graph it is clear that until 2000/2001 the ratio was just above two. However, a decade later the ratio is around four to five. In other words, overall there has been at least a doubling of cash rent contracts within a short period of time. This trend holds for many crops.[2] Thus, for corn in 1996 across the U.S. the ratio of cash rent to cropshare contracts was 1.1, the fraction of cash rent to all farmed acreage was 26%, and the fraction of all leased acreage was 52%. By 2010 the ratio of cash rent to cropshare had increased to 2.38 (more than double), the fraction of total acreage to 35%, and the fraction of all leased acreage to 70%. For soy it is a similar picture: between 1997 and 2006 the ratio of cash to share increased from 1.14 t 2.09; the fraction of cash rent to all acreage increased from 30% to 39%; and the fraction of cash rent to all leased acreage increased from 53% t 68%.

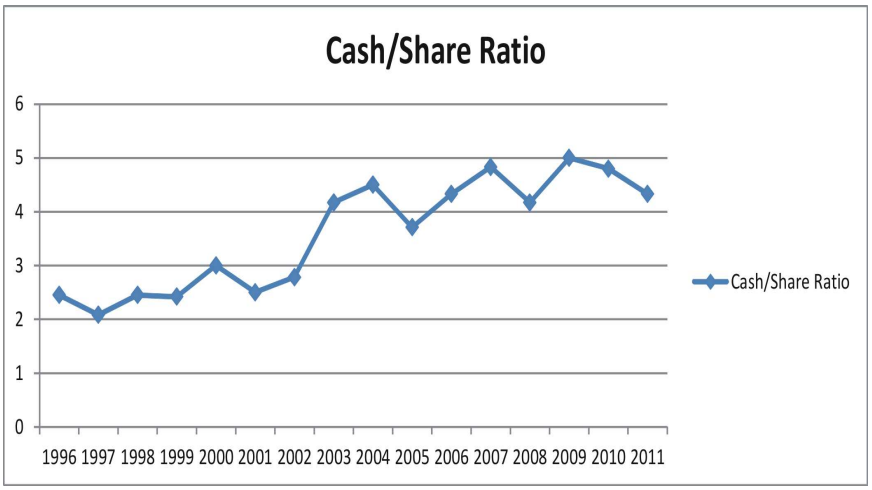

Figure 1

Ratio of Cash Rent/Cropshare Contracts by Acreage

Source: USDA, ARMS Phase 3.

[2] The ARMS data is not collected by crop for every crop for every year.

Figures 2 and 3 shows another perspective on the transition of cropshare to cash rent. Looking at all acreage across the U.S., and breaking down the percentage of contracts in either type of contract across different regions shows the changing landscape. Figure 2 shows that there is great variation in the use of cropsharing, and that generally cropshare contracts are falling in terms of covered acreage in all regions except the southeast. The fall in sharing for the corn belt and mountain states is particularly striking. Figure 3 shows similar variance in the use of cash renting, and again generally shows that most regions have experienced an increase over time.

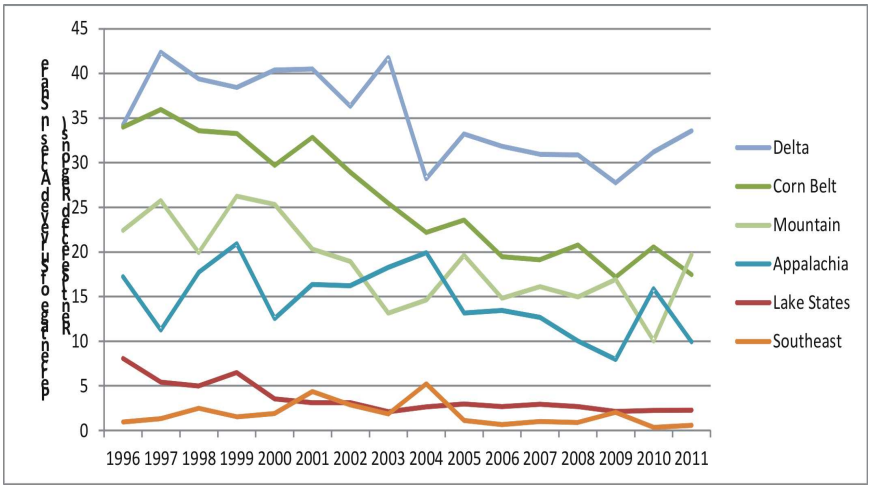

Figure 2

Percentage of Acres in Cropshare, by Region

Source: USDA, ARMS Phase 3.

3. The Growth of No-Till Cultivation

Tillage has a history as old as human cultivation records go back. Tillage is the practice of mechanically disrupting soil by digging, ploughing, overturning, harrowing, and various other techniques. Primary tillage takes place when the soil is first broken with a deep and thorough agitation. Secondary tillage is a shallow

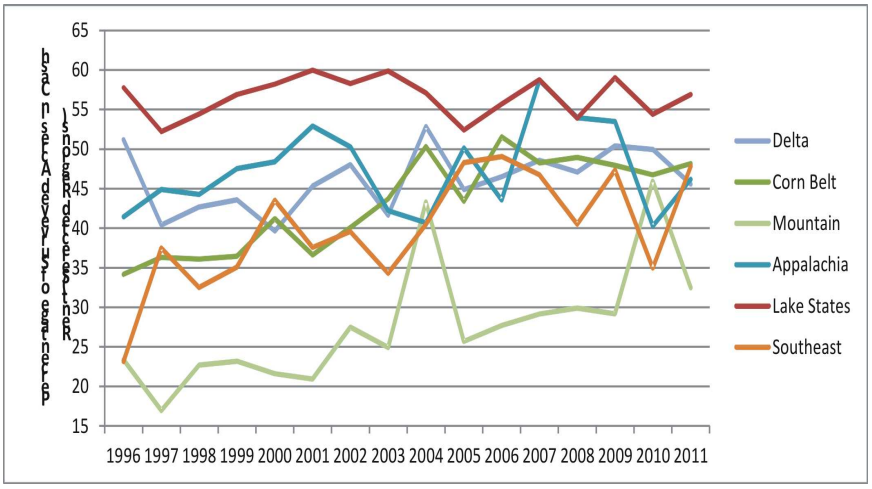

Figure 3

Percentage of Acres in Cash Rent, by Region

Source: USDA, ARMS Phase 3.

raking of the soil, often used with row crops, to kill weeds while leaving the crops untouched. Tillage is mostly used to prepare the soil for an appropriate seed bed for planting, but it also kills weeds and other competing plants. In drier areas, land is often left fallow (no crop planted) to increase the moisture content of the soil. In such cases the soil may be tilled to mechanically kill weeds.

The intensity of tillage can vary, but conventional practice would be characterized as follows. After harvest a crop residue is left over. This residue helps to trap snow over the winter, but may be ploughed under in the fall to give a longer period of decay. In the spring the remaining residue is ploughed and overturned into the soil, the ground is then raked with harrows or disks to provide a smooth bed for planting. The entire process takes several passes over the field with the tractor and the other equipment.

The chief benefit of tillage is the elimination of weeds and native plants, and the aerating and loosening of the surface soil to facilitate planting. The mixture of residue, manures, and fertilizers have traditionally been complementary benefits of tillage. However, tillage is not without its costs. Tillage dries soils out, reduces the

moisture storage, moisture infiltration, and nitrogen in the soil. It also kills much of the small organic matter in the soil: the microbes, ants, worms, and other small animals that create natural fertilizers and regenerate soils. Ironically, though tillage is intended to loosen the surface soil, it ultimately creates a "tillage pan" about six inches under the surface. This is a hard, dense, non-porous soil that has reduced ability to absorb and hold moisture, and therefore encourages run-off of both water and chemicals.

Starting in the 1940's the concept of conservation or "no-till" cultivation began to take root. However, it was not until technical advances in the mid to late 1980s that no-till cultivation became profitable on a wide scale. The idea of no-till is rather simple: the farmer plants his crop right over the stubble left from the previous crop or a winter cover crop, and avoids the tillage stage of production. With no-till all of the costs of the practice are avoided: there is minimal disturbance of the soil; many fewer passes over the field (reducing fuel costs); the porosity of the deep soil increases; and the micro-organisms eventually return to regenerate the soil naturally. With fewer passes on the field, the land is less likely to flatten out, and more likely to absorb any water and chemicals applied. Furthermore, the residue or winter cover protects the soil from wind and rain (the major causes of soil erosion), protects the soil from the sun and reduces the evaporation of rains, and reduces the ability of weeds and native plants to germinate. Although herbicides are used to kill the residue and winter cover before planting, no-till cultivation reduces the total amount of herbicide and pesticide use, and therefore reduces the increasing problem of herbicide resistance. The difficulty with no-till cultivation is that weeds have to be controlled non-mechanically, and planters and seeds must be adjusted to work in deep stubble and residue left over from the previous crop. The soil is also cooler because it is not exposed to the sun, and so seeding times can be delayed.

Changes in seeding, chemical, and seed technology, rising fuel and labor costs, increased government regulations on chemical use, and perhaps philosophical changes in "green" agriculture have all made no-till agriculture more viable over the past

twenty years. Evidence from the USDA supports this growth. Figure 4 shows the change in the percentage of acres farmed with more than fifty percent of the crop residue left in the field.[3] [Need a descriptive table using the machine code definition of no-till.] All crops show a growth in the use of no-till cultivation. Some crops, like durum wheat show a remarkable transformation. In the late 1990s about 20% of the acreage in durum wheat was using no-till, by a decade later around 90% of the acreage was.

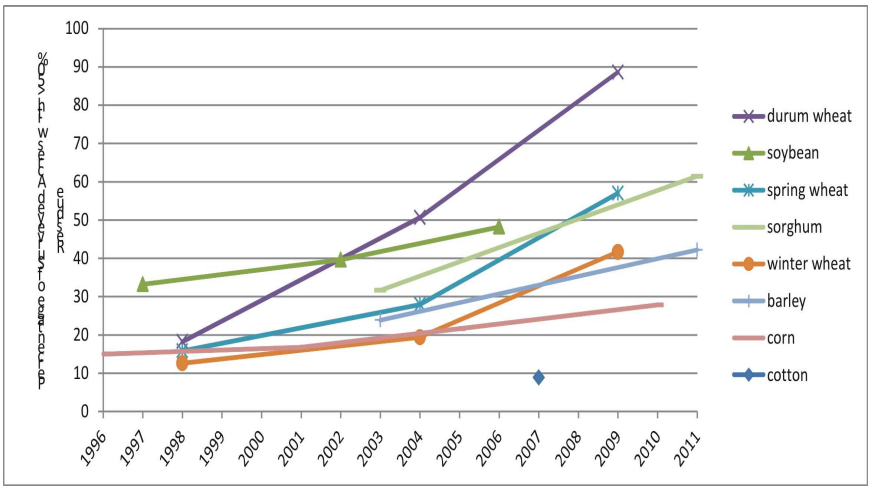

Figure 4

Percentage of Acres With Crop Residue ¿ 50%, by Crop

Source: USDA, ARMS Phase 2.

4. Explaining The Rise of Cash Renting

Our explanation of contract choice is taken from the one-sided, multi-task model of Allen and Lueck (1992). In that model a farmer rents a fixed plot of land from a landowner for either a fixed cash payment or a share of the crop output. The crop is observable with some fixed measurement cost, and depends on unobservable farmer

[3] This is one measure of no-till cultivation.

effort and unobservable land attributes (like moisture and nutrients). Importantly, farmers do not bear the full cost of the land attributes because their land lease is only short term. Excessive use of moisture or other soil nutrients that enhance the current crop but reduce the value of the land is considered beneficial to the farmer. Hence, although the true cost of using a soil attribute may be r, the farmer only bears r'. The cash renting farmer faces the following problem:

$$\max \Pi^R = h(e,l) - we - r'l$$

where $h(e,l)$ is the crop production function, dependent on farmer effort e, and the land attribute l; w is the opportunity cost of farmer effort, and $r' < r$ is the cost of the land attribute to the farmer. The farmer chooses e^R and l^R, which satisfy the equations $h_e(e^R, l^R) \equiv w$ and $h_l(e^R, l^R) \equiv r'$. In this set up, the farmer uses too much of the land attribute, and this is the downside of cash renting.

A farmer who shares receives a share s of the output, and still faces the lower cost of using the land attribute. The cropshare farmer's problem is:

$$\max \Pi^S = sh(e,l) - we - r'l.$$

Now the farmer chooses e^S and l^S to solve $sh_e(e^S, l^S) \equiv w$ and $sh_l(e^S, l^S)] \equiv r'$. With sharing the farmer puts less effort into the farm, but also uses fewer land attributes compared to cash renting. Were there only a moral hazard problem on the land attribute side, the cropshare would always dominate, but output sharing creates an incentive to under report the crop quantity and quality, and so with these types of contracts some type of monitoring has to take place.

In the Allen and Lueck model, no one type of contract dominates the other. When land is senstive to exploitation or when certain crops provide an opportunity to exploit the soil, then cropshare contracts are more likely because they mitigate this problem. On the other hand, when certain crops are easy to under report on either he quantity or quality dimension, then cash renting is more likely. Allen and Lueck have found considerable support for this model. Using data from various

states and provinces they've found that row crops (where extensive cultivation is normal) are typically shared, while irrigated and grass crops are most often cash rented.

Here, the implication for no-tilling is quite straight forward. Extracting nutrients and moisture from soil for current crops at the expense of future ones requires access to the soil. Traditionally this has come from conventional tilling. As mentioned, conventional tilling means the farmer manipulates the soil, determines the depth of the plough, decides the timing of raking and herbicide use, and the general number of passes on the field.[4] Almost by definition, no-till cultivation means "no opportunity to exploit the soil." Growing a row crop under no till conditions becomes similar to growing a grass crop, where the grass is planted and mowed several times over the season. As a result, the innovational changes that made no-till cultivation viable are essentially an exogenous shock to the farmland lease market. When a farmer switches over to no-till cultivation, there should be a subsequent switch to cash rent contracting.

As shown above, even visually there exists a dramatic positive correlation: the growth in cash renting across the U.S. corresponds to a large change in the amount of no-till cultivation. However, there is much variation to exploit and test the hypothesis. Some crops are more likely to be shared than others, and sharing is more common in some regions than others. Individual farms vary on many dimensions, and so in the next section we test the hypothesis more carefully.

5. USDA ARMS Data: Phase 2 and 3

This article uses data collected through field-level surveys — the Agricultural and Resource Management Survey (ARMS) — from years 1996 through 2011. The ARMS is conducted by USDA's National Agricultural Statistics Service (NASS)

[4] See Allen and Lueck 2002, for the detailed ways in which farmers can use various methods on these dimensions to enhance their current crop at the expense of the land owner.

and the Economic Research Service (ERS).[5] ARMS is the USDA's primary source of nationally representative data on the practices and finances of U.S. farm operations, and contains data on field-level production practices, operator characteristics, farm finances, and the farm household characteristics that are linked to each field surveyed. Each year a portion of the ARMS targets specific commodity crops. The targeted sample is designed to be nationally representative of all acres planted to the specific crop in the survey year. The observations are weighted by probability based weights (supplied by NASS) so that descriptive statistics and estimation results are nationally representative. The portion of the ARMS dataset used in this analysis contains xxxx field level observations on fields which the operator leased with either a cash rent or cropshare agreement.

Table 1 shows the percentage of planted acres that are rented by the operator by survey year and crop targeted included in this article. There is at least one crop suveyed in each year, and every crop is surveyed at least twice. In the analysis a field represents the unit of observation, as tillage practices and tenure vary at the field level and many other variables were collected at the field level.

6. Testing The Hypothesis

Regressions to be presented at ISNIE conference.

[5] More information regarding the survey and data can be found at: htp://ww.ers.usda.gov/data/arms/GlobalAbout.ht