THE COSTS OF COOPERATION: THE EFFECTS OF SECTION 199 ON BASIS FOR FARM COOPERATIVES IN THE MIDWEST

by

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DEDICATION

For my parents:

Doug and Karen

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ABSTRACT

The 2004 American Jobs Creation Act created Section 199, a tax provision for producers of domestic goods. During the ensuing decade, Section 199 became especially important for agricultural cooperatives, partly because of a series of favorable Internal Revenue Service private letter rulings for marketing cooperatives. I analyze the impacts of Section 199 on agricultural markets by assessing differential effects on the pricing behavior of grain marketing cooperatives and non-cooperatives in Nebraska and Kansas. I first develop a model for the agricultural cooperatives pricing behavior that incorporates a tax on the qualified patronage received by cooperative patrons. This model produces several testable predictions. First, Section 199 will lower the spot prices offered by cooperatives while increasing the spot prices offered non-cooperatives that compete with cooperatives for agricultural commodities. Second, the widening of prices between cooperatives and non-cooperatives will be mitigated by increased spatial competition. I empirically test the predictions of this model using a difference-in-difference empirical strategy and winter wheat basis data. The results indicate that the series of IRS letter rulings in 2008 widened the basis differential between cooperative and non-cooperative firms by almost 5 cents per bushel on average. Furthermore, these market distorting effects are greater for elevator locations that do not have a competing location within 10 miles of their location. While the benefits of Section 199 have been widely touted by cooperative lobbying groups, the results of this thesis show the importance of also considering the costs of policy interventions directed at specific agricultural firm types.

INTRODUCTION

A widely accepted belief is that U.S. agricultural commodity markets are representative of perfectly competitive markets. A large number of homogeneous producers market a homogeneous product to a large number of homogeneous buyers. However, the reality has repeatedly been shown to be different (Rogers and Sexton, 1994; Lavoie, 2005). Commodity markets have unique structures, may exercise market power, and may produce quality differentiated goods, among others. Another example of how markets can be heterogeneous is the structure of firms that buy agricultural commodities. Many firms in commodity markets use a form rarely seen in other markets: the producer-owned cooperative.

Cooperatives have been an ongoing presence in U.S. agricultural markets since the first dairy and cheese cooperative was formed in 1810.[1] In 2015, 2,047 agricultural cooperatives served 1.9 million members and accounted for $212.1 billion in business throughout the United States (Wadsworth and Huang, 2017).[2] In addition, cooperatives hired over 187,200 employees (ibid). Grain marketing and supply cooperatives are a main buyer and supplier of goods for producers. They account for over $48 billion in revenue while serving over 365,000 members (ibid).

Cooperatives face specific regulatory conditions. Since the passing of the 1922 Capper-Volstead Act, cooperatives have been exempt from antitrust laws because—as

[1] The University of Wisconsin-Madison provides a brief history of agricultural cooperatives in the U.S. See: http://www.uwcc.wisc.edu/whatisacoop/History/

[2] The USDA provides numerous statistics on agricultural cooperatives, including data differentiated by cooperative type, commodity, and size. The latest year data are available is 2015. See: https://www.rd.usda.gov/files/publications/SR79AgriculturalCooperativeStatistics2015_0.pdf

producer-owned organizations—cooperatives are assumed to be an anti-monopsony entity. In addition to their exemption from antitrust laws, cooperatives also have their own section of the IRS tax code called Subchapter T, which governs how they can pass through monetary benefits to their patron-owners.

Even as recently as 2017, cooperatives continued to be differentially treated using new tax laws. In December of 2017, a last minute provision in the Tax Cuts and Jobs Act called Section 199A brought one aspect of cooperative tax policy into the limelight. This amendment was supposed to replace a long standing tax policy called the domestic production activities deduction (DPAD), which gave domestic producers and manufacturers of any firm type a tax deduction. However, the new amendment was designed in a way that gave producers a deduction in their tax liability of up to 20% of their gross sales receipts from their business with cooperatives. This created a significant incentive for agricultural producers to market their commodities to cooperatives instead of non-cooperatives because they could significantly reduce (if not fully eliminate) their annual income tax liability.

Some independently-owned firms (IOFs) became concerned that they would not be able to compete with cooperatives.[3] Lawmakers eventually repealed the amendment; however, they did not entirely do away with the provision. Instead, they reverted back to policies initially passed in 2004: the original Section 199 provision. While this original law did not generate as much outcry, it still may create market-distorting impacts in the

[3] https://www.wsj.com/articles/agriculture-firms-decry-provision-in-new-tax-law-1515529022

grain handling industry by artificially increasing incentives to market products to agricultural cooperatives rather than private firms.

Complicating the effects of Section 199 is the Internal Revenue Service's (IRS) application of Section 199 for marketing cooperatives. In 2008, the IRS issued a series of letter rulings that significantly increased the value of the deduction for commodity marketing cooperatives (Harris and McEowen, 2013).This deduction became so important for cooperatives that lobbying groups representing them claimed that Section 199 saved farmers across the United States $2 billion annually.[4] However, the IRS letter rulings may have exacerbated market distortions resulting from Section 199.

Despite the fact that the Section 199 tax policy has existed since 2004, no empirical work has been conducted to test whether the deduction has altered markets by creating competitive advantages for cooperatives. This thesis conducts an empirical price analysis of grain marketing firms to estimate the effects of Section 199 on grain markets through measuring changes in local basis—the difference between the local cash price and the next winter wheat futures contract at the Kansas City Board of Trade. I develop a cooperative model that for the first time incorporates a tax on the patronage received by cooperative patrons, generating several testable comparative statics. I use a difference-in-difference empirical strategy using publicly available winter wheat basis data for the time period of 1998-2017 in Nebraska and Kansas. The main hypothesis is that if the original Section 199 policy caused farmers to increase their deliveries to cooperatives as a result

[4] http://ncfc.org/press-release/co-ops-oppose-increased-tax-burden-farmers/

of the policy and cooperatives are capacity constrained in the ability to accept the increased supply, the cooperatives would respond by altering their combination of prices or patronage in order to stay within their capacity limitations. Furthermore, non-cooperatives—competing against cooperatives for the same group of producers' commodities—will have to increase their prices, if they want to maintain a similar volume of grain pre- and post-Section 199. However, the size of these price changes may depend on the amount of spatial competition.

Using a difference-in-difference model and winter wheat basis data from grain elevators in Nebraska and Kansas, I find that Section 199 before any of the IRS letter rulings went into effect did not cause a widening of the price differential between cooperatives and non-cooperatives. However, after the IRS letter rulings went into effect, the price difference between cooperatives and non-cooperatives increased by almost 5 cents per bushel on average. That is, cooperatives offered prices that were approximately an additional 5 cents per bushel lower than private firms offered than before the Section 199 policy. Moreover, this increase in the price differential is 2.5 cents per bushel greater for elevator locations that do not have a competitor within 10 miles of their location than elevator locations that do have a competitor within 10 miles of their location. Thus, the IRS letter rulings appear to exacerbate any distortions in grain markets caused by Section 199, but these distortions may be partially mitigated by the presence of spatial competition in local grain markets, which reduce firms' abilities to pass through costs to producers.

The results of my research add to the theoretical and empirical literature of cooperatives. No previous research has incorporated a tax on cooperative dividend payments into models of agricultural cooperatives' commodity pricing behaviors, and there is almost no literature comparing the price differences between cooperatives and non-cooperatives. In addition, the results of my empirical analysis indicate the importance of local market conditions for agricultural policy making. The presence of market power may cause the benefits of agricultural policies to accrue with intermediaries in agricultural markets such as commodity processors and marketing firms, even if the policy is mainly supposed to help agricultural producers.

Furthermore, the fight over Section 199A in 2017 revealed the continual influence of agricultural lobbying groups—such as the National Council of Farmer Cooperatives—on policy making. These proponents of agricultural policy changes need to be forthright with the possible costs of their proposals to producers, consumers, and taxpayers. While Section 199 may indeed have provided benefits to agricultural commodity producers, this thesis puts into question whether Section 199 was indeed a net gain for producers. In the future, when Section 199A or a similar tax policy is proposed by lobbyists or lawmakers, this thesis will hopefully improve the discussion over the benefits and the costs of such proposals.

THE HISTORY OF SECTION 199 AND ITS APPLICATIONS

The infamous late-night addition to the 2017 Tax Cuts and Jobs Act was meant to replace an older version of Section 199 passed in the 2004 American Jobs Creation Act. Internal Revenue Service (IRS) letter rulings that started to be issued in 2008 then gave Section 199 special importance to agricultural cooperatives, particularly through their internal patronage policy. And as evidenced by the Section 199A provision in the 2017 legislation, cooperatives are likely to continually be a focal point of future legislation.[5]

History of Section 199

The original Section 199—also known as the domestic production activities deduction (DPAD)—was passed by legislators to replace Section 114 of the U.S. tax code. Section 114 gave a tax deduction for U.S. companies from their net income derived from foreign trade. It was, in effect, an incentive for U.S. companies to increase their exports. However, in 2001, the World Trade Organization deemed this tax provision as a violation of its free-trade rules, calling it an export subsidy. In response to the WTO ruling, the U.S. legislature repealed Section 114 and passed Section 199.

Section 199 gave domestic manufacturers a tax deduction based on their qualified production activities income from sales to buyers within the United States. In effect, the law gave a deduction for domestic production of real goods in the United States such as the production of commodities, real estate construction, software, and natural gas.

[5] See U.S. Code § 199A. Qualified business income for the current law. The text is available at www.law.cornell.edu/uscode/text/26/199A

However, it excluded the retail sellers of those goods. For example, natural gas drillers would get a Section 199 deduction for the net income derived from the sale of raw natural gas to refiners in the United States, but companies that sell natural gas to consumers would not be eligible for a Section 199 deduction on those sales. When the Section 199 was passed, it included a phasing-in provision. From 2005-2006, the deduction was only 3% of net income. In 2007, the amount increased to 6%, and in 2010, it increased to 9% of net income. Furthermore, from its inception, Section 199 was capped by 50% of the W-2 wages—essentially, wages where the employer withholds a portion of income for taxes—the domestic manufacture paid, as the purpose of the provision was to increase domestic employment.

The capping of Section 199 by W-2 receipts made the deduction unusable for a significant portion of agricultural producers across the Midwest because they hire little paid labor and paid wages that do not withhold taxes (Harris and McEowen, 2013). Furthermore, wages paid to a farmer's dependents or a members of the partnership owning the farm business would not be eligible for the Section 199 tax benefits (Ibid). However, the cooperative firms that procured the products of farmers were eligible, as the cooperatives storing, processing, and marketing of raw agricultural products qualified as domestic production. To allow farmers to take advantage of Section 199, lawmakers included a provision in the law allowing cooperatives to pass-through their own

deduction to their patrons, as can be seen in the IRS final rules and regulations for Section 199 issued in 2006.[6]

However, while some marketing cooperatives used the pass through provision, many were unsure of its proper application.[7] In fact, the IRS scrutiny of the DPAD deduction for all firm types is rather notorious.[8] Nevertheless, starting in 2008, the IRS began to issue private letter rulings guiding the implementation of the DPAD pass-through for cooperatives (Harris and McEowen, 2013).[9] Moreover, the IRS gave favorable rulings for agricultural marketing cooperatives (Kenkel, Boland, and Barton, 2014).[10] The 2008 letter rulings affirmed that marketing cooperatives could count their cash receipts to producers for commodity sales as advance per unit retains payments in money (PURPIM) (Harris and McEowen, 2013). That is, cooperatives did not have to deduct their cash sales to their patrons from their domestic production gross receipts (DPGR), effectively increasing the potential size of the DPAD deduction (ibid). If commodity sales from patrons represented a substantial portion of a cooperative's business, then the effect of the letter rulings could be quite significant (ibid.). Thus, while the private letter rulings only technically applied to the cooperatives that specifically petitioned the IRS, they still provided a rubric for all commodity marketing cooperatives to follow.

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[6] See 26 CFR § 1.199–6 Agricultural and horticultural cooperatives.
[7] Tidgren, K., personal communication, February 14th, 2018
[8] See www.mwe.com/insights/a-look-at-tax-code-section-199/#overview for more details (McDermott Will & Emery is one of the largest law firms by revenue in the world).
[9] See IRS written determinations index number: 1382.00-00, 199.06-00 (subject: Taxable Income of Cooperatives) for the start of the letter rulings regarding the Section 199 pass through for cooperatives.
[10] For example of one these favorable letter rulings, see IRS letter ruling: 200806011.

Finally, while the IRS letter rulings on Section 199 did indeed give cooperatives an advantage over IOFs, it does not appear the advantage was large enough to induce IOFs to change their firm form to cooperatives. When Section 199A was passed in 2017, grain marketing corporations began to speak of changing their firm forms to cooperatives in order to take advantage of the new tax advantages.[11] Furthermore, even non-agricultural firms were considering forming new cooperatives to take advantage of Section 199A.[12] However, there appears to be no discussion—in the press at least—of corporations forming cooperatives to take advantage of Section 199.

This could be the result of the costs of switching to a cooperative from a corporate form. Orsi, Lisa, and Jacob (c. 2017) discuss how to convert an IOF into a worker-owned cooperative. All means of conversion involve some form of divesting of the original entity and then reinvesting in the new cooperative (ibid.). This process would inevitably include the paying off or reorganizing of liabilities and the investors of the IOF entity would have to pay capital gains taxes on the value of their equities. The entire process would require the extensive use of lawyers and accountants. Moreover, the process could take several years, as evidenced by case studies in Orsi, Lisa, and Jacob (c. 2017). Thus, while the IRS letter rulings of did give an advantage to cooperatives over IOFs, these costs may be too prohibitive to allow for IOFs to switch to cooperatives.

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[11] See https://www.wsj.com/articles/agriculture-firms-decry-provision-in-new-tax-law-1515529022 for examples of corporations decrying the effects of Section 199A.

[12] See https://www.forbes.com/sites/peterjreilly/2018/02/11/cooperative-glitch-in-tax-bill-may-mean-food-fight-in-congress/#598cd46d65dd for a journalist discussing the possibility of law firms forming worker-owned cooperatives to take advantage of the law.

Section 2.2: Example of DPAD and IRS Letter Rulings

The inclusion of the IRS letter rulings creates added complexity to the understanding of DPAD. These complexities are best understood through example. For this example, it is worth directly quote at length from the newsletter prepared by tax lawyers with the Center for Agricultural Law and Taxation at Iowa State University:

> Ruraltown Farmer's Cooperative is a marketing cooperative that had $5,000,000 in gross receipts in 2008 from the sale of corn its members delivered to it, who are the farmers that produced the corn. Ruraltown paid $4,000,000 to its members at the time they delivered the corn and another $500,000 in patronage dividends after the close of the 2008 tax year. Ruraltown also had $500,000 of other expenses that includes $120,000 of wages.
>
> Historically, Ruraltown treated the payments to its members at the time they delivered corn as payments for the purchase of the corn. However, after reviewing its membership agreement in light of the letter ruling issued by the IRS, Ruraltown concluded that those payments are advance PURPIM. Therefore, it did not deduct those payments from DPGR to compute its QPAI [qualified production activities income, i.e. DPGR minus relevant expenses and deductions] for 2008 and it included those payments in Box 3 of the 2008 Forms 1099-PATR it sent to its members.

> Because Ruraltown marketed grain produced by its members, all of its receipts are DPGR. Consequently all of its expenses are allocable to DPGR and its QPAI is $4,500,000 ($5,000,000 - $500,000). (Harris and McEowen, 2013)

In the above example, without the IRS letter ruling, the cooperatives QPAI would be $500,000 ($5,000,000 - $500,000 - $4,000,000). The DPAD deduction is then the relevant rate multiplied by QPAI, which would be $405,000 with the letter ruling and $45,000 without the letter ruling once the 9% tax deduction went into effect in 2010. This gives commodity marketing cooperatives a substantial potential—again, actual deduction will be capped by W-2 wages and net income—increase in the size of their Section 199 deduction over non-cooperatives. Furthermore, if they decide to pass through their deduction, it increases the incentive of producers to market their commodities through cooperatives versus IOFs, ceteris paribus.

The 2008 IRS letter rulings created the impetus for cooperatives to change how they calculate the deduction to maximize its size (ibid.). Moreover, the IRS letter rulings on the cooperative implementation of Section 199 may have created a greater reliance on Section 199 for cooperatives for their production decisions as compared to their independently-owned competitors, for the letter rulings only applied to cooperatives. Furthermore, only cooperatives could pass-through their Section 199 deduction calculated at the firm level (ibid.). In the end, the deduction became so important for cooperatives and their members that during the fight to keep Section 199 in the 2017 tax law, the National Council of Farmer Cooperatives claimed that the Section 199 deduction

amounted to $2 billion annually across the U.S. with a substantial majority being passed-through to members.[13]

Cooperative Patronage

One limiting factor for cooperative implementation of the Section 199 pass through is that they could only pass through their Section 199 deduction through a specific type of patronage called qualified distributions. Qualified distributions are just one form of cooperative patronage; therefore, to better understand the workings of Section 199 and its implications, some background knowledge in cooperative patronage policy is necessary.

Cooperatives operate according to the user-owner principle. This principle states that those who patronize the cooperative should primarily be the owners of the cooperative. Thus, the accounting profits of the cooperative are primarily generated by its equity holders. Furthermore, when a cooperative makes accounting profits through the business it conducts with its patrons, the cooperative must then choose how to distribute those profits. The profits are then distributed into four categories: "(1) allocated patronage refunds to patrons, (2) unallocated retained earnings, (3) dividends on selected equity classes to owners, and (4) income taxes based on the taxability of the first three distribution choices" (Kenkel, Boland, and Barton, 2014).

Cooperatives have two classes of equity: allocated and unallocated. With allocated equity, the equity on the balance sheet is attached to a specific producer, who

[13] http://ncfc.org/press-release/co-ops-oppose-increased-tax-burden-farmers/

has a legal claim to her equity. Cooperatives distribute allocated equity to members based upon their percentage of the total business conducted with the individual cooperative. However, the user-owner structure creates pressure for the cooperative to redeem—pay out in cash—allocated equity to their patrons at a future date (Li, et al, 2015). If a farm business is no longer using the cooperative, then the equity is useless to the farm business, as does not accumulate interest nor is it transferable to other members (ibid). This pressure to redeem equity at a future date creates ambiguity in how lenders may treat allocated equity on a cooperative's balance sheet (ibid.).

Unallocated equity is not attached to any specific producer and is simply owned by the patrons as a whole. When a cooperative losses money, it can use unallocated equity to absorb the loss (Kenkel, 2016). The presence of unallocated equity, however, may create pressure to dissolve the cooperative if the ratio of unallocated to allocated equity gets sufficiently high (Boland, 2012).

Once a cooperative has decided the amount of profits to allocate, it must then distribute those allocated profits among two different equity classes: nonqualified and qualified. With nonqualified equity, the equity is in the name of a specific producer, but the cooperative assumes the full tax burden of the equity. However, if the equity is redeemed at a future date, then the cooperative receives a refund of its previous tax payments, and the producer must pay a tax on the redeemed equity at their relevant marginal income tax rate. With qualified distributions, the producer is liable for the income tax of the entire distribution; however, at least 20% of the distribution must be paid in cash. One possible downside of qualified distributions is that they may result in a

negative cash flow if the percentage paid in cash is less than the producer's marginal tax rate (Kenkel, Boland, and Barton, 2014; Junge and Grinder, 1986). Furthermore, the patron always owes the tax on qualified distributions at the patrons relevant marginal income tax rate—just as corporate shareholders must always pay taxes on dividends received from the corporation.

Qualified distributions become important for the purposes of Section 199 for two reasons.[14] First, IRS code stipulates that the Section 199 pass-through must occur through qualified distributions. However, the pass through cannot be double counted. For example, if a cooperative issues $500 in qualified patronage and passes through $100 in DPAD, then cooperative only gets to deduct the value of the qualified patronage not including the DPAD pass through. Second, because patrons must always pay the tax on their received qualified distributions, the passing through of the DPAD deduction can simply be used against the qualified distribution tax liability, even if the farm business itself makes no accounting profits. For example, consider a farm business that makes $0 in accounting profits, receives $10,000 in qualified distribution with $2,000 paid in cash, and has a tax rate of 20%, then, without any DPAD pass through, the farm business would only have $8,000 in equity after paying taxes. However, if the cooperative also passes through its DPAD deduction, of which the producer receives $500 in tax write-off,

[14] Historically, nonqualified distributions played a small role in cooperative patronage policy (Kenkel, Boland, and Barton, 2014); in fact, in 2008, nonqualified distributions only accounted for 4% of allocated distributions (Eversull, 2011). However, the use of nonqualified—and unallocated equity—distributions has increase in recent years, perhaps because some cooperatives were declining to pass-through their Section 199 deduction (Kenkel, 2016). Still there is no evidence to date—that this author is aware of—that reveals that the use of non-qualified equity has substantially replaced qualified equity for a large majority of cooperatives.

then the producer would have $8,000 in equity and $500 in cash after taxes. As such, the DPAD pass through can be seen as increasing the net value of any qualified distributions.

The Optimality of Cooperative Distributions and DPAD Deductions

The choice to pass through the Section 199 lies with each cooperative firm. Cooperatives may indeed take advantage of the Section 199 deduction to reduce their own tax liability. The National Council of Farmers Cooperatives claims that 95% of the Section 199 deduction is passed through by cooperatives to their patrons.[15] However, as no publicly available data exist on cooperative financials, it is not possible to verify this claim. Nevertheless, existing economic research provides some clues about the behavior of cooperatives by asking the question of: what is the optimal choice?

Existing research has focused on whether cooperatives should use non-qualified or qualified deductions. The main method of analysis is the maximization of net present value for producers' after-tax cash flow.[16] For example, using simulation methods, authors have shown that the optimal patronage decisions depend on the marginal tax rates of the farm businesses, as compared to the marginal tax rate of the cooperative—which is taxed at the corporate rate (Royer, 1987; Junge and Grinder, 1986). Russell and Briggeman (2014) find that a risk averse producer may prefer a greater proportion of nonqualified distributions to qualified distributions, indicating that producer's perception of the relative risk between the cooperative and the farm business may be more important

[15] http://ncfc.org/press-release/180-groups-call-house-preserve-section-199-ensure-farmers-not-face-tax-increase/

[16] For the cash-flow studies, it is important to note that equity in cooperatives does not accumulate interest.

than marginal tax rates for optimal allocations. However, Royer (2017) finds that after-tax cash flows for producers are maximized when the Section 199 deduction is passed through to producers, ceteris paribus.

Another method used to evaluate whether cooperatives should pass through or retain the DPAD deduction is the maximization of internalized rates of return (IRR). The IRR is a means of calculating the profitability of an investment by finding the discount rate that makes the investment have a zero net present value. Kenkel, Boland, and Barton (2014) find that the IRR is maximized when the Section 199 deduction is retained at the cooperative level. The primary reason for this result would be the reduction in the tax burden created by an increase in the nonqualified distributions, while keeping the farm business' cash flows constant. However, one difficulty of this approach may be member preferences. Zhang et al (2013) find that for Financial Credit Services (FCS) members—a financial cooperative—their patrons favored cash patronage payments over better interest rates. Moreover, they find that the number of FCS associations paying cash patronage increased over the first decade of the 2000s increased from 40 to 73% (ibid). While the study is not perfectly analogous to commodity marketing cooperatives, the results may still indicate that even if Section 199 may be better used at the cooperative level, member preferences may be such that they would prefer the immediate tax break rather than a greater return in the future.

In general, there's no consensus about optimal deduction pass-through strategies. However, there is suggestive evidence in support of cooperatives pass through deductions to their members. Even if the deduction could achieve a higher rate of return at the

cooperative level, a higher after-tax cash flow and member preferences may be enough to convince cooperative managers to pass through some if not all of their Section 199 deduction to their members. This implies that the Section 199 provision could impact not only management decisions at the cooperative-level, but also management and marketing decisions by farmers, who may view tax deductions passed through by cooperatives as an additional value of marketing to cooperatives rather than private firms.

LITERATURE REVIEW

The unique business structure of cooperatives requires an economic modelling approach that is distinct from the typical neoclassical theory of the firm. Topics in the agricultural economics literature on cooperatives include organizational theory, financial constraints, pricing strategies, inefficiencies as compared to independently-owned firms (IOFs), and effects on social welfare, particularly in non-perfectly competitive markets. However, very little empirical work has directly compared the pricing performance of cooperatives to non-cooperatives (Katchova, 2010).

Pricing Theory of Cooperatives

One challenge to analyzing cooperative behavior—especially when comparing cooperative behavior to IOF behavior—is the ambiguity surrounding the cooperatives' maximization objective. With non-cooperatives, the general consensus is quite clear: IOFs maximize profits. However, this objective may not apply to the user-owner structure of cooperatives. As Taylor (1971) details, the profit-maximizing quantity for the firm is not necessarily the quantity that maximizes welfare for the producers that patronize and own a cooperative.

Helmberger and Hoos (1962) provide the groundwork for most modelling on agricultural cooperatives, and the authors hypothesize that cooperatives will maximize net prices to their members, and in the long run, pay no patronage dividends. Later research added several other maximization objectives such as cost minimization,

patronage maximization, price stability, and member net return maximization (LeVay, 1983a; Royer, 2014).

Empirical literature about cooperatives is less expansive; however, Featherstone and Rahman (1996) find that among 20 Midwestern cooperatives, all consistently sought a cost minimization strategy while none acted consistently with a profit-maximization hypothesis. The maximization of member net returns appears to have a consensus support among agricultural economists as the optimal solution for the patrons of cooperatives (Enke, 1945; Ohm, 1956; Taylor, 1971; LeVay, 1983b; Sexton, 1984).[17] However, it is not immediately clear if this objective is sustainable in the long run (Ohm, 1956; Helmberger, 1964; LeVay, 1983b; Sexton, 1984; Sexton et al, 1989).

Helmberger's (1964) pricing model for cooperatives is similar to models developed for IOFs. The author's model has the distinct advantage of creating a simple means to measure the size of the patronage payments to patrons of the cooperatives. The author creates a function called the net average revenue product. The net average revenue product function (NARP) is the typical average revenue product function of a firm minus its average cost function. As LeVay (1983b) and Taylor (1971) show, pairing the (NARP) with the supply curve—for a commodity marketing cooperative—faced by the cooperative allows the easy calculation of the patronage payment(NARP – price).

[17] There is some debate in the literature as to which economist first developed the maximization of member net returns solution as LeVay (1983b) and Sexton (1984) disagree. However, it appears that the solution was developed separately by Enke (1945), Ohm (1956), and Taylor (1971)—as discussed by Sexton (1984).

LeVay (1983b) and Taylor (1971) state that the net returns to patrons will be maximized when the net marginal revenue product function (NMRP)—marginal revenue product minus marginal costs—intersects the supply curve faced by the cooperative. However, as LeVay (1983b) and Helmberger (1964) note, if cooperative members consider any patronage to be part of the price received from their output, then patronage, in the long run, will be zero, assuming the cooperative pays a price equal to marginal cost.[18] Thus, the maximization of net returns to members may not be a tenable objective for cooperatives without supply restrictions, and cooperatives not using supply restrictions will operate at a point where price equals NARP (Helmberger, 1964; Sexton, 1990). Only Royer and Smith (2007) have proposed a model where patronage payments will be positive in the long run.

Cooperatives and the Competitive Environment

Over the last several decades, the conventional notion that agricultural markets largely resemble perfectly competitive markets has been widely challenged (Rogers and Sexton, 1994; Sexton, 2013). While being the typical textbook example of perfectly competitive markets, actors in agricultural commodity markets do indeed have to contend with market power (Lavoie, 2005; Davis and Hill, 1974). A thorough study of commodity markets in the United States needs to account for the possible presence of local oligopsonies. Furthermore, the presence of market power could drastically effect who actually receives the benefits of a policy change (Saitone et al., 2008; Russo et al., 2011).

[18] See Royer (2001) for a nice mathematical treatment of this result.

Policies such as Section 199 are legislated at the national level, yet, local oligopsonies may create heterogeneous effects on prices and on welfare outcomes. The effects of oligopsonies on prices may also be influenced by the presence of competing cooperatives (Sexton, 1990). Therefore, a thorough research study into the effects of Section 199 needs to consider the impacts of oligopsonies and the form of the firm possessing local market power.

The key term describing the presence of cooperatives in agricultural markets is the "competitive yardstick". The competitive yardstick states that producer cooperatives in agricultural markets will counteract some market power exerted by profit-maximizing firms, resulting in higher prices for farm businesses. In commodity markets, cooperatives exert a pro-competitive effect through the vertical integration of farm businesses—thereby, increasing prices for members—and competing for the raw products of farm businesses with IOFs, moving the market towards the perfectly competitive structure.

However, the pro-competitive effects of cooperatives appear to depend on the form of the cooperative itself. In an oligopsonistic market, an open-membership cooperative—a cooperative in which any individual or firm can join—will offer higher prices than its competitors, creating a pro-competitive effect on the market (LeVay, 1983b; Sexton, 1986; Sexton, 1990). A closed-membership cooperative, on the other hand, may have a much more limited effect on the competitive landscape in agricultural markets (Helmberger, 1964; Sexton, 1990; Royer, 2014). In fact, if marketing cooperatives have market power on the downstream wholesale/retail markets, then they may use their market power to raise prices on consumers (Cakir and Balagtas, 2012). Yet,

if a cooperative is limiting output on the raw product market, the negative social welfare effects may be less than if the cooperative was a profit-maximizing firm (Royer, 2001). Furthermore, a tax on the cooperatives profits may actually move the cooperative to produce the socially optimal amount (ibid.).

One way in which imperfect competition can occur is through spatial market power. Bekkerman and Taylor (pending publication) find that only 8% of wheat harvested in Kansas is stored on-farm, while the rest is delivered to elevators. Meanwhile, much of this grain is often delivered to locations within a short distance from the farm. Harvest is a busy time for most producers and speed is of the utmost importance; thus, many producers may simply deliver their grain to a nearby elevator to same on travel time (Clark et al, 2003). As a whole, the need for Kansas wheat farmers to use off-farm storage and the need to harvest quickly means farmers are heavily reliant on nearby elevators. In Nebraska and Kansas wheat markets, Vachal and Tolliver (2001) find that over 50% of wheat received by elevators was delivered from a distance no greater than 15 miles while around 75% was delivered from within 30 miles.[19] This reliance on nearby elevators could create the conditions for elevators to exert market power. In fact, Davis and Hill (1974) find that local partial monopsonies may exist during harvest periods of corn. Thus, the pressure on farmers to harvest quickly and the necessity of using local elevators for storage highlights the importance of local grain markets.

[19] Clark et al (2003) find that in Washington 63% of wheat is delivered to elevators within 10 miles of the harvest site, and 85% is delivered to elevators within 20 miles.

In the past, authors have found a positive effect on basis—the difference between the local cash price and the next futures contract at the closest national market—from the introduction of ethanol plants (McNew and Griffith, 2005; Gallagher et al, 2005). Moreover, these effects reverberated for tens of miles around the ethanol plant, but they decreased as the distance to nearby ethanol plants increased (McNew and Griffith, 2005). Thus, impacts on local grain markets from policy changes—even national policy changes—may have spatially heterogeneous effects that depend on local conditions such as transportation distances.

Furthermore, any effects on local grain prices may depend on the density of local elevator competition. If economies of scale exist in the local markets served by agricultural cooperatives, as some studies have indicated (Schroeder, 1992), then local path dependencies may keep new firms from entering the local market. In fact, these economies of scale may encourage local cooperatives or local IOFs to merge and take advantage of these economies of scale. If only a few elevators are competing against each other, then any positive price effects from policy or technological may not pass through to the producer. Bekkerman and Taylor (pending publication) find that the use of a new technology to load grain on trains had a larger positive effect on grain prices in Kansas than in Montana, as Kansas has a much higher density of grain elevators than Montana. In the context of Section 199, any potential market distortions from changes in cooperatives' and/or producers' behaviors caused by Section 199 and the IRS letter rulings may be exacerbated by a lack of local competition.

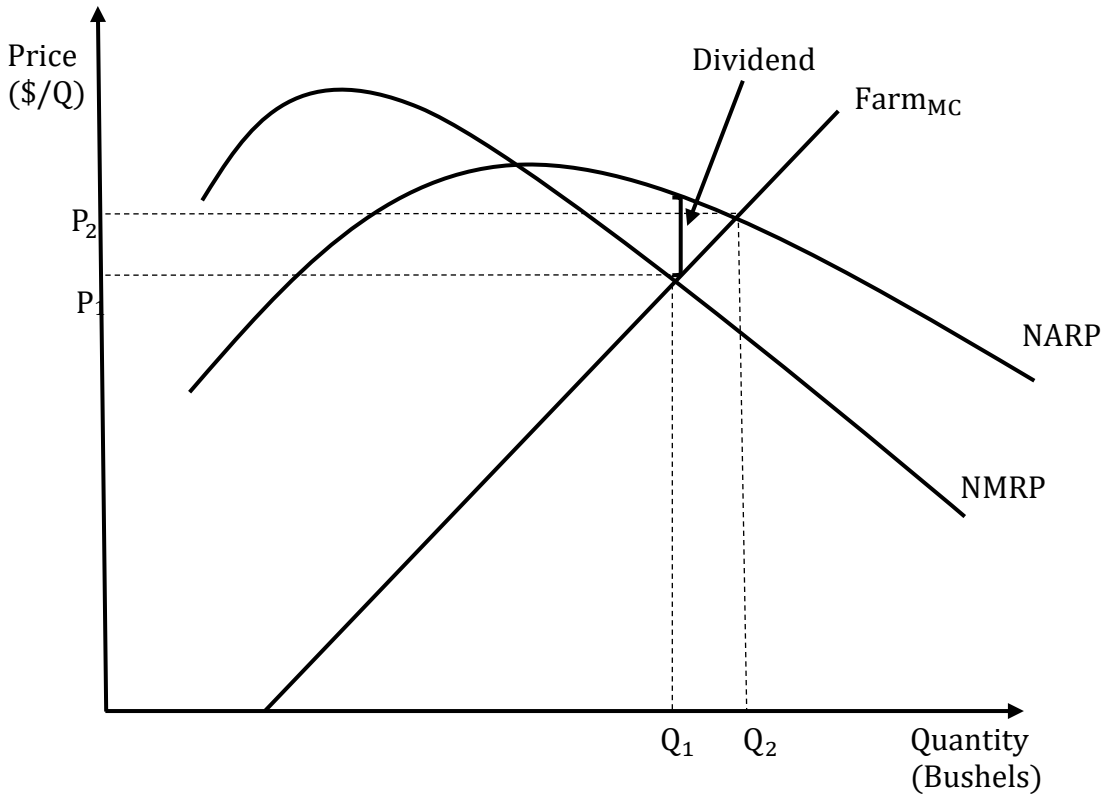
MODELLING OF MARKETING COOPERATIVES

From a legal perspective, cooperatives are an extension of the farm business that is controlled by managers and a board of directors. Cooperatives make decisions for the purpose of maximizing the welfare of their member owners.[20] Commodity marketing cooperatives benefit their members through purchasing the raw products of farm businesses—generating producer surplus—and through distributing accounting profits to members in the form of equity or cash dividends. The profit distributions are called patronage, and they are allocated according to farms as a percentage of the total business conducted by members at the cooperative. Taylor (1971) shows that a cooperative will maximize total net returns to members by maximizing the sum of cooperative profits and producer surplus.

Our analysis of cooperative and producer behavior builds off the general cooperative model developed by Hoos (1964) and extended by Taylor (1971) and LeVay (1983b). Figure 4.1 presents a graphical representation of the model. The supply curve facing the cooperative is the horizontal summation of the marginal cost curves of producers who deliver to the cooperative. A particular feature of these models is the use of net revenue curves; the two most prominent curves being the net average revenue product (NARP) and the net marginal revenue product (NMRP)—both of which we will now derive.

[20] Marketing cooperatives will be the focus of this model.

Figure 4.1: Graph of Cooperative Decision Making



Note: NARP is net average revenue product. NMRP is net marginal revenue product. $Farm_{MC}$ is horizontal summation of the marginal cost curves of commodity producers. Q_1, P_1 is where net returns to patrons are maximized while Q_2, P_2 is where raw product price is maximized.

We assume the cooperative has some price control in the final product market and has constant marginal costs of processing the raw product.[21] In addition, we assume a one-to-one ratio between raw product purchased and final process product sold. The revenue function and cost function of the cooperative are as follows

$$(4.1)\quad Total\ Revenue: F(Q)Q$$

[21] We work out the same model for a processor that is a price taker in the appendix.

$$(4.2)\ Total\ Costs: G(Q)$$

where *Q* is quantity of raw product purchased and *F(Q)* is the demand curve the cooperative faces in the final product market. *G(Q)* only includes the costs of processing the raw product and does not include the purchase price of the raw product. From the revenue and cost functions, we can derive the NARP and NMRP.

The NARP is the average revenue product from the final sale of the processed raw product minus average processing costs

$$(4.3)\ NARP: F(Q) - \frac{G(Q)}{Q}.$$

NMRP is the marginal revenue product from the processed product minus marginal costs

$$(4.4)\ NMRP: F'(Q) * Q + F(Q) - G'(Q)$$

where *F'(Q)*<0 and where *G'(Q)*>0. These curves allow us to analyze the net value the cooperative brings to the farm business through the provision of a simple means to calculate the dividend received by the farm business.

Cooperative Patronage Policy

Cooperative distribution of profits can take two forms: qualified and nonqualified. With qualified, the farm business is liable for the tax on the distribution, as the cooperative allocates the distribution from its profits. Qualified distributions take the form of equity or cash, but since the producer is liable for one hundred percent of the distribution regardless of form, by law, at least twenty percent must be in cash dividend.

With nonqualified, the cooperative is liable for the tax on the profits because nonqualified allocations only take the form of equity.[22] For our analysis, we will assume all patronage distributions are qualified. Eversull (2011) finds that only 4% of cooperatives used nonqualified distributions in 2008.[23] The percentage paid in cash could vary drastically from one cooperative to another (Boland, 2012). However, there is no reason to expect that this would create a different qualitative effect in the calculation of the comparative statics of Section 199. That is, the sign of an effect on prices from Section 199 should be the same regardless of the percentage of qualified distributions (hereby denoted as dividend so as not to confuse qualified patronage with either price or quantity in the mathematical derivations) paid in cash, even if the magnitudes might vary.

As Figure 4.1 demonstrates, the NARP and NMRP curves can be used to show the value of the member dividend. The dividend is simply the allocated value of the cooperative profits after all costs, including the cost of purchasing the raw product from producers. On a per unit calculation, the dividend is the NARP minus the purchase price of the raw product (P)

$$(4.5)\ Dividend: NARP - P$$

On Figure 4.1, the per unit dividend is the vertical distance between the NARP curve and

[22] Farm businesses and cooperatives operate under the assumption that nonqualified equity will at some point in the future be redeemed in cash. See Institutional Details section for a more detailed explanation.
[23]Kenkel and Boland (2012) state that nonqualified distributions were rarely used by cooperatives until the late 2000s. However, the use of nonqualified distributions has increased since that time, possibly because Section 199 mitigates the higher tax liability of nonqualified distributions it those same cooperatives do not elect to pass through their Section 199 deduction (ibid.). The keeping would be a source of heterogeneity in any empirical analysis of the price impacts of Section 199, but its full exploration is beyond the topic of this thesis.

the producer marginal cost curve, assuming the cooperative pays price equal to marginal cost.[24] Figure 4.1 shows that the dividend is a value paid to the producer over and above the producer's marginal costs. As LeVay (1983b) shows, and as will be derived below, a positive dividend payment presents a theoretical issue for a cooperative, as a payment above marginal costs will result in a quantity supplied greater than the cooperative intended.

The Behavior of Farm Businesses that Patronize Cooperatives

To maximize the sum of producer surplus and cooperative profits, the cooperative must set output equal to the point where NMRP equals producer's marginal cost (shown at point Q_1 on Figure 1). At Q_1, the marginal net returns to the farm business equals the dividend—on a per unit calculation. As long as the dividend is positive, the farm business earns economic profits, and it has an incentive to expand output past Q_1. As LeVay (1983b) notes, the producer will expand output until Q_2 where NARP equals producer marginal costs and the dividend equals zero.

LeVay's postulate of a dividend equal to zero has faced little rebuttal since its first publication. Only Royer and Smith (2007) present a model where a positive dividend could persist if cooperative managers price the raw product while accounting for the farm business' rational expectation of a dividend. However, neither model has been empirically tested nor do they model the tax (or changes to the tax rate) on dividends

[24] This is an assumption made by Helmberger and Hoos (1962) in the seminal neoclassical cooperative paper and has been accepted by cooperative economists since then. Any price above marginal cost would indicate economic profits while any price below marginal costs would not incite production.

faced by the farm business.

To expand LeVay's analysis, we include a tax on the dividend payment. Because the cooperative allocates the dividend from its profits, the dividend incurs an income tax paid by the farm business. However, even with a tax on dividends, the equilibrium quantity is still where NARP equals producer marginal cost for a cooperative that sets price equal to marginal costs.

A farm business that operatives in a competitive market will take both price and dividend per unit as given. The farm business receives both price and dividend according to quantity produced. For the simplification of analysis, we abstract away from multiple marginal tax rates and income taxes on any income besides the dividend payment. That is, the only tax incurred is on the dividend payment. Because of the tax, the dividend will result in both a positive and negative effect on profits. However, since recent income tax rates have been less than one hundred percent, the net value of the dividend will be positive. Therefore, the farm business' maximization problem is as follows

$$(4.6)\ \pi = [P + D(1-t)] * Q - C(Q)$$

where *t* is the tax, *C(Q)* is the cost function of the producer, *D* is the dividend payment, and *P* is the raw product price. A producer's necessary first-order condition then is

$$(4.7)\ \frac{d\pi}{dQ}: P + D * (1-t) - C'(Q) = 0$$

where *C'(Q)* is assumed to be positive. As earlier defined, the dividend will equal $NARP - P$. Thus, the maximization condition becomes

$$(4.8)\ \frac{d\pi}{dQ}: P + (NARP - P) * (1 - t) - C'(Q) = 0\ .$$

This can be rearranged and simplified to

$$(4.9)\ \frac{d\pi}{dQ}: NARP(1 - t) = C'(Q) - P * t\ .$$

However, because a cooperative pays a raw product price equal to marginal costs, the maximization condition becomes

$$(4.10)\ \frac{d\pi}{dQ}: NARP * (1 - t) = C'(Q) * (1 - t).$$

Even with the income tax on dividends, the long-run equilibrium of the dividend is still where NARP equals marginal cost (Q_2 on Figure 4.1). At this point, the value of the dividend equals zero. This, however, raises the question of why dividends seem to persist in modern agricultural cooperatives. In Nebraska alone, agricultural cooperatives distributed $97 million in patronage annually for business years 2012-13 to 2014-15 (Herian and Thompson, 2016). Agricultural cooperatives across the Midwest appear to still be paying dividends, despite the theoretical hypotheses to the contrary. Thus, either cooperatives are never in a state of long-run equilibrium, or cooperatives limit their throughput.

Cooperative Capacity Constraint

As previously discussed, the general consensus in the cooperative economics literature is that positive dividends should not persist; Royer and Smith (2007) provide a different conclusion. They show that a cooperative could limit output through using a

rational expectations framework to calculate an optimal price such that price plus expected dividend payment equals marginal costs. In this case, the cooperative would persistently pay a price below marginal cost. However, in the author's simulations, no price equilibrium was reached within 5 years, even with everything else held constant.[25] So, it is not immediately clear how feasible a rational expectations approach to dividend payments would be for cooperative managers. An alternative is the possibility of a binding capacity constraint for cooperatives at a point where NARP is persistently above marginal costs.

There are numerous reasons to believe that marketing cooperatives serving major U.S. grain production regions operate under a capacity constraint. First, if cooperatives are truly trying to maximize the sum of producer surplus and cooperative profits, then the optimal capacity to build would be where NMRP=C'(Q). Any additional capacity beyond Q_1 simply decreases net returns for producers. It would be non-optimal to build capacity beyond Q_1 unless producers consistently expected future yield gains.

Second, the substantial increase in corn and soybean yields places pressure on capacity-limited cooperatives to shift storage space away from wheat in favor of corn and soybeans (Kenkel, 2016).[26] The rise of genetically-modified technologies has contributed to yield gains in corn and soybeans above the long-term trend lines (Pardey and Wright, 2003). Furthermore, Bechdol, Gray, and Gloy (2010) find that the speed of harvest and planting has increased. This tighter harvest period requires grain marketing firms to

[25] Moreover, if marketing cooperatives are price takers in the final product market, no dividend would exist even with a rational expectations framework. This is shown in the appendix.
[26] Kenkel (2016) contains a fuller exposition of the points made in this paragraph.

handle more volume in less time. Any grain storage facility expecting long-term trends to hold would be experiencing demand for storage beyond their expectations. Thus, cooperatives may be facing pressure to expand their facilities beyond their previous long-term plans.

The yield trends with corn and soybeans create even more capacity pressure for cooperatives because these firms may face financial constraints, which may be less endured by their independently-owned competitors (Chaddad et al, 2005; Li et al, 2015). Because the cooperative is an extension of the farm business, cooperatives do not legally own their equity. The equity belongs to the member patrons who expect the equity to be redeemed in cash at some point in the future. Thus, for the cooperative, the equity has some of the same properties as a liability; its use as collateral for loans may be limited (Li et al, 2015). As such, cooperatives may struggle to find capital outside the firm for large investments such as new storage facilities.

In addition, because the equity in cooperatives belongs to the producers, any equity that is retained in the cooperative must prove to be a worthwhile investment for the producers. Yet, as the average age of producers moves towards and past 60 years of age, most patrons of the cooperative may not see benefits to a long-term investment such as a new storage facility. The investment of a new storage facility can only be justified if it pays itself off by the time these producers expect to have their equity retired. For a 60 year-old producer, this could be anywhere from 5-15 years. At an average rate of return of 4%, a cooperative could expect an investment to pay itself off in 25 years. Thus, a relatively low risk investment such as a new storage facility will most likely not pay itself

off in time before the average producer will retire their equity. Together, these arguments point to the fact that a marketing cooperative may face a binding capacity constraint for storing and processing grain. Therefore, dividends may indeed be persistently positive.[27]

Derivation of the Optimal Price and Dividend for a Farm Cooperative under a Capacity Constraint and a Tax on Qualified Patronage

Under a capacity constraint, existing models do not immediately provide insights about the optimal price and dividend offered by cooperatives. Cooperative managers could continue to pay a price equal to the farm business's marginal cost, or they could pay a price higher than marginal cost at the expense of the dividend payment. A primary concern cooperative managers must consider is the cash flow of producers (Boland and Kenkel, 2012). Farm businesses not only seek to maximize profits, but within every year, they must maintain enough cash flow to make regular payments on expenses. If a cooperative pays a price below marginal costs, farm businesses could struggle to meet cash flow needs. Because of the tax on qualified distributions, the dividend may result in a negative cash flow until full equity redemption (Junge and Ginder, 1986) Also, the cooperative itself has cash flow requirements and investment decisions to make. If it paid out its entire profits at once in cash, the cooperative may not be able to meet its own cash flow requirements and it may not have enough capital on hand to invest.

[27] This does not necessarily mean economic profits for cooperative patrons are persistently positive. The non-transferability of cooperative equity could mean that producers place a heavy discount on equity in the cooperative. Furthermore, Barzel (1974) presents a theory of rationing by waiting where queuing negates any consumer surplus for the marginal consumer when quantity demanded is limited by government edict. In the case of cooperatives that issue positive patronage payments because of capacity constraints, it is entirely possible that queuing (and other non-monetary competition) could negate any economic surpluses incurred by positive patronage payments.

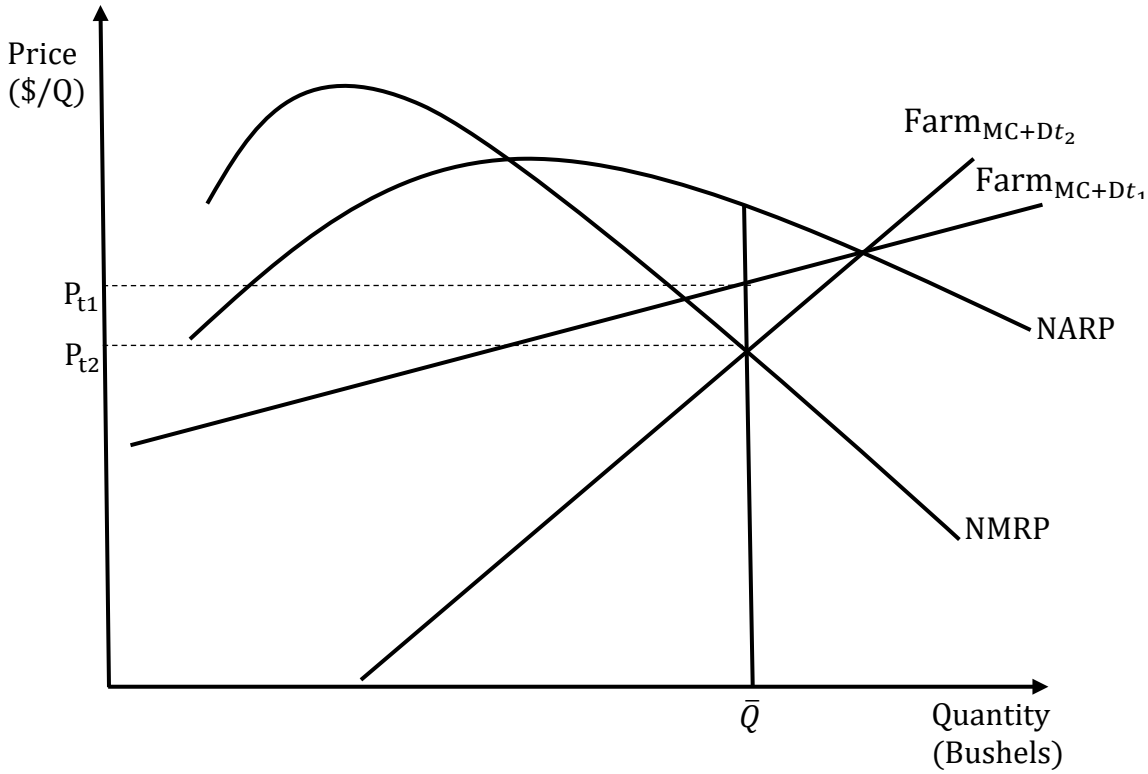
Furthermore, while cash dividends are allocated at the end of the calendar year, only 20% of the qualified patronage must be paid in cash of the year it is allocated. The other 80% simply has to be redeemed at some future date, even decades from the time of allocation. In the meantime, the producers must pay the tax on the full value of the qualified patronage even if only 20% is allocated in cash. This is because the dividends are accounting profits from the cooperative, and are, thus, taxable income. Even if the farm business makes no taxable profits, it must still pay the tax on its allocated profits from the cooperative. Nevertheless, while producers may earn no economic profits on average, they must still be earning some accounting profits; otherwise, they would fail to be making an average rate of return. The presence of accounting profits at the farm business level could cause the presence of the marginal tax bracket to be greater than 20%, leaving producers with a negative cash outflow in the short term.

As a result of the possible negative cash outflow caused by the qualified dividend distribution, a producer would need to be paid a higher price from the cooperative.[28] Figure 4.2 represents the higher price paid by the supply curve $Farm_{MC+Dt_1}$. Figure 4.2 also shows the capacity constraint as $\bar{Q}$. P_{t_1} is the equilibrium price.

Because the dividend creates a tax liability, it also creates a cash out-flow. Because cooperatives distribute dividends according to quantity sold to the cooperative, the cash out-flow is also according to quantity sold to the cooperative. If we assume that cooperatives only pay 20% in cash—creating a negative cash out-flow—then for the next

[28] A negative cash flow is not necessary for the signs of any of the comparative statics. However, it may affect the size of any equilibrium changes.

Figure 4.2: Cooperative Model with Capacity Constraint



Note: NARP is net average revenue product. NMRP is net marginal revenue product. $\text{Farm}_{\text{MC+Dt1}}$ is the marginal cost curve of commodity producers with a tax on qualified patronage before Section 199/IRS letter rulings. $\text{Farm}_{\text{MC+Dt2}}$ is the marginal cost curve of commodity producers with a tax on qualified patronage after Section 199/IRS letter rulings. Q_1, P_1 is where net returns to patrons are maximized while Q_2, P_2 is where raw product price is maximized.

production year the farm business will need a higher price than the previous year to cover its marginal costs and the value of the tax liability. For the sake of simplifying the mathematics, we state that the price for the current year would need to at least cover the producer's marginal costs and the cost of paying last year's tax liability in the current period. Thus, the inverse supply equation becomes

$$(4.11)\quad P_{i+1} = D_i * t_1 + C'(\bar{Q})$$

where i is the beginning year and t_1 is a constant marginal income tax rate with a value between zero and one. Likewise, the dividend for a particular year is

$$(4.12)\ D_i = NARP - P_i\ .$$

Since t_1 is a positive value less than one, equation (11) becomes a geometric series as i increases (see Appendix B for full derivation). Because equation (4.11) is a geometric series, a steady-state equilibrium exists for both optimal price and dividend. For price, the steady state equilibrium is

$$(4.13)\ P_{t_1} = \frac{NARP * t_1 + C'(\bar{Q})}{1 + t_1}$$

as shown on Figure 4.2. The long-run dividend will then be

$$(4.14)\ D_{t_1} = \frac{NARP - C'(\bar{Q})}{1 + t_1}.$$

Comparative Statics for a Change of the Tax Rate on Dividends

With the development of the long-run equilibria for price and dividend, we can now generate the comparative statics for changes in optimal dividend and price because of the Section 199 pass-through and the pass-through's increase in value because of the IRS letter rulings. First, it is important to note that the quantity is being held fixed at $\bar{Q}$. As shown earlier, even with the tax, the producers have an incentive to supply more grain until the dividend equals 0. The producers' incentive to supply beyond $\bar{Q}$ means the cooperative capacity constraint will always be binding with a positive dividend. This

allows us to generate the comparative statics by simply differentiating Q_{t_1} and P_{t_1} with respect to the tax.

Differentiating P_{t_1} by t_1 yields

$$(4.15)\quad \frac{\partial P_{t_1}}{\partial t_1}: \frac{NARP - C'(\bar{Q})}{(1+t_1)^2}.$$

Differentiating D_{t_1} by t_1 yields

$$(4.16)\quad \frac{\partial D_{t_1}}{\partial t_1}: -\frac{NARP - C'(\bar{Q})}{(1+t_1)^2}.$$

As can be easily seen

$$(4.17)\quad \left|\frac{\partial P_{t_1}}{\partial t_1}\right| = \left|\frac{\partial D_{t_1}}{\partial t_1}\right|.$$

Figure 4.2 represents the comparative statics with the curve $Farm_{MC+D_{t_2}}$. The supply curve rotates through the point where NARP equals marginal cost because at that point the dividend equals zero. As can be seen from the differentials, when NARP equals marginal costs, the change in price is zero. If the capacity constraint holds, the Section 199 pass-through leads to a decrease in the price offered by the cooperative, P_{t_2}, as the farm business now incurs a smaller tax liability from the dividend.[29] However, since the dividend equals NARP minus the spot price, the dividend increases by the same size of the price decrease. All the lost producer surplus becomes patronage able to be distributed

[29] Comparative statics are the same when Section 199 increased in value because of IRS letter rulings and increase in percentage eligible for deduction.

by the cooperative. Nevertheless, cooperatives passing-through Section 199 should lead to lower spot prices offered by the cooperative.

Section 199 under Competition

The presence of a positive dividend for farm businesses represents economic profits at the farm business level, transferred to them from the cooperative. These economic profits should induce rival marketing firms to enter the market to capture some of the profits earned by farm businesses. To analyze the effects of competitive entry on cooperative behavior, we will further develop the cooperative supply function, which will be supplemented with the graphical representation in Figure 4.3.

The individual demand curve for a farm business will depend on the business' marginal costs and any cash outflow from the tax on qualified patronage, as demonstrated above. The supply function faced by an individual cooperative will also incorporate the number of producers supplying the cooperative. The supply facing the cooperative will then be

$$(4.18)\ \bar{Q} = nq_f$$

where $\bar{Q}$ is the capacity constrained quantity the cooperative can handle, *n* is the number of farm businesses supplying the cooperative, and q_f is the quantity supplied by an individual farm business.

An IOF that competes with a cooperative will have to offer a price equal to the total net present value received by a cooperative patron, which is composed of the price and patronage. The price received must cover marginal costs and the expected present

value of the equity which will be redeemed at a future date. At the individual farm business level, the inverse supply function faced by a private firm competing for raw products with a cooperative is

$$(4.19)\ P_p = C'(\bar{Q}) + \frac{D*(1-t)}{(1+r)^w}$$

where P_p is the price offered by a private firm, *r* is the average return to farm businesses, and *w* is the expected number of years until equity redemption.

A change in the tax rate yields

$$(4.20)\ \frac{\partial P_p}{\partial t} = \frac{-D}{(1+r)^w}$$

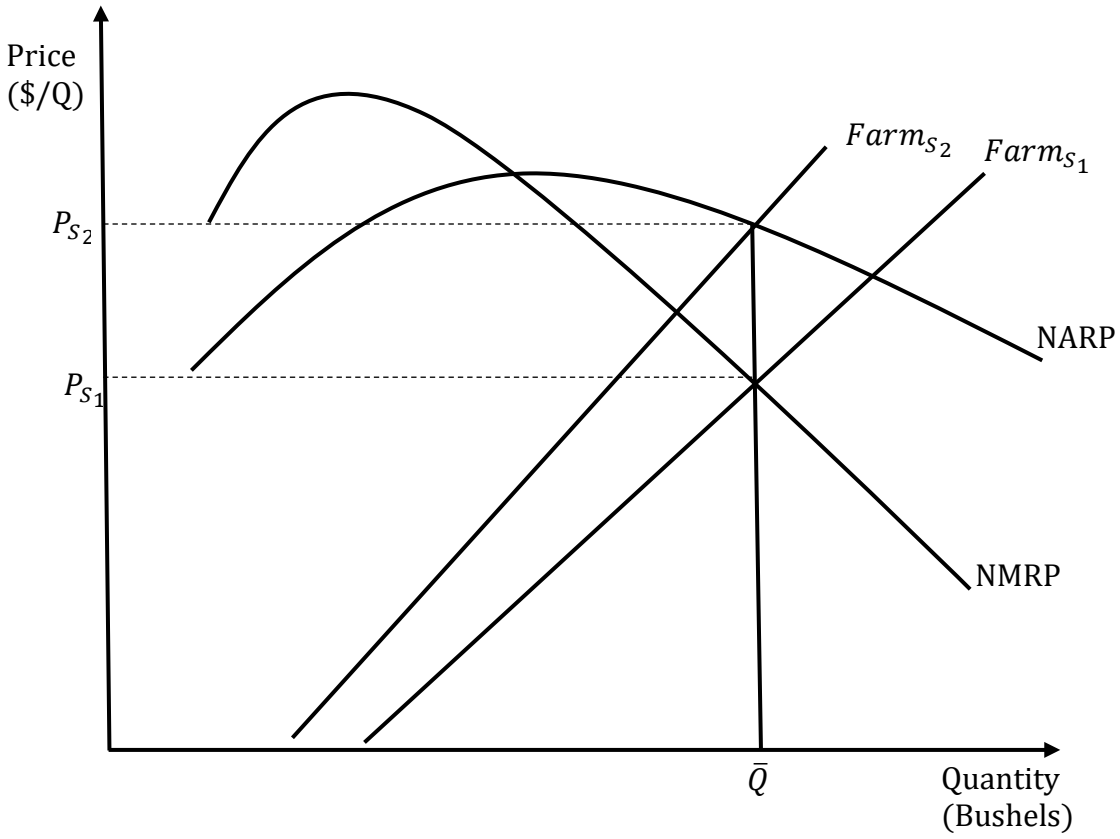
Thus, an increase in the tax on the dividend payments would lower the price offered by IOFs competing against cooperatives.

If cooperatives were indeed passing through their Section 199 deduction to their patrons, then the pass through would result in a de facto lower tax rate on the dividend payments issued by cooperatives. Thus, any IOF, competing against a cooperative that passes through its Section 199 deduction to its patrons, will have to increase its price to attract the same amount of quantity as before the introduction of Section 199.

As depicted in Figure 4.3, the entrance of a private firm will reduce the number of farm businesses delivering to the cooperative, shifting the supply function facing the cooperative from $Farm_{S_1}$ to $Farm_{S_2}$. Because of the reduction of the number of firms delivering to the cooperative, the cooperative will receive a smaller quantity supplied for

any given price it offers. The quantity reduction will result in one of two scenarios, depending on how large the reduction in supply is.

Figure 4.3: Capacity Constraint and Spatial Competition



Note: NARP is net average revenue product. NMRP is net marginal revenue product. $Farm_{s1}$ is the supply curve facing the cooperative before the entrance of competition. $Farm_{s2}$ is the supply curve facing the cooperative after the entrance of competition. Ps_1 is the cash price before the entrance of competition. Ps_2 is the cash price after competition.

First, a reduction in *n* may be sufficient to cause the capacity constraint to no longer be binding. In this case, the supply curve of the facing the cooperative will intersect *NARP* at a point less than $\bar{Q}$. Because the capacity constraint is no longer binding, any positive dividend payment will induce farm businesses to increase their

quantity supplied. This increase in quantity supplied will continue until dividend payments equal zero (P_{s_2}).[30]

In the second scenario, the capacity constraint will still be binding at $\bar{Q}$ with a supply curve in between $Farm_{S_1}$and $Farm_{S_2}$. With $\bar{Q}$ fixed and *n* reduced, each individual firm must increase its quantity supplied, q_f. However, because C'(Q) is increasing in Q, marginal costs for each firm will also increase. From the steady-state price equation (4.13), an increase in marginal cost will increase the steady-state price. Likewise, from the steady-state dividend equation (4.14), an increase in marginal costs will decrease the size of the dividend.

In both scenarios, the entrance of a new firm will decrease the size of the dividend payment, perhaps even to zero. With a decrease in the size of the dividend payment, we would expect a change in the tax on dividends to have a smaller effect in magnitude, as is evident from equation (4.16).

However, the magnitude of the decrease in dividend is likely to depend on factors relating to transaction costs. One major factor will be the distance to the IOF. An increase in the distance between a cooperative and a private firm increases the costs of transporting the grain for a farm business choosing to supply to the private firm as opposed to a cooperative. The increase in transportation costs will then lead to a smaller number of producers choosing to deliver to the IOF firm. With a smaller number of farm

[30] It is unclear whether how stable a dividend of zero would be as a new equilibrium. If patrons still expect a dividend, the lack of dividend could cause member discontent. Disgruntled members may then choose to no longer patronize the cooperative, even possibly seek the dissolution of the cooperative.

businesses switching to the private firm, we would expect the price increase to be less all else equal (these points would be true regardless of firm type). With a smaller price, the dividend will be larger in magnitude, and thereby, a change in the tax on dividends should have a larger effect on price, as equation (4.15) shows.

In summation, if cooperatives are indeed capacity constrained—and/or using a rational expectations framework to control quantity—then cooperatives may be persistently issuing positive patronage to their member-owners. This does not necessarily mean that cooperative patrons are earning economic profits as non-monetary competition, such as queuing at grain elevators during harvest, may offset any economic profits earned from patronage payments.[31] Nevertheless, the passing-through of Section 199—and the IRS letter rulings increasing the value of Section 199 for cooperatives—should cause a decrease in the price offered by cooperatives. Likewise any IOF competing against a cooperative will have to increase its price. However, the expected price decrease should be less for cooperatives that have other firms competing against them. Thus, the price effects of Section 199 may be heterogeneous based on spatial competition factors.

[31] See Barzel (1974) for a full treatment of how queuing could dissipate economic rents.

DATA DESCRIPTION AND EMPIRICAL MODEL

The incorporation of Section 199 into the cooperative management model leads to several testable predictions. One expected outcome is that Section 199 incentivizes commodity producers to increase their quantity supplied to cooperatives because of the decrease in marginal costs incurred by qualified patronage. The cooperative management model predicts that the IRS letter ruling related to Section 199 will decrease prices at agricultural marketing cooperatives relative to independently-owned firms (IOFs), but the presence of competitors could mitigate these negative effects.

The most direct means of measuring the impact of the IRS letter ruling on Section 199 are cooperative patronage payments. If the IRS letter ruling induces cooperatives to pass through their Section 199 deduction to producers, then this pass-through may appear on their financial statements, enabling a direct calculation of the value of Section 199. Furthermore, the IRS letter ruling gives an advantage to qualified patronage distributions over non-qualified (Royer, 2017). Thus, cooperatives may increase their use of qualified distributions as a percentage of total patronage, ceteris paribus. However, data on cooperative patronage payments are proprietary information. Since almost no cooperatives are publicly traded, patronage data are rarely available to the public.

An alternative approach of measuring impacts of the Section 199 ruling is by assessing differences in pricing strategies among cooperatives and IOFs. If the IRS letter ruling reduces the tax liability of producers delivering to cooperatives, then we would expect the decrease in tax liability to have a similar effect as a decrease in marginal costs:

a reduction in price. Furthermore, if the letter ruling incentivizes producers to switch some of their sales from IOFs to cooperatives, it will incentivize IOFs to increase their prices to compete with cooperatives. Both of the above cases would be expected to widen the basis between cooperatives and IOFs.

This alternative approach to measuring Section 199 impacts is particularly useful because local cash price data for individual elevator locations—which would be required to measure differences in cooperative and IOF basis—are readily available. For example, Kansas State University's AgManager database provides weekly basis data for elevator locations throughout the Midwest including North Dakota, South Dakota, Nebraska, Kansas, Colorado, Wyoming, Missouri, Oklahoma, and Texas. In addition, it has data for 1997-2018, which provides the ability to sufficiently account for any ongoing differences in pricing behavior before and after Section 199. The database also provides elevator information on location names and the nearest city.

Basis Data

This study focuses on winter wheat markets for several reasons. First, while U.S. winter wheat acres planted have decreased in the last decade, it is still a widely grown crop throughout the entire Midwest and Great Plains regions. Second, wheat is only indirectly effected by the Renewable Fuels Standard (RFS), reducing possibly conflation effects of policies passed during similar time periods. The RFS is a policy change that significantly affects the basis for corn (McKnew and Griffith, 2009; Carter, Rausser, and Smith, 2017). Furthermore, the RFS may affect soybean prices as well, as it also incentives soy biofuels (Smith, 2018). While the policy may have affected winter wheat

prices (ibid), there is no reason to expect that these indirect effects would be different between cooperatives and IOFs, preserving any previous differences in trends. In light of these arguments, winter wheat has distinct advantages over corn and soybeans markets for policy analysis other than RFS.

Using the original data collected from AgManager, I first create a pooled cross-section of weekly elevator-level basis values by using the first and last year firms appear in the dataset to filter them.[32] I exclude firms if they first appear in the dataset after the end of the year 2000 and, also, if firms no longer appear in the dataset after the year 2009. For a firm to remain in the dataset, it must have basis data point during or before the year 2000 and during or later than the year 2010.[33] This filtering facilitates the creation of more accurate pre- and post-policy trends without the use of firm-specific fixed effects by excluding firms that do not appear throughout all portions of the policy periods. I later use robustness checks to determine to what extent various data management decisions potentially affect the insights.

Table 5.1 presents the summary statistics for the original and filtered. The filtered dataset includes 124 firms of which 98 are cooperatives.[34] The data show that, on average, cooperatives have a weaker overall basis than independently-owned firms by over 10 cents. The standard error is almost the same for both groups, and it is below both

[32] Some firms do not have data for every week observed, and some do not have data points for all years outside of the year boundaries discussed above.
[33] A firm that only appears in the dataset for a week or a year may have unique characteristics that can only be accounted for through firm-specific fixed effects. However, since cooperatives rarely switch to IOFs and vice versa, the cooperative designation is will not change throughout the time frame of the dataset. Thus, any firm-specific fixed effect will negate the calculation of the cooperative coefficient.
[34] The ratio of cooperatives to IOFs is similar to the findings of other papers (Bekkerman and Taylor, pending publication).

means. The range, however, is rather wide as it is almost $3 for both groups. The wide range reflects the time period of the main dataset. The data include points from 2000 to 2017. This year range includes the wide commodity price swings caused by production conditions documented futures market conversion issues, and possible indirect effects of biofuel policies. Table 5.1 shows that the unfiltered dataset has similar summary characteristics, providing evidence that the filtering does not cause any immediately obvious concerns.

To designate whether a firm is a cooperative or an IOF, we first use an algorithm that designates cooperatives as any firm that had the words “coop,” “co-op,” or “cooperative” in the firm’s name. This approach correctly identifies most firms, but additional steps were taken to ensure that the data are classified. Some cooperatives such as Central Valley Ag or AGP, Inc. classify themselves as cooperatives, but do not have any form of the word “coop” in their name. For example, Agmark LLC, is classified as a private LLC; however, it is owned by a group of cooperatives. Per a phone interview, producers who do business with Agmark who are also members of the owning cooperative may receive patronage form their business dealings with Agmark through profits redistributed to the cooperative form the LLC. To account for any instances in which an automated classification approach may not have been fully successful, classification errors after the initial identification algorithm, we searched for firm websites and/or made phone calls to manually check firms’ status. If there is any possibility at all that a producer might expect a patronage payment from business dealings with a firm, we designate the firm as a cooperative.

As the summary statistics in Table 5.1 indicate, the dataset has far more cooperatives than IOFs. The final dataset is characterized by more cooperatives than private firms. This disparity is reflective of the competitive landscape in the Midwest, as most firms were started in the early 1900s when producers were attempting to counteract the market power of up-stream buyers.

While the AgManager database has data for several states across the Midwest, we use only data from firms in Nebraska and Kansas. The data for firms in other Great Plains states such as South Dakota and Texas are very sparse once the year restrictions are employed, as can be seen in Table 5.2. With the imposed year restrictions, no data for firms in Missouri, North Dakota, South Dakota, and Wyoming are available. States like Texas and Oklahoma only have 1 or 2 firms. Such a small number of firms is clearly not going to be reflective of those states as a whole, so all firms outside of Nebraska and Kansas are only used for calculating the number of competing firms within a specific distance for the NE and KS locations (e.g., NE firms that may have competitions across the state border).

Figure 5.1 presents the average basis by firm type for each year for the filtered dataset. The data show that before the passing of Section 199 in 2004, cooperatives consistently offer a slightly larger basis. After the passing of Section 199 and before the IRS letter ruling in 2008, the difference in basis by firm type appears to hold relatively steady with no large deviation from the difference in the pre-policy period. However, the post-2008 difference in basis does appear to increase, with cooperatives offering even less after the IRS letter ruling is implemented. Figure 5.2 presents the average basis by

firm type and year for the unfiltered dataset. The figure appears to also show a widening of basis between cooperatives and IOFs.

Furthermore, Figures 5.3 and 5.4 show the average basis by year for each firm type. Both figures appear to support the supposition that the IRS letter ruling on Section 199 may have affected the difference in basis between cooperatives and non-cooperatives.

Table 5.1: Summary Statistics by Firm Type

	Filtered by Year		Unfiltered by Year	
Statistic	Firm Type		Firm Type	
	Cooperative	IOF	Cooperative	IOF
Number of Firms	98	26	604	150
Number of Observations	70, 992	14,232	157,380	30,664
Average Basis	-0.510	-0.391	-0.610	-0.471
SE Basis	0.334	0.337	0.361	0.378
Maximum Basis	0.635	1.198	0.690	1.198
Minimum Basis	-2.171	-1.845	-2.425	-1.958

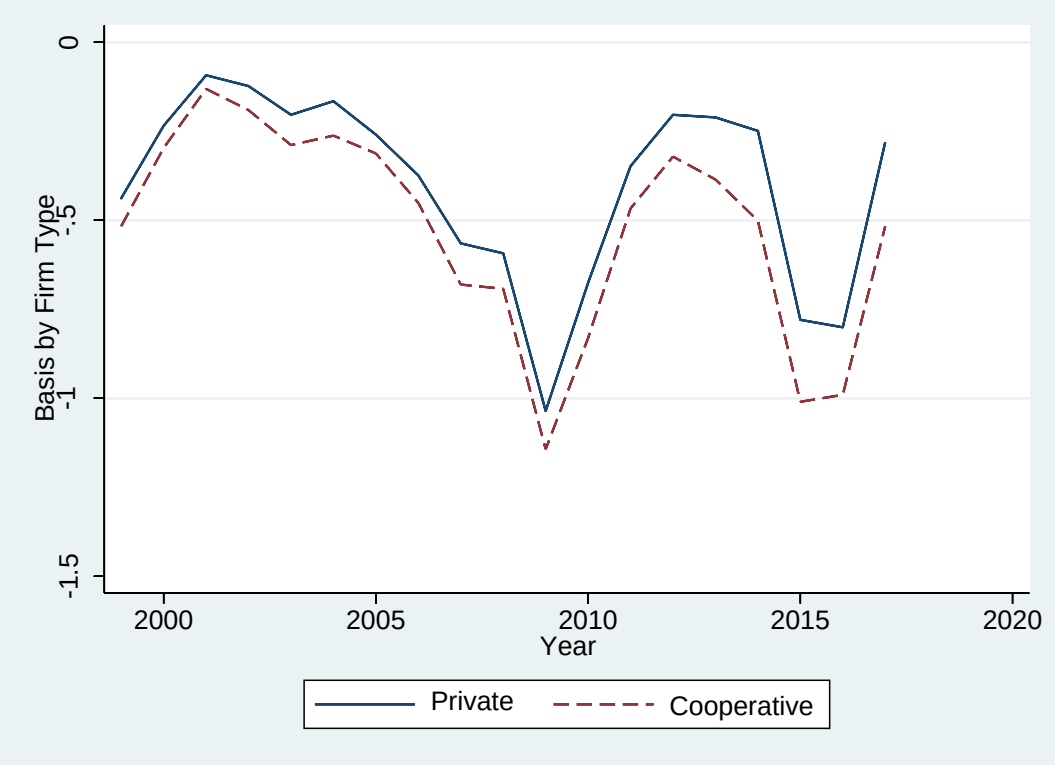
Note: Filtered by year dataset excludes all firms without data points before the year 2000 or without data points after the year 2010. Unfiltered dataset contains no year restrictions. IOF stands for independently-owned firm. Both datasets only include firms in Nebraska and Kansas.

Table 5.2: Number of Each Firm Type by State

	Filtered by Year		Unfiltered by Year	
State	Firm Type		Firm Type	
	Cooperative	IOF	Cooperative	IOF
CO	4	3	26	26
KS	49	18	409	105
MO	0	0	10	23
ND	0	0	65	40
NE	49	8	195	45
NM	1	1	2	1
OK	1	1	83	53
SD	0	0	98	38
TX	1	0	76	29
WY	0	0	1	0
Total	105	31	965	360

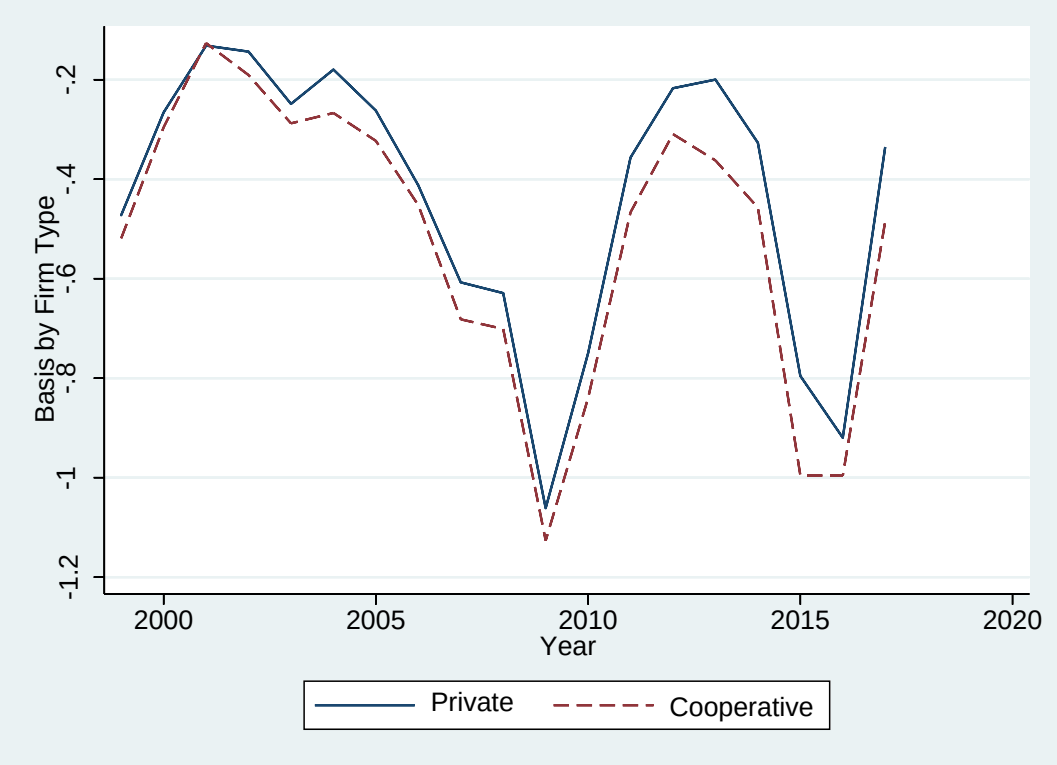
Note: Filtered by year dataset excludes all firms without data points before the year 2000 or without data points after the year 2010. Unfiltered dataset contains no year restrictions. IOF stands for independently-owned firm.

Figure 5.1: Basis by Firm Type with Filtered Dataset



Note: Private is used equivalently to IOF. Filtered dataset excludes all firms without data points before the year 2000 or without data points after the year 2010. Only firms in Nebraska and Kansas are included.

Figure 5.2: Basis by Firm Type Non-Filtered Dataset

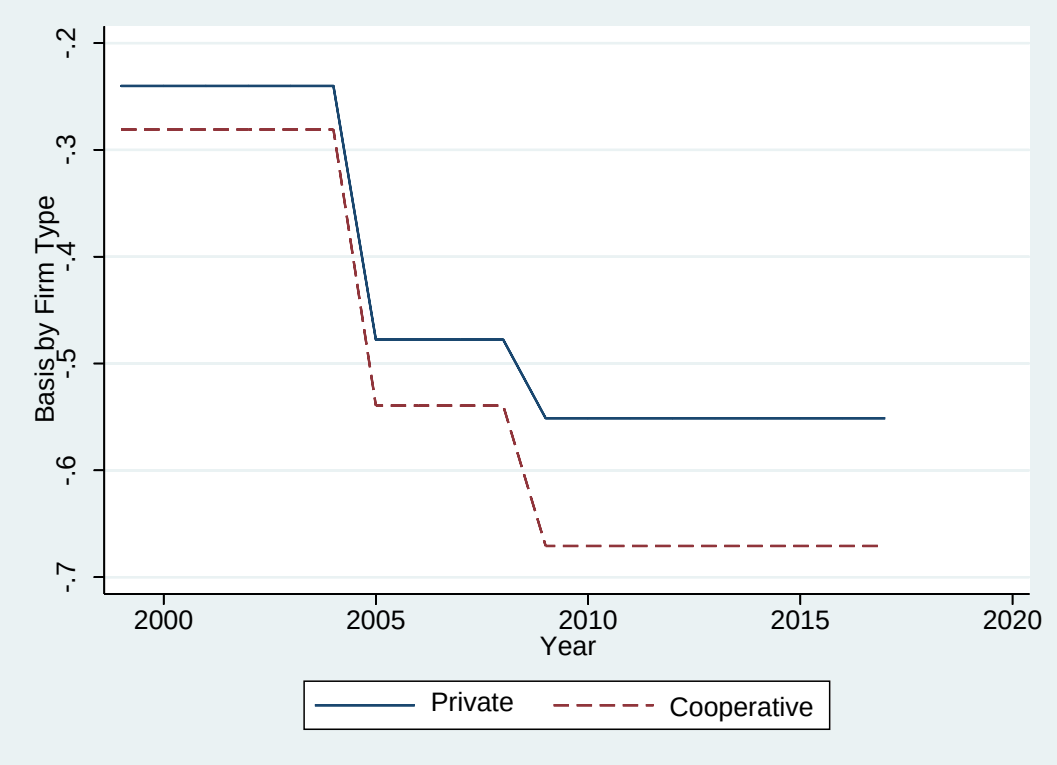


Note: Private is used equivalently to IOF. Only firms in Nebraska and Kansas are included.

Figure 5.3: Basis by Firm Type and by Policy Period with Filtered Dataset

Note: Private is used equivalently to IOF. Filtered dataset excludes all firms without data points before the year 2000 or without data points after the year 2010. Only firms in Nebraska and Kansas are included. Section 199 was passed in 2004, and the IRS letter ruling was issued in 2008.

Figure 5.4: Basis by Firm Type and by Policy Period with Non-Filtered Dataset



Note: Private is used equivalently to IOF. Only firms in Nebraska and Kansas are included. Section 199 was passed in 2004, and the IRS letter ruling was issued in 2008.

Firm Location Data

The original data only provide the name, city, and state of firms. To determine the specific location of firms, we find the latitude and longitude of the city centroid of the city name where an elevator is located.[35] While the city centroid may not be the most precise approach, it should still be fairly accurate as most elevators are located within city

[35] We first attempted to use Google Earth, the elevator names, and the provided city to find the exact location of each elevator. Many remote elevators, however, do not have a location pinpointed on Google Earth, so any algorithmic approach would substantially misidentify the location of some firms. Furthermore, some firm locations are acquired by rival companies, or they are currently out of use, meaning their address is no longer provided on the company's website. While some firms can be located through a visual inspection of Google Earth, this approach is rife with the potential for error.

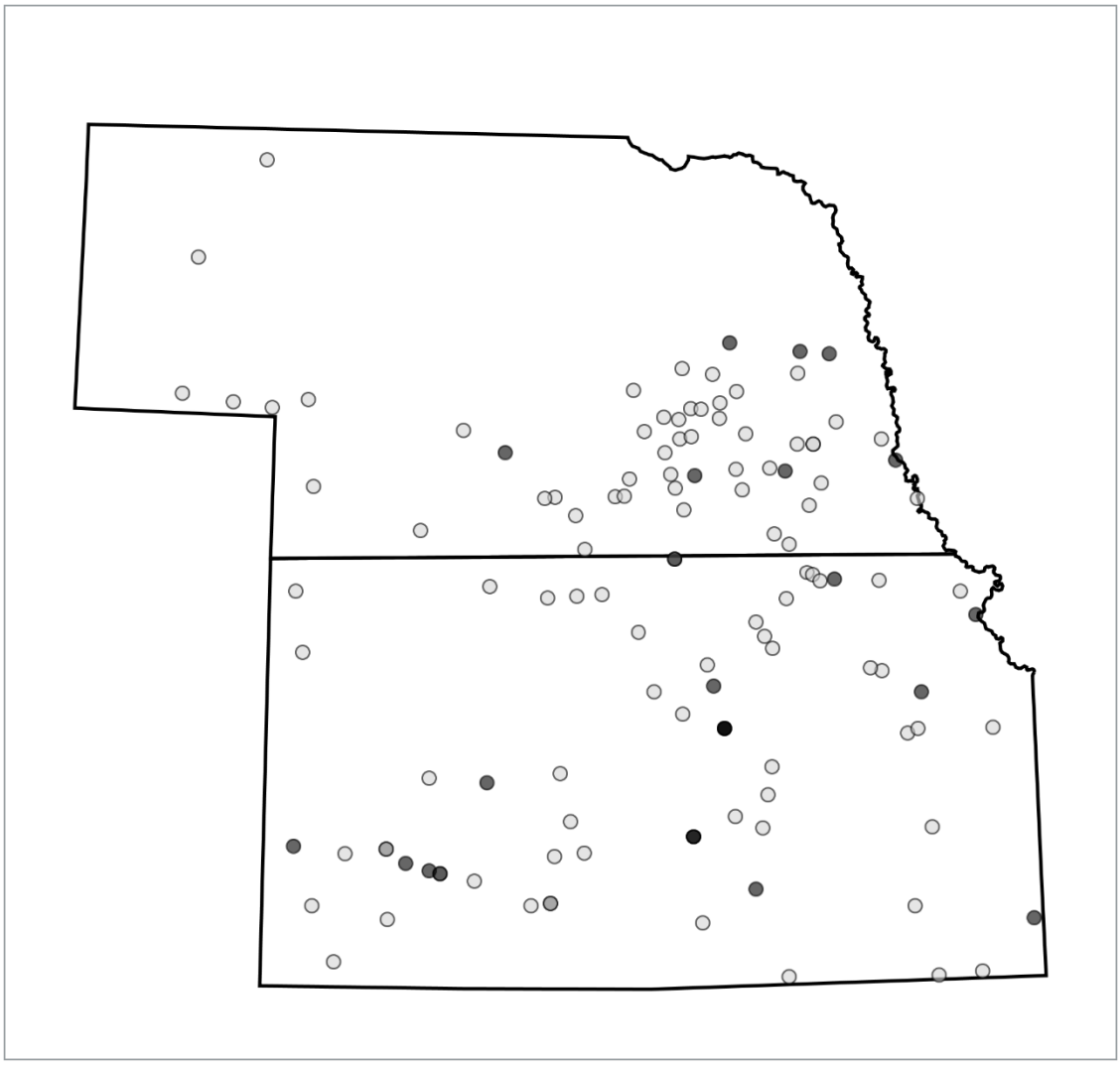
limits on railroad lines.[36] Using the provided elevator city location, we located the city center and then collected its latitude and longitude. Figure 5.5 shows a map of the firms within the filtered dataset.

Figure 5.6 displays the locations of the firms in the unfiltered dataset. In Kansas, firms are spread throughout the entire state while in Nebraska firms are clustered towards the southeastern third of the state. The clustering in Nebraska is representative of the wheat growing regions in that state, as fewer farms in the northwestern region grow grains because of the local climate and soils. Nevertheless, the map reveals that cooperatives tend to be more isolated than IOFs, especially in Nebraska where IOF presence is lower than Kansas. Thus, any empirical model will need to account for spatial competition.

After assigning latitude and longitude coordinates for each firm, we calculate how many other firms are within a certain radius of a firm's city centroid. A competing firm is classified as a distinct elevator location within our full, original data (prior to filtering). The competing location may be owned by the same company or the same parent company (primarily because we do not have info to accurately identify ownership). Furthermore, we use firm locations in the states surrounding Nebraska and Kansas—when available—as some firms are clearly on the border of either state. This approach ensures that we are using all possible firms as competitors. The possibility exists that a firm may be operating throughout the entire time frame of our dataset, but it only appears

[36] See map of firm locations in Bekkerman and Taylor (pending publication).

Figure 5.5: Firm Locations of Filtered Dataset



Note: Light-colored dots are cooperatives while black-colored dots are IOFs. Gray-colored dots indicate locations with both IOFs and cooperatives.

in our dataset for one month. We, therefore, include firms that do not meet our year restrictions as competitors within our dataset. We use radii of 10, 20, and 30 miles (Clark et al, 2003; Vachal and Tolliver, 2001).

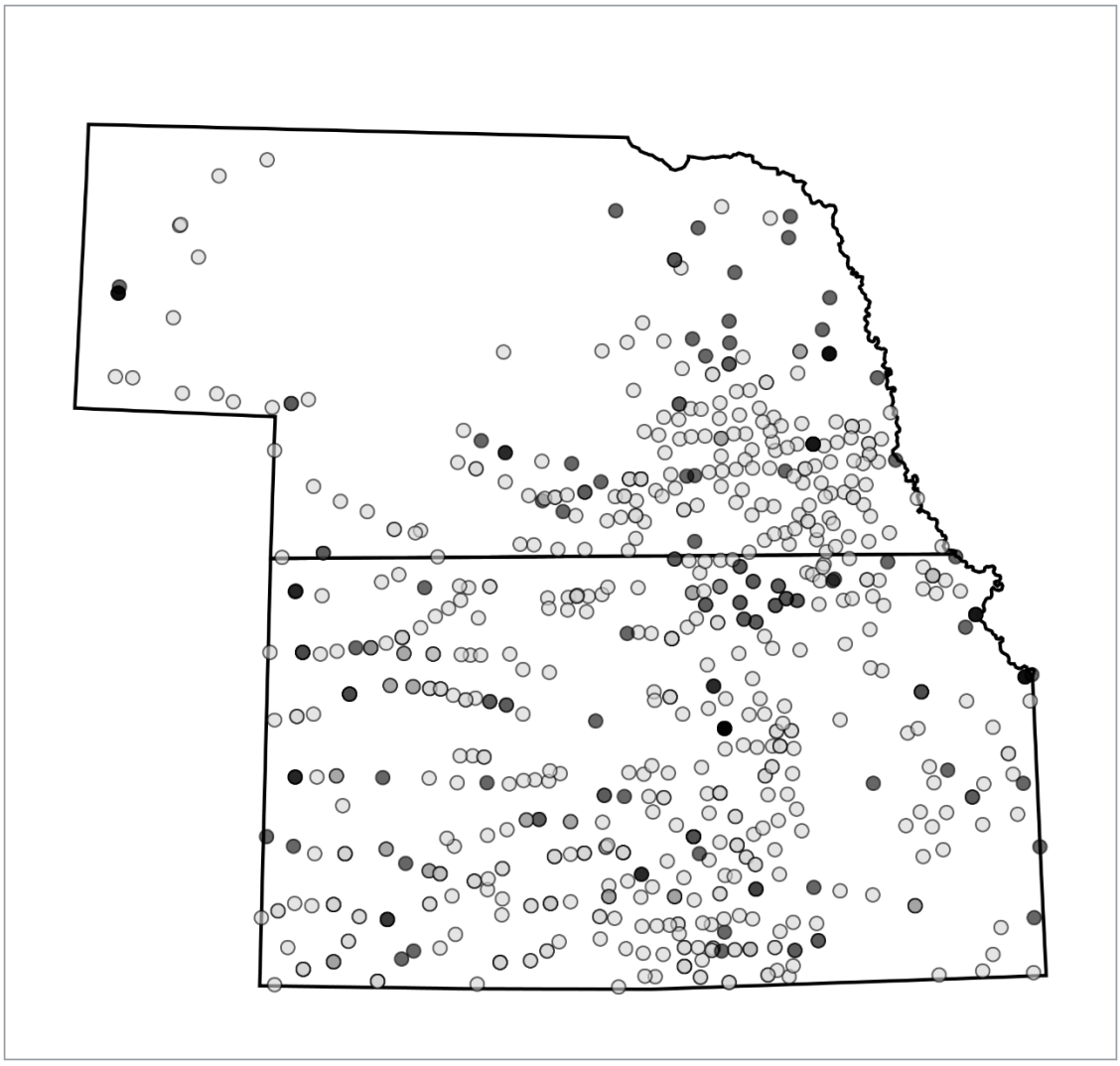
Table 5.3 shows that the vast majority of all the firms have competitors within 10 miles of their city centroid—for both datasets. In fact, with the unfiltered dataset, there

are only 4 firms that do not have a competitor within 20 miles of their city center. This high spatial elevator density is another reason for excluding firms not located in Kansas and Nebraska. Firms in our dataset from other Great Plains states by nature do not have as many firms within 10 to 20 miles as firms in Nebraska and Kansas.[37] In the agricultural regions of states such as Colorado, Texas, Oklahoma, and South Dakota producers regularly driver farther to deliver their grain than producers in Nebraska or Kansas (Vachal and Tolliver, 2001).

Table 5.3 shows that cooperatives have slightly fewer firms on average within 10 miles of their city centroid than independently-owned firms. This slight disparity, however, tilts towards cooperatives as the radius of competition expands to 20 miles. If the radius of competition is 20 miles, both types of firms have almost 10 firms on average within that distance from their city centroid. This amounts to an almost four fold increase in the average number of competing locations as the radius of competition doubles from 10 to 20 miles. This increase in the number of firms then doubles from roughly 10 to around 20 competing firms as the competition radius changes from 20 to 30 miles. These statistics further demonstrate the intense elevator competition in Nebraska and Kansas. Most producers should have multiple options to deliver their grain within an approximately 30 minute commute of their fields.

[37] This is mainly because of the lower density of the towns in the other states. See image at the end of this section for reference.

Figure 5.6: Firm Locations for Non-Filtered Dataset



Note: Light-colored dots are cooperatives while black-colored dots are IOFs. Gray-colored dots indicate locations with both IOFs and cooperatives.

Table 5.3: Competition Statistics by Firm Type

	Filtered by Year		Unfiltered by Year	
Statistic	Firm Type		Firm Type	
	Cooperative	IOF	Cooperative	IOF
Number of Firms:	98	26	604	150
With Competitors within 10 Miles	84	22	517	126
With Competitors within 20 Miles	94	26	595	145
Average Number of Competitors:	Cooperative	IOF	Cooperative	IOF
Within 10 Miles	2.57	2.92	3.02	3.28
Within 20 Miles	9.98	8.96	10.82	8.80
Within 30 Miles	21.12	18.81	22.94	18.77

Note: Filtered by year dataset excludes all firms without data points before the year 2000 or without data points after the year 2010. Unfiltered dataset contains no year restrictions. IOF stands for independently-owned firm. Both datasets only include firms in Nebraska and Kansas.

Empirical Model

The IRS letter rulings represent an exogenous policy change within the U.S. grain merchandising landscape—a decision made separate from actions of producers, cooperatives, and private grain merchandisers. This is especially the case because firm-type decisions—such as deciding to be a cooperative or IOF—were made long before the policy came into effect. Thus, self-selection and reverse causality will likely not be significant issues in the empirical analysis. Additionally, this type of policy change lends itself to the use of a well-known difference-in-difference class of models. A difference-in-difference model will facilitate the testing of differences in trends in basis between cooperatives and IOFs. The results of the difference-in-difference model can then be used to test the comparative statics of the cooperative behavioral model developed in Section 3.

The major assumption of a difference-in-difference model is parallel trends between the treatment and the control groups prior to the treatment taking effect. In this case, the assumption is that prior to 2004, there is no discernible difference in basis trends between cooperatives—the treatment group—and IOFs—the control group. The two groups may have different baseline levels for the dependent variable, but the baseline levels must be trending in the same direction and at relatively the same rates. In the context of this thesis, this assumption implies that the basis trends of cooperatives and IOFs must be similar prior to the passing of Section 199 in 2004 and the IRS letter rulings in 2008. As seen in Figure 5.1, there appears to be no real differences in trends between cooperatives and IOFs prior to the 2004 law. The Section 199 law may have caused some widening of the basis differential between 2005 and 2008, but after the 2008 IRS letter rulings went into effect, the basis differential appears to widen even more.

Equation (6.1) presents the basic difference-in-difference model. BS_{icswt} represents the basis observed for firm *i* located in county *c* and state *s* during week *w* and year *t.* The model accounts for differences between average IOF and average cooperative basis before the Section 199 policy change ($Coop_i$), differences in the average basis of IOFs after the passing of Section 199 in the year 2004 and the pre-policy period (Law_t), differences in the average basis of IOFs after the IRS letter ruling in 2008 and the pre-policy period (IRS_t), differences in the average basis between cooperatives and IOFs during the period after the passing of Section 199 but before the IRS letter rulings ($Coop_i * Law_t$), and the differences of basis between cooperatives and IOFS after the issuing of the IRS letter rulings ($Coop_i * IRS_t$). Equation (6.2) has the same basic model

as (6.1), but it also controls for the number of competing firms within a defined radius of the city centroid of firm i (CM_i).

$$B_{icswt} = \beta_0 + \beta_1 Coop_i + \gamma_1 Law_t + \gamma_2 IRS_t + \delta_1 Coop_i * Law_t + \delta_2 Coop_i * IRS_t + \epsilon_{icswt} \quad (6.1)$$

$$B_{icswt} = \beta_0 + \beta_1 Coop_i + \sigma_0 CM_i + \gamma_1 Law_t + \gamma_2 IRS_t + \delta_1 Coop_i * Law_t + \delta_2 Coop_i * IRS_t + \epsilon_{icswt} \quad (6.2)$$

In reference to the above equations, if cooperatives tend to have a different basis on average than IOFs – perhaps because of cash dividend payments – then this difference will be captured by the cooperative coefficient estimate β_1. If Section 199 and/or the IRS letter rulings caused cooperatives to lower their cash price offers, then this effect will be captured in the differential δ_2. These two coefficients will be the primary coefficients of interest to test the hypothesis about the impacts of Section 199.

Spatial Competition

As other authors have noted (Clark et al, 2003; Vachal and Tolliver, 2001), wheat producers in high production regions rarely travel more than 50 miles to deliver their grain. In fact, 70-80% grain is delivered inside of 30 miles for Nebraska and Kansas (Vachal and Tolliver, 2001). Thus, spatially isolated firms may possess some market power, as producers may be unwilling to pay the extra expense in time and monetary costs to truck their grain over distances greater than 30 miles. Moreover, as can be seen Table 5.3, only 4 firms do not have a competitor within 20 miles for the filtered dataset, and for the unfiltered dataset, only 13 firms do not have a competitor within 20 miles.

Most producers should have several options to deliver their grain within a 20 mile distance. Thus, for producers to deliver their grain longer than 20 miles, the price difference may have to be more than a few cents (Edwards, 2017).

We measure the interaction of spatial competition with Section 199 policy effects using both the intensive and the extensive margins. The intensive margin of spatial competition measures how intense—in the sense of the number of firms—the competition is within a certain radius. The extensive margin measures the effect of the exist—whether competition exists—within a certain radius.

As it may be the case that only a small portion of grain is delivered outside of 25 miles, this study will focus on intensive effects within a distance of 30 miles with competition radii of 10, 20, and 30 miles for the intensive margin. In equation (6.2), (CM_i) counts the number of firms within a specific radius of firm *i's* city centroid, with (σ_0) measuring the effect.

As can be seen in Table 5.3, very few firms do not have competitors within 20 miles of their city centroid, and a radius smaller than 10 miles may not capture competition from firms in another town down the highway. Furthermore, most grain may not be trucked within a distance of 10 miles (Vachal and Tolliver, 2001). Thus, a radius of 10 miles will be the primary cutoff point to determine the effect the extensive margin of competition. This model will not in any way changed equations (6.1) or (6.2); it will simply change the subsample. The effect of extensive margin will be examined by comparing the intercept β_0 and the cooperative coefficient β_1 of both subsamples to each other.

Fixed Effects and Clustering of Standard Errors

Equations (6.1) and (6.2) given above describe the basic form of the empirical model to test the policy impact hypotheses developed in Section 3. However, the dataset discussed in the previous subsections contains relatively few controls because the AgManager database does not collect information about elevator land characteristics. The lack of controls creates the possibility of coefficient bias caused by factors omitted from the regressions such as distance to processors, railroad access, and seasonal variation. However, fixed effects could be included in equations (6.1) and (6.2) to account for many of these time-dependent or location-dependent factors.

Equations (6.3), (6.4), and (6.5) display the three fixed effects specifications that will be used for assessing the basis data.[38] The three equations below are written in respect to equation (6.1), and from the three equations, analogues to equation (6.2) can be easily deduced.

$$B_{icswt} = \beta_0 + \beta_1 \mathrm{Coop}_i + \gamma_1 Law_t + \gamma_2 IRS_t + \delta_1 Coop_i * Law_t + \delta_2 Coop_i * IRS_t + \omega_w + \tau_t + \theta_s + \epsilon_{icswt} \quad (6.3)$$

$$B_{icswt} = \beta_0 + \beta_1 Coop_i + \gamma_1 Law_t + \gamma_2 IRS_t + \delta_1 Coop_i * Law_t + \delta_2 Coop_i * IRS_t + \omega_w + \tau_t + \varphi_c + \epsilon_{icswt} \quad (6.4)$$

[38] I also attempted to use a county-by-year fixed effects approach as well. However, the dataset is too sparse in some counties to be effective with this specification. The fixed effects in counties with relative few firms will inevitably soak-up variation in basis into themselves that should in fact be accorded to one of the specific variables such as the cooperative differential.

$$B_{icswt} = \beta_0 + \beta_1 Coop_i + \gamma_1 Law_t + \gamma_2 IRS_t + \delta_1 Coop_i * Law_t + \delta_2 Coop_i * IRS_t + \omega_w$$

$$+\tau_t + \theta_s + \vartheta_{st} + \epsilon_{icswt} \quad (6.5)$$

In equations (6.3), (6.4), and (6.5), all of the models include week fixed effects (ω_w) to control for variation due to sources such as harvest and planting season and year fixed effects (τ_t) to control for sources of variation such as drought and large Canadian harvests. Equation (6.3) and (6.5) also include state fixed effects for factors such as the Kansas City Board of Trade's presence in Kansas City. Equation (6.4) also includes county fixed effects (φ_c) to control for factors such as railroad access or the presence of flour mills. Equation (6.5) includes state-by-year fixed effects (ϑ_{st}). The state fixed effect is a time invariant control and the year fixed effect is a state invariant control. While both of these fixed effects can control for a number of unobserved factors, they are both too broad to control for factors such as a flour mill shutting down for several months in Kansas or a drought only affecting half of Nebraska. These sources of variation need to be controlled by fixed effects that can vary by time and region, which the state-by-year fixed effect does.

The primary fixed effects model is the state-by-year model. The state fixed effects model is too broad of a measure. It is a reasonable assumption that the fixed effects in each specific state varies from year to year, as the supply and demand dynamics in each state change from year to year. Year and state fixed effects by themselves are not enough to pick up this variation. On the other hand, the county fixed effects model may be too narrow of a specification. As the firm location maps in Section 5 display, many rural

counties in Kansas and Nebraska have very few if any private firms that we observe. Thus, the county specific fixed effect may absorb some basis variation that should be attributed to a differential with a cooperative dummy variable. In a perfect world, we would observe every firm for every week of the year. In that case, a county-by-year fixed effect model would be the best model, but does not remove so much variation as to make it impossible to identify the impacts of the Section 199 legislation. With the data we observe, however, the state-by-year fixed effects is the best model available, as it allows for year specific local supply and demand changes. These year specific changes will partially account for broad changes across each state such as a gradual decrease in the number of firms, changes in land use, technological adaptation, and more localized weather conditions.[39]

For the dataset used in this thesis, firms directly competing against each other are likely to have similar idiosyncratic error terms. If one firm increases its basis for some uncontrollable reason, then the firm competing against it 5 miles down the road is more likely than other firms to also increase its basis by the same amount. Thus, their error terms are likely to be correlated. The correlated idiosyncratic errors within groups may lead to standard errors being smaller than they should be, increasing the likelihood of a Type I error—i.e. reject a true null hypothesis (Angrist and Pischke, 2009).

[39] Using agricultural districts in lieu of counties or states as the geographic region for fixed effects is another possibility. However, as the regression results in Section 6 will show, neither county nor state-by-year fixed effects models differ from each other by a substantial margin from each other. Thus, agricultural districts may not provide any new information.

While fixed effects will account for omitted variable bias, fixed effects, in and of themselves, may not fully control for correlated error terms within groups, (Angrist and Pischke, 2009). As such, this may not mitigate the possibility of a Type I inference error. One approach to reduce the Type I error possibility is to cluster according to competition groups. For example, if one group of five firms compete against each other for the business of producers in their area but not against a group of three other firms thirty miles away, then I would need to cluster the error term by each group. However, I do not observe these competition groups. A second-best alternative is to cluster at the smallest regional level possible as producers are unlikely to truck their grain across distances more than 50 miles (Clark et al, 2003; Vachal and Tolliver, 2001). Thus, the county level is the best available option for clustering standard errors to eliminate the possibility of a Type I error.[40]

I also employ White robust standard errors. While I am much more concerned about correlation within observed groups than, the possibility still remains that the value idiosyncratic errors could be dependent on values of the explanatory variables. This again creates the possibility of a Type I error—Type II error is also a possibility—(Wooldridge, 2009). White robust standard errors will account for this serial correlation, minimizing the chance of a Type I error (ibid.).

[40] One other option would be to cluster by firm type as the error terms of cooperatives may be correlated because of similar legal and regulatory factors. However, it is this author's opinion that while there may be some correlation by firm type the correlation from firms competing within the same county is likely to be much stronger. That is, a cooperative near Garden City, Kansas is much more likely to have correlated errors with a private firm in the same town than a cooperative outside Omaha, Nebraska. Thus, clustering at the county level versus by firm type is more appropriate.

RESULTS

I developed a model of cooperatives' grain purchasing decisions. The model assumes that a cooperative seeking to maximize the net returns to its patrons will weigh the benefits of paying higher prices to its members—and possibly buying more quantity—with the costs of a decrease in the available dividend payment to its patrons. Producers will make production decisions based on their marginal costs, the offered price, the size and structure of the patronage payment, and the tax liability from the patronage payment. The model generated two testable hypotheses. First, Section 199 and its IRS letter rulings will lead to a decrease in the cash price offered by cooperatives. Second, the effects of this decrease in price will be partially mitigated by the presence of competing firms. I test the two hypotheses by a difference-in-difference model to a historical weekly dataset of basis value at cooperatives and independently-owned firms (IOFs).

All marginal effect estimates refer to changes in basis as measured in cents per bushel. For a proper interpretation of the results, a practical context is necessary. As more fully discussed in Sections 1 and 2, cooperatives play an important role in the marketing strategies for many agricultural producers across the rural Midwest. Any consistent action taken by agricultural cooperatives will affect tens of thousands of producers, and past research lacks empirical studies comparing the pricing behavior of agricultural cooperatives to independently-owned firms (IOFs). Furthermore, as noted by Russo et al. (2011), imperfect competition in agricultural markets can affect the welfare enhancing

effects of public policy. These issues provide the context for determining the policy and economic significance of the following results section.

Base Difference-in-Difference Model

Table 6.1 presents the parameter estimates of the difference-in-difference model that use the filtered data. The cooperative coefficient compares the average price offered by cooperatives to the average price offered by IOFs before the enacting of Section 199 in 2005. This coefficient estimate indicates an economically and statistically significant 4-8 cents per bushel lower average bid at cooperatives relative to IOFs. The lower price could have several explanations. First, the lower cooperative price could be the result of cooperatives issuing patronage either in the form of equity or cash. Second, the price difference could reveal cooperatives to be a higher cost marketer of grain than the independently-owned firms. Third, as Table 5.1 shows, cooperatives tend to have fewer competitors within 10 miles than private firms. This isolation could result some exercise in market power that cooperatives exert through lowering prices.

A 4 to 8 cent decrease is economically significant. For example, if a producer averages 50 bushels per acre and farms 1,000 acres, an 8 cent price difference represents $4,000 less in revenue while a 4 cent decrease would be $2,000 in less revenue. However, this possible loss in revenue could be compensated by an equal value of patronage in the cooperative in the form of equity and cash payments, but the level and type of compensation will depend on the individual cooperative.

Table 6.1: Difference-in-Difference with Subsampling of Firms by Starting and Ending Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.073**	-0.038*	-0.079**
	(0.032)	(0.022)	(0.032)
Cooperative & Section 199: Law	-0.015	-0.012	-0.013
	(0.028)	(0.018)	(0.028)
Cooperative & Section 199: IRS	-0.086***	-0.048*	-0.061**
	(0.025)	(0.025)	(0.023)
Intercept	-0.423***	-0.421***	-0.430***
	(0.035)	(0.024)	(0.034)
R-Square	0.694	0.757	0.702
Observations	72,715	72,715	72,715
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

Results in Table 6.1 also show that the first Section 199 and cooperative differential reveals no statistically discernible difference between the price trends at cooperatives and independently-owned firms from 2005 to 2008—the years after the original passing of the law in 2004 and before the IRS letter rulings—as compared to the years prior to 2005. This result indicates that while the original tax break may have affected local grain prices, it did not affect cooperatives and IOFs in a consistently distinct manner. This result makes intuitive sense. During this period, Section 199 was relatively small—3% for 2005 and 2006 then 6% from 2007 to 2009. Furthermore, many

cooperatives were unsure of the proper application of Section 199 until the IRS letter rulings in 2008 (Tidgren, personal communication, 2018). Any change in the differential between cooperatives and IOFs would be relatively small in this period because of the size of the deduction and the uneasiness about the application of Section 199 until the IRS letter rulings.

For all three specifications, the second cooperative and Section 199 term is negative and statistically significant at least at a 10% level. Since this term is a differential, the result does not necessarily mean that basis has been trending downwards at cooperatives in absolute terms. Rather, compared to IOFs, cooperatives have offered on average at least a 5 cent lower price bid during the time period of 2009-2017. This difference is in addition to a possible difference in basis between cooperatives and independently-owned firms in the pre-treatment period of the years prior to 2005.

A 6 cent decrease amounts to $3,000 in lost grain sale revenue for a producer farming 1,000 acres and averaging 50 bushels of winter wheat per acre. This lost revenue, however, could be offset by a commensurate increase in future equity and current cash payments at the cooperative if the lost revenue occurred because of changes in the patronage tax rate. However, it is still unclear whether any potential benefits are large enough to fully offset the decrease in price.

The difference in basis provides evidence to test the first hypothesis in the cooperative model. If cooperatives were issuing qualified patronage prior to the IRS letter ruling, then the passing-through of the tax break through qualified patronage would result in a decrease in the equilibrium price. The equilibrium price decreases as a result of the

decrease in tax liability incurred by the issuance of qualified patronage. The results indicate the persistent issuing of cooperative patronage despite the prior theoretical consensus to the contrary. The persistent issuing of patronage indicates that marketing cooperatives may be purposely controlling their capacity to maximize the returns to their members. Cooperatives may also be capacity constrained in the short-run because of financial constraints or a larger than expected demand for grain storage. However, additional detailed financial data for cooperatives are needed to more precisely test this hypothesis. It should also be noted that part of this widening of the basis between cooperatives and IOFs could be explained by IOFs increasing their cash price to counter the lowered tax liability for cooperative patrons. If producers are shifting grain sales to cooperatives, IOFs would then need to increase their own price to maintain the same level of volume.

Tables A.1 and A.2 in Appendix A present the results of two different robustness checks. Table A.1 shows that when all differentials with Section 199: IRS are removed then the Cooperative and Section 199: Law is still no longer distinct from zero. Table A.2 presents the results when all differentials with Section 199: Law, and in this model, the Cooperative and Section 199: IRS differential is still statistically distinct from zero at a 5% level. These two results together substantiate the result that the IRS letter rulings appear to be the main driver of changes in the basis differential between cooperatives and IOFs after Section 199 was passed in 2004.

Furthermore, Tables A.3 and A.4 present the results of lagging or leading the Section 199: IRS dummy variable. Table A.3 presents the results when the Section 199:

IRS variable starts a year before the IRS letter rulings were issued while Table A.4 presents the results when the Section 199: IRS dummy variable starts a year after the IRS letter rulings were issued—same year when the deduction was increased to 9%. When the Section 199: IRS dummy variable starts a year early then the Cooperative and Section 199: IRS differential is no longer distinct from zero at the 10% level, but when the Section 199: IRS dummy variable starts a year later, then the Cooperative and Section 199: IRS remains distinct from zero at a 5% level. Again, these results point to the IRS letter rulings in 2008 being a main driver in the widening of the observed difference between cooperatives and IOFs after Section 199 was originally passed in 2004.

Table 6.2 shows parameter estimates for data that include all elevator locations in Nebraska and Kansas from the years in 1998-2017. With this data specification, the cooperative differential is only statistically distinct from zero in the state by year fixed effects model, indicating that a cursory scan of prices by firm type may not lead to any discernible conclusions on price differences. This result contrasts with the statistically significant results of Table 6.1. It may be that the elevator locations that appear in a more random fashion are noise to the dataset, thus, lowering the precision of the cooperative differential estimates.

For the second Section 199 differential, the results of the filtered dataset in Table 6.1 match the results of the unfiltered dataset in Table 6.2 with some slight quantitative differences. With either dataset, the result remains the same: a persistent decrease in the price at cooperatives as compared to IOFs following the binding IRS letter ruling.

Table 6.2: Difference-in-Difference with No Subsampling of Firms

Variable	Model 1	Model 2	Model 3
Cooperative	-0.040 (0.026)	-0.031 (0.019)	-0.048* (0.026)
Cooperative & Section 199: Law	-0.019 (0.024)	-0.008 (0.018)	-0.019 (0.024)
Cooperative & Section 199: IRS	-0.072** (0.028)	-0.057** (0.027)	-0.058** (0.027)
Intercept	-0.470*** (0.028)	-0.430*** (0.020)	-0.480*** (0.027)
R-Square	0.676	0.719	0.682
Observations	188,044	188,044	188,044
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Difference-in-Difference Model with Intensive Competition Control

Table 6.3 uses the same basic empirical model as Tables 6.1 and 6.2. The lone change is the inclusion of a variable controlling for the number of firms within a 10 mile radius of the city centroid where the grain marketing firm is located. Because this term is a numeric variable, it serves primarily as a measure of the effects from the intensity of competition; that is, the average increase in price from having an additional competing firm within 10 miles. While it can be used as an extensive measure, it performs a less than satisfactory role. For example, it treats a movement from 0 to 1 in the same manner as an increase from 5 to 6; however, it may be the case that the first competing firm has a

much larger effect on basis than the addition of a sixth. Because it washes over this variation, the intensive measure proves to be somewhat a blunt measure by itself.

Table 6.3: Difference-in-Difference Controlling for Competitors within 10 Miles: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.070**	-0.036*	-0.076***
	(0.029)	(0.020)	(0.028)
Additional Firm within 10 Miles	0.016***	0.007*	0.016***
	(0.004)	(0.004)	(0.004)
Cooperative & Section 199: Law	-0.009	-0.012	-0.007
	(0.026)	(0.017)	(0.027)
Cooperative & Section 199: IRS	-0.067***	-0.047*	-0.043*
	(0.024)	(0.025)	(0.022)
Intercept	-0.468***	-0.462***	-0.475***
	(0.030)	(0.028)	(0.028)
R-Square	0.706	0.758	0.714
Observations	72,715	72,715	72,715
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

When comparing the competition variable across the three different fixed effects specifications, an additional competing firm increases the price offered by at least 0.7

cents and possibly up to 1.6 cents.[41] The average cooperative has just below 2.5 competing firms within 10 miles while the average private firm has just above 2.5 competing firms within 10 miles. As such, the competition effect for an average marketing firm is somewhere between 2.5 to 4 cents.

The substantially smaller coefficient for the competition variable in the county fixed effects model may suggest the presence of omitted variable bias. The county fixed effects should be controlling for other unobserved local factors such as local road conditions, railroad access, and unobserved competing firms. However, as evidenced in the summary statistics table, only 14 firms in the year condensed dataset do not have competitors within 10 miles of their city centroid. Thus, if all of the observed firms in a county have a competitor within 10 miles, the county fixed effects model may be absorbing some variation that should accrue towards the competition variable, instead of, the county fixed effect.

Since greater competition should increase prices and since cooperatives tend to operate in more isolated locations, controlling for the number of competing firms within a 10 mile radius eliminates negative omitted variable bias in all of the terms with a cooperative dummy variable. When comparing Table 6.3 to Table 6.1, almost all of the terms containing a cooperative differential slightly attenuate towards zero. Furthermore, the precision of the estimates decrease slightly. Despite these effects, cooperatives may indeed pay close to 5 cents less on average than independently-owned firms. The

[41] I employed a second interacting term, exploring whether cooperatives and IOFs react to competing firms in different extents; however, neither term was individually statistically significant, and the difference in coefficients was slight and non-significant as well.

relatively consistent result further substantiates the hypothesis that the IRS letter rulings may have reduced the basis at agricultural cooperatives.

When using the unfiltered dataset in Table 6.4, the second cooperative and Section 199 differential has slightly decreased. Furthermore, the differential's statistical significance did not change across the three fixed effects specifications. This results supports the hypothesis that the IRS letter rulings would lead to a decrease in the cash price offered by grain marketing cooperatives, as the IRS letter rulings consistently leads to a 5 to 10 cent widening of the basis between cooperatives and IOFs.

Table 6.4: Difference-in-Difference Controlling for Competitors within 10 Miles: No Subsampling of Firms

Variable	Model 1	Model 2	Model 3
Cooperative	-0.033	-0.029	-0.041*
	(0.024)	(0.018)	(0.024)
Additional Firm within 10 Miles	0.013***	0.009***	0.012***
	(0.003)	(0.002)	(0.003)
Cooperative & Section 199: Law	-0.021	-0.006	-0.021
	(0.024)	(0.018)	(0.024)
Cooperative & Section 199: IRS	-0.071***	-0.054**	-0.058**
	(0.027)	(0.026)	(0.027)
Intercept	-0.512***	-0.487***	-0.521***
	(0.024)	(0.023)	(0.022)
R-Square	0.682	0.721	0.688
Observations	188,044	188,044	188,044
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Changing the Radius of Competition

Tables 6.5 and 6.6 present the results of the difference-in-difference models with an expanded radius of competition. The competition variable in Table 6.5 now controls for the number of firms within a 20 mile radius instead of a 10 mile radius. Table 6.6 uses a competition radius of 30 miles. Both of the new competition specifications include the firms counted in the 10 mile radius plus any additional firms that lie between the old and new boundary. For example, if a cooperative had 3 competing firms within a 10 mile radius of its city centroid and if it had an additional 5 firms between 11 to 20 miles away from its city center, then the 20 mile radius competition measure would equal 8. As such, a 10 mile competition radius would likely capture competition from firms in a nearby small town. While a radius of 30 miles is likely to capture the effects of competition across half of a county. As shown in Table 4.1, for the filtered dataset, all of the firms have at least one competitor within 20 miles. The one downside to a larger competition radius is that it treats all firms in a linear fashion. A competitor that is within 10 miles from firm *i* is treated the same as a competitor that is 24 miles away.

In comparing the competition variables across Tables 6.3, 6.5, and 6.6, the estimated coefficients for the intensive competition variable decrease as the radius of competition expands. That is, the average effect for having another location within a 20 mile radius is greater than the average effect when the radius is expanded to 30 miles. This comparison indicates that competing elevator locations farther away have less of a positive effect on basis than locations nearby. An additional competing firm within 10 miles may increase the local price by roughly 1.5 cent while an additional competing firm

20 or 30 miles away may only raise the price by half a cent. One possible explanation for why firms farther away have such a small effect on prices is the increased shipping costs in terms of money and, especially, in terms of time (McKnew and Griffith, 2005). For a producer trucking their grain, a firm 10 miles away would cost 20 minutes of total travel time traveling at an average speed of 60 miles per hour. A firm 30 miles away would cost an hour of travel time. Depending on the length of unloading and loading time for grain, this extra travel time could translate into several less loads trucked in a day. For

Table 6.5: Difference-in-Difference Controlling for Competitors within 20 Miles: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.080**	-0.039*	-0.086***
	(0.031)	(0.021)	(0.031)
Additional Firm within 20 Miles	0.007***	0.004**	0.007***
	(0.001)	(0.002)	(0.001)
Cooperative & Section 199: Law	-0.007	-0.012	-0.006
	(0.028)	(0.018)	(0.029)
Cooperative & Section 199: IRS	-0.064**	-0.047*	-0.042*
	(0.024)	(0.025)	(0.024)
Intercept	-0.479***	-0.491***	-0.486***
	(0.034)	(0.026)	(0.032)
R-Square	0.709	0.758	0.716
Observations	72,715	72,715	72,715
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

producers trucking their grain during harvest such as those employing customer harvesters, the slower speeds at harvest could be enormous. Because of these time costs, firms over 20 miles away may not even be a real source of competition.

Examining the second of the Section 199 and cooperative differentials in Tables 6.3, 6.5, and 6.6 continues to substantiate the negative effects of the IRS letter rulings on the basis offered by cooperatives. However, the negative coefficients are weakly statistically significant, meaning that greater divergences in prices between cooperatives and IOFs may depend on the level of spatial competition.

In the unfiltered dataset—Tables 6.7 and 6.8—the second Section 199 differential continues to be negative by several cents with a high degree of statistical significance, regardless While the unfiltered dataset places some doubts on whether cooperatives did indeed offer lower prices before the policy change, post-policy differences seem to be beyond doubt.

Table 6.6: Difference-in-Difference Controlling for Competitors within 30 Miles: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.083***	-0.041*	-0.088***
	(0.031)	(0.021)	(0.031)
Additional Firm within 30 Miles	0.004***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)
Cooperative & Section 199: Law	-0.006	-0.012	-0.004
	(0.028)	(0.018)	(0.030)
Cooperative & Section 199: IRS	-0.064**	-0.046*	-0.042*
	(0.025)	(0.025)	(0.024)
Intercept	-0.502***	-0.517***	-0.508***
	(0.037)	(0.029)	(0.035)
R-Square	0.715	0.758	0.723
Observations	72,715	72,715	72,715
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

Table 6.7: Difference-in-Difference Controlling for Number of Competitors within 20 Miles: No Subsampling of Firms

Variable	Model 1	Model 2	Model 3
Cooperative	-0.047*	-0.040**	-0.054**
	(0.026)	(0.017)	(0.026)
Additional Firm within 20 Miles	0.007***	0.005***	0.007***
	(0.001)	(0.001)	(0.001)
Cooperative & Section 199: Law	-0.023	-0.008	-0.022
	(0.024)	(0.018)	(0.025)
Cooperative & Section 199: IRS	-0.077***	-0.054**	-0.064**
	(0.028)	(0.026)	(0.027)
Intercept	-0.529***	-0.524***	-0.539***
	(0.027)	(0.026)	(0.026)
R-Square	0.688	0.722	0.694
Observations	188,044	188,044	188,044
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Table 6.8: Difference-in-Difference Controlling for Number of Competitors within 30 Miles: No Subsampling of Firms

Variable	Model 1	Model 2	Model 3
Cooperative	-0.051*	-0.039**	-0.058**
	(0.026)	(0.017)	(0.026)
Additional Firm within 30 Miles	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Cooperative & Section 199: Law	-0.024	-0.01	-0.022
	(0.025)	(0.019)	(0.025)
Cooperative & Section 199: IRS	-0.079***	-0.056**	-0.066**
	(0.029)	(0.027)	(0.028)
Intercept	-0.549***	-0.537***	-0.560***
	(0.029)	(0.027)	(0.027)
R-Square	0.693	0.723	0.698
Observations	188,044	188,044	188,044
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Difference-in-Difference with Subsampling by Competition Radius

In Table 6.9, the filtered dataset is further subdivided by excluding firms that do not have a competitor within 10 miles. Only firms that have competitors within 10 miles of their city centroid are included in this dataset. This subsampling creates an extensive margin by which to measure the effects of competition. To measure this effect, the first result to note is the intercept. When comparing the intercept of Table 6.9 to Tables 6.1, 6.3, 6.5, and 6.6, the intercept has decreased by close to 10 cents. The comparison of the baseline averages indicates a lower basis for independently-owned firms prior to any policy changes in this subsample. This result coincides with basic economic intuition that increased competition, even only on the extensive margin, can reduce market power. To fully measure the extensive margin effect, however, it needs to be compared to the intercept for the subsampled group without a competitor within 10 miles, which will be introduced in the next subsection.

Table 6.10 shows the regression for grain marketing firms in the filtered dataset that do not have a competitor within 10 miles of their city centroid. The intercept term is 15 to 20 cents higher than in the estimates of Table 6.9. Independently-owned firms that do not have a competitor within 10 miles of their pay on average 15 to 20 cents less than independently-owned firms that do. This result indicates that a separation of more than 10 miles in all directions between firms may be enough to allow a firm to exercise some spatial monopoly power. For a producer harvesting over 1,000 acres of wheat and averaging 50 bushels an acre, this difference in basis results in a decrease of revenue close to $10,000.

Table 6.9: Subsample of Firms that have at least One Competitor within 10 Miles: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.103***	-0.026	-0.107***
	(0.034)	(0.018)	(0.034)
Cooperative & Section 199: Law	-0.015	-0.019	-0.016
	(0.029)	(0.018)	(0.029)
Cooperative & Section 199: IRS	-0.086***	-0.051*	-0.068***
	(0.026)	(0.029)	(0.023)
Intercept	-0.394***	-0.434***	-0.399***
	(0.038)	(0.021)	(0.036)
R-Square	0.706	0.763	0.713
Observations	62,346	62,346	62,346
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

Subsampling on the extensive margin results in a lower cooperative term in Table 6.9 as compared to Tables 6.1, 6.3, 6.5, and 6.6. This result is somewhat in doubt as the cooperative term for the county fixed effects model is substantially lower, and it fails to be statistically distinct from zero. However, as stated in the introduction to this section, the presence of few firms in many counties makes the use of county fixed effects suspect, as some counties may only have cooperatives observed. Nevertheless, there is some evidence that in the face of local competition cooperatives may not respond as much in terms of price as IOFs. In fact, the data indicates that cooperatives pay close to 10 cents

less than IOFs when another firm is within 10 miles. The cooperatives may compensate this difference in other ways such as the continuance of cash patronage payments and the issuing of equity in the cooperative. Therefore, it may be that having competition on the extensive margin of 10 miles is not sufficient to eliminate a cooperative's ability to limit output to maximize net returns to its patrons.

Table 6.10: Subsample of Firms that have No Competitor within 10 Miles: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	0.090***	0.028	0.074***
	(0.027)	(0.030)	(0.021)
Cooperative & Section 199: Law	0.025	0.0140	0.045
	(0.033)	(0.034)	(0.038)
Cooperative & Section 199: IRS	-0.067	-0.040	-0.038
	(0.049)	(0.059)	(0.041)
Intercept	-0.555***	-0.593***	-0.570***
	(0.018)	(0.018)	(0.014)
R-Square	0.703	0.736	0.720
Observations	10,369	10,369	10,369
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

In two of the three models in Table 6.10, the sign of the cooperative term flips from negative to positive when comparing firms that do not have a competitor within 10

miles to firms that do. Again, there is some doubt to this result as the result for the county fixed effects model is not statistically distinct from zero at the 10% level, but for the other models, cooperatives without a competing firm within 10 miles of their city centroid pay almost 10 cents higher than their independently-owned peers. This result seems to lend credence to the work of Sexton (1990) which predicts that cooperatives with some monopsony power will pay a higher price then IOFs with the same amount of monopsony power.

In Table 6.9, the negative sign and the statistically significance of the second cooperative and Section 199 differential supports the interpretation of the possible difference in price between cooperatives and private firms, as resulting from the issuance of patronage by cooperatives. While the cooperative differential is now only significant at the 10% level for the county fixed effects model, the overall results still support the hypothesis that the IRS letter rulings weakened the basis at agricultural cooperatives. Even with the presence of at least one other firm within 10 miles, the policy is still associated with a widening of the basis between agricultural cooperatives and IOFs by a magnitude of 5 to 10 cents.

As discussed in Section 4, the IRS letter ruling would only cause a decrease in price at cooperatives if cooperatives are able to consistently issue patronage payments in the form of equity or cash. The result for the second Section 199 differential indicates that the presence of one other firm within 10 miles is not enough to eliminate the possibility of cooperatives issuing patronage payments. Furthermore, while the presence of another firm creates a higher overall price by reducing the magnitude of the intercept

term, it is still not enough to eliminate the widening of the basis between cooperatives and IOFs.

In Table 6.10, however, the second Section 199 and cooperative differential is now statistically insignificant for the first time. This result, however, also may simply be due to the relatively few observations in this dataset. With only 10,000 observations, the regression has more noisy estimates, affecting the inference. In reference to Table 6.11, the filtered dataset—only including firms without a competitor within 10 miles—only contains 18 distinct firms. The filtered dataset that only includes firms with a competitor within 10 miles, however, contains over 100 hundred distinct firms[42]. Therefore, the lack of statistical significance for the second cooperative and Section 199 term in Table 6.10 may simply be due to a small dataset.

Table 6.11: Number of Firms without Competitors within 10 Miles

Firm Type	Number of Firms	Percent of Total
Independently-owned Firm	4	22.22
Cooperative	14	77.78

Note: Subsample of firms with first year of data no later than 2000 and last year of data no later than 2010.

In Tables 6.12 and 6.13, the results of the unfiltered dataset follow tend to mirror the results of the filtered dataset. The one major difference is that the second cooperative and Section 199 term is now statistically significant substantially larger in magnitude when comparing Table 6.13 to Table 6.11. This does lend some credence to the contention that the primary reason why the second Section 199 and cooperative

[42] See Table 5.1 for the number of firms with competitors within 10 miles for both datasets.

differential is insignificant for Table 6.10 is the smaller dataset. Furthermore, the large decrease in price may indicate that despite paying more than IOFs in the pre-policy period cooperatives may be issuing large qualified patronage payments, resulting in a substantial tax cut in dollar terms for producers.

These robustness checks tend to substantiate the hypotheses that the IRS's letter ruling decreased the prices offered by agricultural cooperatives and that decreased spatial competition reduces the prices offered by grain marketing firms, regardless of type. Furthermore, Table 6.13 provides some evidence that a decreased amount of spatial competition will increase the size of the effects of Section 199, but the null result in Table 6.10 fails to substantiate this hypothesis.

Table 6.12: Subsample of Firms that have at least One Competitor within 10 Miles: No Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.053* (0.029)	-0.036* (0.020)	-0.060** (0.029)
Cooperative & Section 199: Law	-0.015 (0.026)	-0.001 (0.019)	-0.015 (0.027)
Cooperative & Section 199: IRS	-0.056** (0.028)	-0.035 (0.023)	-0.045* (0.025)
Intercept	-0.453*** (0.031)	-0.425*** (0.022)	-0.464*** (0.030)
R-Square	0.687	0.733	0.694
Observations	159618	159618	159618
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Table 6.13: Subsample of Firms that have No Competitor within 10 Miles: No Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	0.045*	0.072	0.050***
	(0.027)	(0.102)	(0.019)
Cooperative & Section 199: Law	-0.054	-0.025	-0.066
	(0.061)	(0.078)	(0.069)
Cooperative & Section 199: IRS	-0.172**	-0.139	-0.167*
	(0.076)	(0.122)	(0.093)
Intercept	-0.581***	-0.710***	-0.589***
	(0.016)	(0.097)	(0.015)
R-Square	0.625	0.682	0.634
Observations	28,426	28,426	28,426
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Competition Subsampling with Intensive Competition Control

Table 6.14 shows the results when including an intensive competition measure along with the subsampling of firms that have a competing firm within 10 miles of their city centroid. The inclusion of the number of competing firms within a 10 mile radius creates an intensive measure to complement the extensive measure created by selectively subsampling firms

The results indicate that the addition of another firm within 10 miles leads to almost a 1.5 cent increase in the cash price offered by grain marketing firms. With the county fixed effects model, however, the intensive margin variable is now no longer statistically distinct from zero. This result indicates that the presence of a single competing firm within 10 miles may be enough to substantial boost the basis at a grain marketing firm because the intercepts in Tables 6.14 and 6.9 differ only slightly. Also in comparison to Table 6.9, the results of the cooperative dummy variable and the second Section 199 and cooperative differential differ only slightly compared to the values on Table 6.14.

When comparing Tables 6.14 and 6.15, the two intercept terms now differ by close to 20 cents despite the inclusion of the intensive competition variable. A single competing firm within a 10 mile radius does appear to substantially increase the price offered by grain marketing firms. As discussed in the previous subsection, a difference of 20 cents per bushel amounts to close to $10,000 in lost revenue.

Despite the inclusion of the intensive margin, the cooperative term on Table 6.15 continues to be positive and significant economically and statistically. In fact, the cooperative term is now statistically significant for the fixed effects model when it failed to be so for the fixed effects model on Table 6.10. This result further substantiates the hypothesis that cooperatives with monopsony power will offer a higher price compared to

Table 6.14: Subsample of Firms that have at least One Competitor within 10 Miles with Competition Control: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.097***	-0.027	-0.100***
	(0.033)	(0.018)	(0.032)
Additional Firm within 10 Miles	0.013***	0.005	0.013***
	(0.004)	(0.003)	(0.004)
Cooperative & Section 199: Law	-0.011	-0.019	-0.012
	(0.029)	(0.018)	(0.029)
Cooperative & Section 199: IRS	-0.070***	-0.051*	-0.052**
	(0.026)	(0.029)	(0.024)
Intercept	-0.440***	-0.460***	-0.444***
	(0.035)	(0.027)	(0.033)
R-Square	0.714	0.764	0.721
Observations	62,346	62,346	62,346
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

IOFs with monopsony power. In addition to any patronage the cooperatives' patrons receive, these producers also receive a 5 to 10 cent higher price at cooperatives. The price increase alone could lead to an additional $5,000 in revenue for an average producer.

Table 6.15: Subsample of Firms that have No Competitors within 10 Miles with Competition Control: Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	0.113***	0.046*	0.100***
	(0.032)	(0.025)	(0.028)
Additional Firm within 11 to 20 Miles	0.015***	0.017***	0.014***
	(0.004)	(0.004)	(0.004)
Cooperative & Section 199: Law	0.036	0.014	0.051
	(0.031)	(0.034)	(0.035)
Cooperative & Section 199: IRS	-0.039	-0.04	-0.024
	(0.058)	(0.059)	(0.048)
Intercept	-0.624***	-0.644***	-0.632***
	(0.027)	(0.044)	(0.022)
R-Square	0.713	0.736	0.728
Observations	10,369	10,369	10,369
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All firms with starting years greater than 2000 or with ending years greater than 2010 were excluded from the data set. Section 199: Law represents the treatment effect of the passing of Section 199 in the American Jobs Creation Act of 2004. Section 199: IRS represents the issuing of the IRS letter rule in 2008.

The inclusion of the intensive margin, however, fails to produce a statistically significant result for the Cooperative and Section 199 Part 2 differential. This result could again be the lack of data points, but the strong statistical significance for the cooperative

term suggests another possible interpretation. For the IRS letter rulings to decrease the price at cooperatives, the cooperatives first had to be maximizing the net returns to their patrons, not maximizing the raw product price received by their patrons-a second possible cooperative maximization postulate. Maximizing the raw product price would leave no profits available for patronage distribution; thus, there would be no effect on prices from the Section 199 and the IRS letter rulings. If some cooperatives maximize the net returns to their patrons while others maximize the raw product price, this could create a noisy estimate for the second cooperative and Section 199 differential. The small number of firms in the dataset could then not be enough to overcome the noise created by two different maximization goals, even if a minority of cooperatives maximize the raw product price instead of net returns to patrons.

The results in Tables 6.16 and 6.17 largely substantiate the results of the filtered dataset. The intercept term for firms with competitors within 10 miles is 10 cents lower in magnitude than the same term for firms without competitors within 10 miles. The cooperative differentials maintain the same signs and relatively the same magnitudes, indicating that cooperatives may indeed not exert their market power in the same form as IOFs. Furthermore, the second cooperative and Section 199 differential continues to be negative and statistically significant at a 10% level.

Table 6.16: Subsample of Firms that have at least One Competitor within 10 Miles with Competition Control: No Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	-0.044	-0.037**	-0.051*
	(0.028)	(0.019)	(0.027)
Additional Firm within 10 Miles	0.012***	0.009***	0.012***
	(0.004)	(0.003)	(0.004)
Cooperative & Section 199: Law	-0.018	0	-0.018
	(0.026)	(0.019)	(0.026)
Cooperative & Section 199: IRS	-0.056**	-0.032	-0.045*
	(0.026)	(0.021)	(0.024)
Intercept	-0.500***	-0.479***	-0.509***
	(0.028)	(0.028)	(0.026)
R-Square	0.692	0.734	0.698
Observations	159618	159618	159618
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Figure 6.17: Subsample of Firms that have No Competitors within 10 Miles with Competition Control: No Subsampling by Years

Variable	Model 1	Model 2	Model 3
Cooperative	0.045*	0.071	0.055**
	(0.025)	(0.105)	(0.022)
Additional Firm within 11 to 20 Miles	0.007***	0.002	0.007***
	(0.002)	(0.014)	(0.002)
Cooperative & Section 199: Law	-0.067	-0.027	-0.081
	(0.061)	(0.071)	(0.071)
Cooperative & Section 199: IRS	-0.184**	-0.144	-0.184*
	(0.079)	(0.102)	(0.096)
Intercept	-0.609***	-0.719***	-0.617***
	(0.019)	(0.074)	(0.018)
R-Square	0.630	0.682	0.640
Observations	28,426	28,426	28,426
Week Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	No	Yes
County Fixed Effects	No	Yes	No
State by Year Fixed Effects	No	No	Yes

Note: Coefficient values are listed parallel to their respective independent variable name while the respective standard errors are listed below their coefficients in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Section 199: Law represents the treatment effect of the passing of Section 199 in the 2004 American Jobs Creation Act. Section 199: IRS represents the issuing of the IRS letter rules in 2008.

Expected Basis by Firm Type and Competition Level

Figures 6.1 and 6.2 help to illustrate the heterogeneous effects of the IRS letter rulings in 2008. Both figures are not exact replications of the results presented in the presiding section. They are the in sample predicted values for each observation averaged by firm type and policy period from the state-by-year regression models presented in Tables 6.14 and 6.15, respectively. Even though these figures are not the regressions themselves, they still illustrate the greater market distorting effects of the IRS letter rulings on elevator locations lacking a competing location within 10 miles.

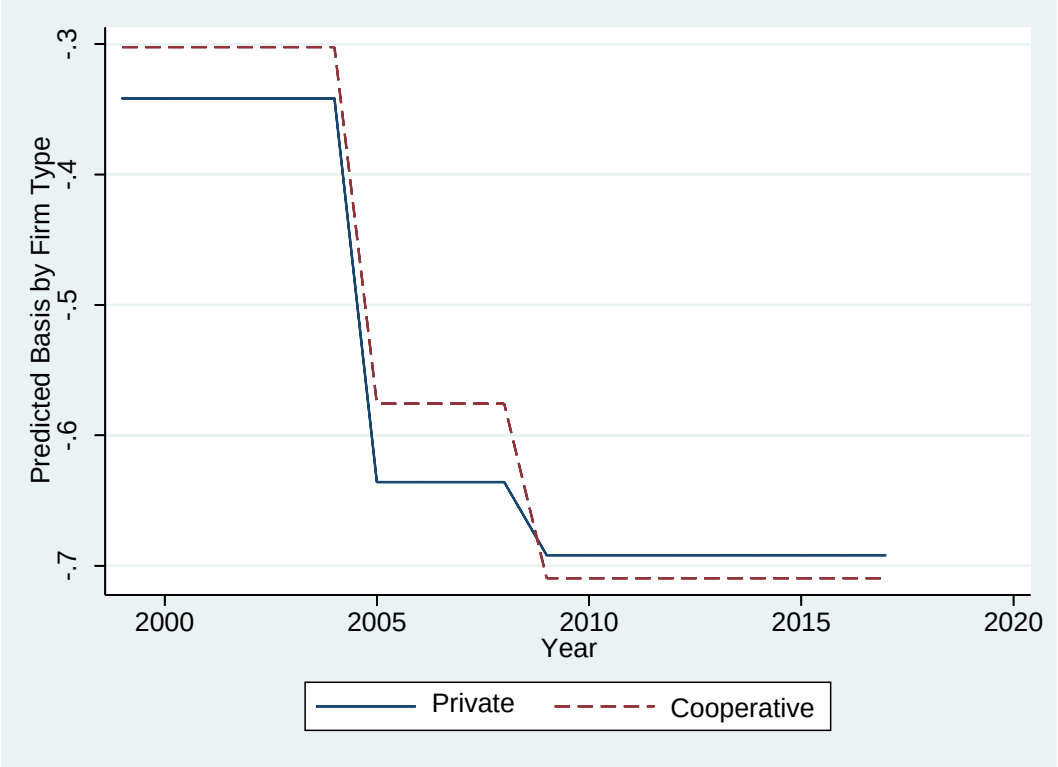
Figure 6.1 shows the predicted basis for elevator locations that have a competitor within 10 miles of the locations city-centroid. The basis differential in Figure 6.1 follows the typical path observed throughout the results section: a nearly 9 cents difference between cooperatives and IOFs before any policy change, a slight widening of 1 to 2 cents after the passing of Section 199 in 2004, and an even greater of widening of 4 to 5 cents after the IRS letter rulings in 2008—with cooperatives paying less in all cases. However, Figure 6.2 tells a shows a different story. Figure 6.2 shows that, before the passing of any policy, cooperatives offered a stronger basis of roughly 5 cents per bushel. Furthermore, this difference increased by a few cents after Section 199 was passed in 2004; however, after the IRS letter rulings were issued in 2008, cooperatives then pay a few cents per bushel less than IOFs. Thus, the IRS letter rulings may have caused a reversal in which firm type offers a stronger basis for the subsample of grain elevators that do not have a competitor within 10 miles of their location.

Figure 6.1: Predicted Basis by Firm Type: Competitors within 10 Miles

Note: Predicted basis values are calculated from averaging the predicted basis values of each observation in the dataset by policy period. The data subsample only includes elevator locations that have a competitor within 10 miles of their city centroid.

This reversal in the differential in Figure 6.2 appears to be driven by the actions of cooperatives and IOFs. The decrease in average basis for cooperatives after 2008 does appear to be a few cents less for cooperatives that do have a competitor than those that do not. However, after 2008, non-cooperatives that do not have a competitor within 10 miles of their location do not lower basis as much as the non-cooperatives that do have a competitor within 10 miles of their location. These results together mean that the effects of the IRS letter rulings appear to have a greater impact on the difference between the cooperative and the IOF price for elevator locations do not have a competitor within 10 miles than those that do.

Figure 6.2: Predicted Basis by Firm Type: No Competitors within 10 Miles



Note: Predicted basis values are calculated from averaging the predicted basis values of each observation in the dataset by policy period. The data subsample only includes elevator locations that do not have a competitor within 10 miles of their city centroid.

Tables 6.18, 6.19, and 6.20 can be used to help further substantiate this result. These tables present the expected basis—adding relevant differentials to intercept plus average of year fixed effects—by firm type, policy period, and competition level from *Model 3 of* Tables 6.6, 6.16, and 6.17, respectively. For example, the Pre-Policy value for cooperative firms in Table 6.18 is the intercept term plus the cooperative differential from Table 6.3—using Model 3. The tables also include the difference between the basis offered by cooperatives and the basis offered by IOFs—defined as the IOF basis minus the cooperative basis. This difference is equivalent to the cooperative term plus any relevant policy differential. Although the tables do not provide any new analysis, they

help to show the differentials from the cooperative and policy terms within the context of the market as a whole.

Table 6.18: Expected Values by Firm Type and Policy Period

Policy Period	Firm Type		Difference
	Cooperative	IOF	
Pre-Policy	-0.550	-0.474	0.076
Section 199: Law	-0.733	-0.650	0.083
Section 199: IRS	-0.544	-0.426	0.118

Note: Pre-Policy period is before the passing of the American Jobs Act of 2004. Section 199: Law is the period following the passing of the American Jobs Act, but before the IRS letter rulings in 2008 while Section 199: IRS is the period after IRS letter rulings. Difference is the average IOF price minus the average cooperative price for each policy period. "IOF" stands for independently-owned firm. Only firms with data before 2000 and after 2010 are included in the dataset.

Table 6.18 presents the expected values associated with the model and results presented in Table 6.6. Although the average basis across both firm types increases by almost 20 cents during the first Section 199 period, the difference in basis between cooperatives and IOFs hardly changes. While in the second policy period, the average difference between firm types grows even as the baseline level decreases. There may be slight trend towards a widening of the basis between cooperatives and IOFs; however, the IRS's letter rulings on Section 199 appear to exacerbate this trend.

Tables 6.19 and 6.20 show the expected values of basis for firms with competitors within 10 miles and firms without competitors within 10 miles, respectively. Throughout all of the policy periods, the difference between IOFs with competitors within 10 miles

Table 6.19: Expected Values for Firms that have at least One Competitors within 10 Miles

Policy Period	Firm Type		Difference
	Cooperative	IOF	
Pre-Policy	-0.544	-0.444	0.100
Section 199: Law	-0.725	-0.613	0.112
Section 199: IRS	-0.538	-0.386	0.152

Note: Pre-Policy period is before the passing of the American Jobs Act of 2004. Section 199: Law is the period following the passing of the American Jobs Act, but before the IRS letter rulings in 2008 while Section 199: IRS is the period after IRS letter rulings. Difference is the average IOF price minus the average cooperative price for each policy period. "IOF" stands for independently-owned firm. Only firms with data before 2000 and after 2010 are included in the dataset.

and IOFs without competitors within 10 miles is close to 20 cents. However, for cooperatives, the difference is only a few cents with cooperative elevator locations that do not have do not have a competitor within 10 miles consistently offering a slightly weaker basis than those that do. Thus, the results indicate that cooperatives may not exert their spatial market power in the same manner as IOFs.

This result can be seen in the opposite signs of the difference columns in Tables 6.19 and 6.20. In Table 6.19, the sign is positive, meaning that IOFs, on average, offer a stronger basis than cooperatives when there is a competing grain elevator location within 10 miles. However, in Table 6.20, the sign is negative, meaning that—for elevators that do not have a competitor within 10 miles—cooperatives offer a stronger basis on average than IOFs.

Furthermore, before the IRS letter rulings, it appears the basis spread between IOFs and cooperatives trends in different directions, depending on the spatial competition

level. Table 6.19 shows the positive spread between cooperatives and IOFs increasing by 1 cent per bushel during the policy period when Section 199 was in effect, but Table 6.20 shows the negative spread increasing by almost 5 cents in magnitude.[43] Thus, there appears to be non-parallel trends before the IRS letter rulings were issued in 2008 depending on the competition level.

Table 6.20: Expected Values for Firms that have No Competitor within 10 Miles

Policy Period	Firm Type		Difference
	Cooperative	IOF	
Pre-Policy	-0.532	-0.632	-0.100
Section 199: Law	-0.745	-0.896	-0.151
Section 199: IRS	-0.562	-0.639	-0.077

Note: Pre-Policy period is before the passing of the American Jobs Act of 2004. Section 199: Law is the period following the passing of the American Jobs Act, but before the IRS letter rulings in 2008 while Section 199 Part 2 is the period after IRS letter rulings. Difference is the average IOF price minus the average cooperative price for each policy period. "IOF" stands for independently-owned firm. Only firms with data before 2000 and after 2010 are included in the dataset.

In light of these possible differences in trends, comparing the basis spreads of the last two policy periods—when the Section 199 was in effect but before the IRS letter rulings were issued to the time period after the IRS letter rulings were issued—reveals that the IRS letter rulings may have caused a greater impact for cooperative elevator locations without a competitor within 10 miles. On Table 6.19, the difference between the second policy period and the last policy period is 4 cents per bushel, but on Table 6.20,

[43] Neither the 5 cent nor the 1 cent differentials are distinct from zero at a 10% level when compared to the pre-policy period. Nevertheless, they still indicate that the raw data may contain distinct trends depending on the level of spatial competition.

the difference is 7.4 cents per bushel.[44] Thus, the effect of the IRS letter rulings on the basis spread between cooperatives and IOFs appears to be almost twice as large for cooperative elevator locations that do not have a competitor within 10 miles than those that do.

Furthermore, this result helps to explain why the cooperative and second Section 199 differential is not statistically significant for Tables 6.10 and 6.15. The second cooperative differential detects differences between cooperatives and IOFs based upon the pre-policy differences; however, the differential does not calculate differences between the first policy period and the second. If local factors are causing the difference to widen in the after Section 199 was passed, but then, if this difference shrinks after the IRS letter rulings, the shrinking difference may not be detectable because the difference in the last policy period is measured against the difference in the pre-policy period. Thus, while it appears Section 199 may have had no effect in the regression results for Tables 6.10 and 6.15, it seems that it may have had an even larger effect than firms with competitors within 10 miles. This result matches the second hypothesis deduced from the cooperative model. A lack of spatial competition leaves more profits for patronage and, thus, an increase in the size of the tax cut caused by the passing through of Section 199. This larger tax cut means an even greater decrease in the price for cooperatives after 2008 and an even greater increase in the price of IOFs after 2008. Thus, a greater widening of

[44] Both the 4 cent difference and the 7.4 cent difference are significant at the 10% using an F-test.

the basis differential of cooperatives and IOFs for elevator locations that do not have a competitor within 10 miles than locations that do.

CONCLUSION

Section 199 remains an important policy in the U.S. grain marketing landscape. The histrionics of 2017 notwithstanding, Section 199 is also a relatively significant policy that has largely been unremarked on by economists. This thesis is the first systematic work analyzing the impacts of Section 199 and the management responses by firms directly affected by the policy—cooperatives—as well as privately owned firms, which are indirectly affected through market competition.

As I show both with theoretical modeling of cooperative behavior and empirical price analysis, Section 199 legislation has had important price-distorting effects in the U.S. grain marketing landscape. That is, because Section 199—especially after the 2008 IRS letter rulings—provided a disproportionate marketing advantage to cooperatives over independently-owned firms, I show that one or both types of firms altered their price management strategies. Specifically, I use a difference-in-difference analysis to measure possible changes in the price spread between cooperatives and non-cooperatives for winter wheat markets in Nebraska and Kansas caused by Section 199 and its complementary IRS letter rulings. The analysis shows that Section 199 itself may not have caused a divergence in basis spreads between cooperatives and non-cooperatives; however, the IRS letter rulings that increased the value of Section 199 to the patrons of agricultural cooperatives may very well have. This thesis finds that the IRS letter rulings are associated with an increase in the price spread between cooperatives and non-cooperatives of roughly 5 cents on average.

Because prices provide critical market signals for grain producers and elevator managers, the distortions may affect the effectiveness and efficiency of operations in U.S. grain markets. Therefore, I provide the first evidence that, even though Section 199 may very well have created real, tangible benefits for farm businesses and cooperatives, these benefits to cooperatives and their patrons also may have come with costs in the form of distorted prices.

It is important to note that while there is strong and robust evidence of price-distorting effects of Section 199, the full welfare effects of Section 199 on all parties—producers and processors, cooperatives and private firms, and taxpayers—is difficult to assess without additional patronage and grain sales data. It may be the case that Section 199—on net—is indeed welfare enhancing, as a simple supply-and-demand undergraduate tax analysis would suggest. However, an important question needs to be raised as well: Who gets the benefits? Rogers and Sexton (1994) present evidence of oligopsonies in multiple agricultural markets. Saitone et al (2008) find that in regards to the Renewable Fuels Standard farm businesses may only receive 25% of the subsides. If Section 199 and its IRS letter rulings do indeed weaken the basis offered cooperatives, then part of the tax break may be flowing back to cooperatives in the form of lower prices. This is especially true in local markets served by a few or perhaps only one grain marketing firm. I find that elevators without a competitor within 10 miles experienced a wider price spread between cooperatives and non-cooperatives after the IRS letter than elevator locations with at least one competitor within 10 miles. If some of the benefits of Section 199 are flowing back into cooperatives, then future research may be needed to

explore how cooperatives are investing their funds and whether these investments truly benefit their members.

This work also provides important new insights for economists conducting policy and marketing research of cooperatives. While several authors have explored the relations of taxes to the net present values of producers' equity in cooperatives (Junge and Ginder, 1986; Royer, 1987; Royer, 2001; Kenkel, Boland, Barton, 2014), this thesis is the first work to develop a theoretical model that includes the tax on cooperatives' qualified patronage and empirically assesses how changes in the tax rate affect cooperatives' price bidding behaviors. Regardless of the accounting profitability of the farm business, farm businesses must always pay income taxes on their received qualified patronage. If farm businesses incorporate patronage payments into their decision making, then the tax on qualified patronage becomes, in effect, a tax on output. The increase in the price spread between cooperatives and non-cooperatives after the IRS letters increased the effective size of the Section 199 deduction provides evidence in support of the output tax. Any future work that assesses cooperatives' management decisions needs to account for the effects of the patronage tax.

More broadly, this thesis is also one of the only empirical works—along with Katchova (2010)—that assesses differences in price bidding behaviors by cooperatives and independently-owned grain marketing firms. The possibility of patronage payments from cooperatives means that cooperatives and IOFs provide benefits in distinct manners to farm businesses. These differences should be reflected in prices. This thesis finds that before any policy changes cooperatives on average were offering almost 9 cents less than

IOFs. This difference in price raises questions about the theoretical hypothesis that cooperative patronage payments should be zero in the long-run (LeVay, 1983b; Sexton, 1984). It may be that grain marketing cooperatives use capacity levels, producer expectation models (Royer and Smith, 2007), or some combination of the two to create positive patronage payments in the long-run.

Finally, it should be noted that Section 199 and its letter rulings are still in effect today. This policy continues to affect grain markets and the 2017 controversy over Section 199A revealed that cooperative lobbying groups continue to have strong influence on policy makers. Policy makers, however, need to be informed of the full costs and full benefits of their decisions. The results of this thesis add a dose of reality to the benefits-only arguments of Section 199 proponents, and will hopefully lead to more enlightened debate when another version of Section 199A or other similar tax incentive policies are proposed in the future.

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APPENDICES

APPENDIX A

RESULTS OF EMPIRICAL ROBUSTNESS CHECKS

A.1: Drop Section 199: IRS

Variable	Model
Cooperative	0.088***
	(0.031)
Cooperative & Section 199: Law	-0.025
	(0.025)
Intercept	0.509***
	(0.035)
R-Square	0.722
Observations	72715

Note: Model is the same as the state-by-year fixed effects model as used in Table 6.6, except for the dropping of all differentials including Section 199: IRS. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

A.2: Drop Section 199: Law

Variable	Model
Cooperative	0.089***
	(0.032)
Cooperative & Section 199: IRS	-0.040**
	(0.019)
Intercept	0.507***
	(0.035)
R-Square	0.723
Observations	72715

Note: Model is the same as the state-by-year fixed effects model as used in Table 6.6, except for the dropping of all differentials including Section 199: Law. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

A.3: Section 199: IRS: Lead	
Variable	Model
Cooperative	-0.088***
	(0.031)
Cooperative & Section 199: Law	0.003
	(0.030)
Cooperative & Section 199: IRS	-0.039
	(0.025)
Intercept	-0.508***
	(0.035)
R-Square	0.723
Observations	72715

Note: Model is the same as the state-by-year fixed effects model as used in Table 6.6, except that Section 199: Law ends in 2006 and Section 199: IRS starts in 2007. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

A.4: Section 199: IRS: Lag	
Variable	Model
Cooperative	-0.088***
	(0.031)
Cooperative & Section 199: Law	-0.006
	(0.030)
Cooperative & Section 199: IRS	-0.049**
	(0.023)
Intercept	-0.508***
	(0.035)
R-Square	0.723
Observations	72715

Note: Model is the same as the state-by-year fixed effects model as used in Table 6.6, except that Section 199: Law ends in 2009 and Section 199: IRS starts in 2010. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

APPENDIX B

DERIVATION AND SIMULATION RESULTS OF LONG-RUN PRICE AND DIVIDEND

Price Derivation and Simulations

(B.1) $P_1 = C'(\bar{Q})$

(B.2) $P_2 = (NARP - P_1) * t + C'(\bar{Q})$

(B.3) $P_2 = \left(NARP - C'(\bar{Q})\right) * t + C'(\bar{Q})$

(B.4) $P_3 = (NARP - P_2) * t + C'(\bar{Q})$

(B.5) $P_3 = C'(\bar{Q}) + \left(NARP - C'(\bar{Q})\right) * t + (NARP - C'(\bar{Q})) * t^2$

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(B.6) $P_i = (NARP - P_{i-1}) * t + C'(\bar{Q})$

(B.7) $P_i = \frac{NARP * t + C'(\bar{Q})}{1+t}$

B.1: Price Long-Run Equilibrium: Simulations			
NARP	100	100	100
Marginal Cost	80	80	80
Tax	0.1	0.5	0.75
Price	Tax: 10%	Tax: 50%	Tax: 75%
P_1	80.000	80.000	80.000
P_2	82.000	90.000	95.000
P_3	81.800	85.000	83.750
P_4	81.820	87.500	92.188
P_5	81.818	86.250	85.859
P_6	81.818	86.875	90.605
P_7	81.818	86.563	87.046
P_8	81.818	86.719	89.716
P_9	81.818	86.641	87.713
P_{10}	81.818	86.680	89.215
P_{11}	81.818	86.660	88.089
P_{12}	81.818	86.670	88.933
P_{13}	81.818	86.665	88.300
P_{14}	81.818	86.667	88.775
P_{15}	81.818	86.666	88.419

Note: NARP is net average revenue product. Price in period one is equal to marginal cost (equation (B.1)). Price in each successive period is defined as NARP minus the previous period's price, both multiplied by the tax rate, plus marginal cost (equation (B.6)).

Dividend Derivation and Simulations

(B.8) $D_1 = NARP - C'(\bar{Q})$

(B.9) $D_2 = NARP - C'(\bar{Q}) - D_1 * t$

(B.10) $D_2 = NARP - C'(\bar{Q}) - (NARP - C'(\bar{Q}) * t$

(B.11) $D_3 = NARP - C'(\bar{Q}) - D_2 * t$

(B.12) $D_3 = NARP - C'(\bar{Q}) - \left(NARP - C'(\bar{Q})\right) * t - \left(NARP - C'(\bar{Q})\right) * t^2$

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(B.13) $D_i = NARP - C'(\bar{Q}) - D_{i-1} * t$

(B.14) $D_i = \frac{NARP - C'(\bar{Q})}{1+t}$

Table B.2: Dividend Long-Run Equilibrium: Simulations			
NARP	100	100	100
Marginal Cost	80	80	80
Tax	0.1	0.5	0.75
Dividend	Tax: 10%	Tax: 50%	Tax: 75%
D_1	20.000	20.000	20.000
D_2	18.000	10.000	5.000
D_3	18.200	15.000	16.250
D_4	18.180	12.500	7.813
D_5	18.182	13.750	14.141
D_6	18.182	13.125	9.395
D_7	18.182	13.438	12.954
D_8	18.182	13.281	10.284
D_9	18.182	13.359	12.287
D_{10}	18.182	13.320	10.785
D_{11}	18.182	13.340	11.911
D_{12}	18.182	13.330	11.067
D_{13}	18.182	13.335	11.700
D_{14}	18.182	13.333	11.225
D_{15}	18.182	13.334	11.581

Note: NARP is net average revenue product. Dividend in period one is equal to NARP minus marginal cost (equation (B.8)). Dividend in each successive period is equal to NARP minus marginal cost minus the previous period's dividend multiplied by the tax rate (equation (B.14)).