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Does risk management matter? Evidence from the U.S. agricultural industry ☆

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ABSTRACT

This article constructs triple-difference tests around shifts in the supply of risk management instruments available to agricultural producers to reveal a positive relation between risk management and productivity. This relation is more robust when producers adopt instruments with payoffs linked to group performance and weaker when payoffs are linked to individual performance. Additionally, productivity is particularly high among risk-managing producers in counties containing high levels of bank deposits, a proxy for access to finance. Overall, this article illuminates the relation between hedging and real firm outcomes as well as the interaction between access to finance and firms' risk management choices.

1. Introduction

This study exploits shifts in the supply of risk management instruments available to producers in the U.S. agricultural industry to examine the relation between risk management and productivity. The empirical risk management literature is vast and begins with studies examining the cross-sectional determinants of the decision to hedge (see, e.g., Nance, Smith, and Smithson, 1993; Tufano, 1996; Géczy, Minton, and Schrand, 1997). In recent years, beginning with Allayannis and Weston (2001), the conversation has turned to whether risk management affects firm value. Despite the obvious importance of this question, the evidence remains mixed.[1] This paper explores the relation

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[1] Allayannis and Weston (2001) study 720 large firms between 1990 and 1995 and find those using currency derivatives have higher market values than those not using currency derivatives. Graham and Rogers (2002), Adam and Fernando (2006), Carter, Rogers, and Simkins (2006), MacKay and Moeller (2007), Bartram, Brown, and Conrad (2011), and Pérez-González and Yun (2010) find a similar, positive relation between risk management and firm value. In contrast, Guay and Kothari (2003) estimate the effect of hedging on cash flows for a sample of 234 large U.S. nonfinancial firms and find the effect to be small. Similarly, Jin and Jorion

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between risk management and productivity, an intermediate channel through which risk management could affect firm value.

The U.S. agricultural industry is a useful setting for studying the effects of risk management for several reasons.[2] First, the risk management data for this industry are detailed and accessible. The Risk Management Agency (RMA) of the United States Department of Agriculture (USDA) collects and verifies data on *crop insurance policies* purchased by agricultural producers. The crop insurance data are available at the county level and vary by county, year, and crop. I construct a data set that comprises more than 175,000 county-year-crop observations from 1989 to 2008. Second, the U.S. agricultural industry remains an untapped setting for examining the real effects of risk management. The agricultural economics literature focuses almost exclusively on the link between crop insurance and input use and, as Glauber (2004) notes, "… no studies have directly analyzed the effects of crop insurance on yield [the primary dependent variable in this paper] …" (*p*. 1190).

To identify the relation between risk management and productivity, I construct triple-difference tests around 14 events where the RMA introduced a new crop insurance policy to particular crops. I classify crops that received access to the new crop insurance policy as "treatment" crops, and crops that do not have access to the new crop insurance policy as "control" crops. The following example illustrates the mechanics of the triple-difference tests in a univariate setting. The RMA introduced a new revenue insurance policy to corn (the treatment crop) producers in 1997. Comparing corn yields before and after the introduction of the policy, one finds an increase equal to 32.0% of the sample standard deviation in counties with below-median adoption of the new insurance policy. In contrast, one finds an increase equal to 61.1% of the sample standard deviation in counties with above-median adoption of the new insurance policy. Comparing these increases reveals a difference-in-difference: the increase in corn yields in high-takeup counties was larger than the increase in corn yields in low-takeup counties by an amount equal to 29.1% of the sample standard deviation.

Continuing the example, it is helpful to think about these changes relative to similar changes among control crops that did not gain access to the new policy. Comparing control crops' yields before and after the introduction of the policy, one finds an increase equal to 21.6% of a standard deviation in low-takeup counties (where corn producers' adoption of the new insurance policy was below the sample median) and an increase equal to 20.4% of a standard deviation in high-takeup counties (where corn producers' adoption of the new insurance policy was above the sample median). These changes reflect a difference-in-difference equal to −1.2% of a standard deviation. Finally, one can compute the difference-in-difference-in-difference (i.e., the triple-difference) by subtracting the difference-in-difference for the control crops from the difference-in-difference for corn crops. The triple-difference equals 30.3% of a standard deviation. One can interpret this positive and significant triple-difference as evidence that (a) crop yields increased after the introduction of the new insurance policy, (b) the increase was sharper among the crops that gained access to the new policy, and (c) the increase was sharpest among treated crops that adopted the new insurance policy. Table 1 displays this example.

This increase is economically meaningful. An increase in corn yield equal to 30.3% of the sample standard deviation equates to an increase in revenue equal to $1.73 million for a single county-year. To provide perspective, the sample contains over 41,000 county-year observations for corn yields. Aggregating across all sample crops, I estimate that crops with above-median liability protection generate $71.6 billion more in revenue than crops with below-median liability protection during the last year of the sample, alone.

The crop insurance policies vary by indemnity criterion. Of the 14 events where the RMA introduced a new crop insurance policy, six events feature policies that pay indemnities when the county-average performance of similar crops falls below the threshold specified in an insurance contract. The other eight events feature policies that pay indemnities when an individual producer's performance (measured by yield or revenue) falls below the threshold specified in an insurance contract. Using multivariate triple-difference regressions, I find that the group-performance-based policies have a more uniform, positive correlation with productivity than individual-performance-based policies. Fig. 1 summarizes these results.

The variation in productivity across policy types could reflect the well-known moral hazard effect inherent in insurance decisions. By purchasing crop insurance, producers protect themselves from losses arising from risky actions that increase the likelihood and magnitude of crop losses. For example, Goodwin and Smith (1996) find that moral hazard incentives lead insured agricultural producers to use fewer chemical inputs. On the other hand, crop insurance policies with indemnities based on the *county*-average performance of similar crops should be difficult for individual farmers to manipulate. These policies could have more success mitigating the effects of moral hazard, and thereby avoid problems that could weaken a positive relation between risk management and productivity.

This paper makes several contributions to the risk management-firm value literature. First, although many

(*footnote continued*)

(2006) examine a sample of 119 U.S. oil and gas producers between 1998 and 2001 and find that hedging does not improve market value. A recent addition to the literature, Campello, Lin, Ma, and Zou (2011) argue that corporate hedging helps reduce the cost of debt financing which, in turn, allows hedgers to increase investment.

[2] Agriculture is a larger industry than others that receive attention in the risk management literature. According to 2008 data from the Bureau of Economic Analysis, the gross output of the farming industry was $335.3 billion. By comparison, the gross output of the oil and gas extraction industry [studies such as Haushalter (2000), Jin and Jorion (2006), and MacKay and Moeller (2007) examine this industry] was $323.4 billion, the gross output of the air transportation industry [studies such as Carter, Rogers, and Simkins (2006) examine this industry] was $159.8 billion, and the gross output of the mining industry [studies such as Tufano (1996, 1998), Petersen and Thiagarajan (2000), Adam and Fernando (2006), and Dionne and Garand (2003) examine this industry] was $95.4 billion.

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