Governance and Performance in the U.S. Agri-Food Industry:

A Comparative Study of Firms and Cooperatives

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Selected Paper prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, Boston, Massachusetts, July 31-August 2

Abstract: This paper presents a unique descriptive and empirical study of governance and performance in the U.S. agri-food industry with specific emphasis on the boards of directors of firms and cooperatives. Per the summary statistics, the average firm has more assets, more sales, and more profits, yet efficiency and profitability ratios indicate the average cooperative is superior. Using seven board and management characteristics, a three-stage least squares model is specified for two samples of 128 firms and 456 cooperatives in order to address the hypothesized endogenous nature of the governance-performance relationship. For the cooperative sample, the impact of board size on performance is estimated to be negative, while female directorship, director independence, and director ownership have a positive and significant causal relationship to various proxies of performance. Overall, in relation to financial performance, governance as proxied by board and management characteristics is concluded to be more impactful for the cooperative sample, which implies a significant difference between corporate and cooperative governance.

Keywords: governance, agricultural cooperative, three stage least squares, comparative study.

JEL Codes: Q13, Q14, Q15.

I. Introduction

Although the U.S. economy is considered to be advanced and industrialized, the agri-food industry continues to be substantial in terms of production. Between 2000 and 2013, the GDP share of the agri-food industry increased from 3.55% to 3.64% (Bureau of Economic Analysis).[1] The agricultural sector in particular showed a strong growth from 0.96% of GDP in 2000 to 1.35% of GDP in 2013.

While the relative share of the agri-food industry has not changed much, the organization and coordination of its value has evolved. Traditionally, the spot market served as the main mechanism for the exchange of agricultural commodities, but over time increasingly more value is coordinated by means of other market arrangements (James et al., 2007). Contracting in particular is on the rise, from 11% in 1969 to 41% and 39% in 2005 and 2008, respectively (MacDonald and Korb, 2011). Meanwhile, the 4.3% decrease in the total amount of farm operations and the 3.8% increase in the average farm size between 2007 and 2012 is further indication of the increasing commercialization and industrialization of U.S. agriculture (USDA, 2014).

The decreasing use of the spot market implies the separation of control and ownership is increasing, in particular in food manufacturing and food retail, which are both characterized by a high degree of concentration (McCorriston, 2002). As ownership is claimed by landlords and investors (asset owners) and control is delegated to managers and directors (non-asset owners), governance of the input-output process is of utmost importance to optimize both ex-ante investment and ex-post allocation (Kim and Mahoney, 2005).

[1] Here, the agri-food industry comprises agriculture, food and beverage manufacturing, and food and beverage retail. Food and beverage wholesale is not included due to lack of disaggregation. Additionally, a substantial amount of food retail is included in the general retail category, which includes Wal-Mart and other large multi-product retailers.

Of course, the matter of governance is most applicable to the investor-owned firm (IOF), for which the separation of control and ownership is absolute or near-absolute.[2] However, the firm is merely one organizational form on the market-hierarchy spectrum (Williamson, 1991). Of particular interest to this study is the cooperative, which is considered to be a hybrid organizational form (Menard, 2007). Although the total number of agricultural cooperatives fell from 3,338 in 2000 to 2,186 in 2013 (-34.5%), the cooperative form is still prominent in the agri-food industry, primarily at the production stage.[3] Between 2000 and 2013, total revenue of all agricultural cooperatives rose from $120.7 billion to $246.1 billion, an annual increase of almost 8%, far surpassing the GDP growth rate (USDA, 2014).

As the cooperative is both owned and controlled by its member producers, its ownership structure is different in comparison to the firm (Chaddad and Cook, 2004).[4] Furthermore, the objectives of the firm and the cooperative are also different. While profit maximization is generally the only true objective of firm shareholders, member producers have a dual relationship with the cooperative as both suppliers and transactors (Feng and Hendrikse, 2012). Consequently, the cooperative balances input cost minimization and output return maximization, which are mutually exclusive.[5] Hence, given the

[2] The classic firm is represented by the pure principal-agent relationship in which the principal has the right to claim profits and the agent has the right to make decisions for a set wage. However, in practice, control and ownership are sometimes not fully separated as the agent has partial ownership or the principal has partial decision authority. In fact, the nature and impact of the agent as owner and the principal as controller is further explored later in the paper.

[3] Cooperatives are also common in the housing sector, the credit sector, the energy sector, the insurance sector, and the retail sector. While similar in ownership structure, such cooperatives are not producer-owned but rather employee-owned (Hyvee) or customer-owned (Puget Consumers Cooperative).

[4] The separation of control and ownership in the classical cooperative is minimal. The primary focus in this paper is on the non-classical cooperative in which control is delegated to management. For a detailed discussion of ownership structures of different types of cooperatives see Chaddad and Cook (2004).

[5] To be clear, to the cooperative input is the product supplied by its members, and output is the product sold to its customers. Since input is the output and output is the input, the cost of the former and the return of the latter cannot both be optimized.

differences in structure and objective, the principal-agent relationship in the firm and the principal-agent relationship in the cooperative are not identical (Hendrikse, 2007).

This paper investigates the relationship of governance to performance in agri-food firms and cooperatives, where governance is to be understood as the system of mechanisms used by the principal to ensure the agent generates a return on investment (Shleifer and Vishny, 1997).[6] The importance of governance is manifested in the grand number of public scandals. In 2014 alone, Wal-Mart and GlaxoSmithKline faced bribery scandals in Mexico and China, respectively, and Tesco, the largest retailer in the United Kingdom, experienced a massive accounting scandal which facilitated a 14% decrease in its share price.[7,8] While not as visible in the news, poor governance is also evident in cooperatives (Richards and Manfredo, 2003; Fulton and Giannakas, 2007). Interest in the governance of cooperatives is also spurred by increased competition in the agri-food sector (Bijman et al., 2013). Additionally, the internal governance of large cooperatives is often compared to corporate governance, which raises the question how identical the two are (Bijman et al., 2014).

After control is delegated, what is done to ensure the agent cannot misallocate the asset? Perhaps the primary mechanism for the principal is the board of directors, which is generally perceived as the intermediary in the principal-agent relationship (Van den Berghe and Levrau, 2004). There is continued interest in the optimal size (Coles et al., 2008), diversity (Gul et al., 2011), independence (Bertoni et al., 2014), and other characteristics of the board. Considering its importance, this paper investigates if variability in the performance of agri-food firms and agri-food cooperatives is explained by such board

[6] This definition of governance is different from the definition in transaction cost theory, where governance is interpreted as the full input-output coordination of a given transaction.

[7] China fined GlaxoSmithKline $490 million.

[8] The 14% decrease is based on trading between September 19, the Friday before the first report of the accounting discrepancy, and December 31. The share price decreased from £2.29 to £1.89.

and management characteristics. Also of interest is the comparative impact of corporate and cooperative governance.

Two important contributions to the literature are noteworthy. First, as compared to the mean cooperative, the raw performance of the mean firm is far superior. However, when incorporating the amount of total assets and total equity to measure efficiency (return on assets) and profitability (return on equity), the mean firm is discovered to be inferior to the mean cooperative. This finding is contrary to the common perception of the inefficient cooperative (Pasour and Rucker, 2005), suggesting the cooperative is the optimal mode of organization, at least in the upstream part of the value chain.

Second, cooperative governance is not identical to corporate governance. In terms of demographics, the only board and management characteristics which are not significantly different for firms and cooperatives are size and CEO tenure. Empirically, the causal impact of corporate and cooperative governance on various proxies of performance is also different. For example, after controlling for endogeneity, the impact of female directorship has a positive impact on the financial performance of cooperatives, while the reverse applies to firms. There are also similarities, such as the negative impact of director tenure and the positive impact of director ownership, although parameter magnitudes are often stronger for the cooperative sample. Overall, the Z-score method supports the ex ante assumption of dissimilarities in corporate and cooperative governance.

The remainder of the paper is structured as follows. Section II provides a brief overview of the recent relevant literature. Section III discusses the data on agri-food firms and cooperatives as well as the descriptive analysis. The methodology is explained in section IV, and results of the ordinary least squares

and three-stage least squares regressions are presented in section V. Section VI contains the summary and the conclusion.

II. Literature Review

A. Agency Theory

At its essence, the principal-agent relationship is about one party acting on behalf of another (Shapiro, 2005). In economics, the agency relationship, which involves the separation of finance and management or the separation of control and ownership by transferring some part of the decision authority to the agent, is most often analyzed in the context of the owners and the managers of the firm (Fama and Jensen, 1983). Per the contract, asset control is delegated by the asset owner to the non-asset owner, who agrees to pursue profit maximization. However, if information is imperfect and expensive, and if each individual is rational and self-interested, then the principal is constrained by hidden information as well as hidden action. Ex ante, the profit-maximizing parameters of the principal may not correspond to the utility-maximizing parameters of the agent, and ex post, the utility-maximizing action of the agent may not correspond to the profit-maximizing action for the principal.

B. Contracting

The primary mechanism to combat the agency problem is the contract, which serves to allocate value, uncertainty, and decision authority (Sykuta, 2012). According to complete contract theory, the optimal contract features a full state-contingent plan as based on perfect information (Wu, 2014). By contrast, incomplete contract theory posits the optimal contract balances ex ante completeness and ex post

Pareto efficiency with a combination of incentives and contingencies.[9,10] Regardless of ex ante optimality, ex post randomness has potential to relegate the predetermined combination of effort and performance to the world of probability in which incentive misalignment is fact. Moreover, as observed by Fukunaga and Huffman (2009), contract optimality is further complicated by heterogeneity in the risk attitudes, abilities, and reservation wages of principals and agents.

C. The Governance-Performance Relationship

Given contractual incompleteness, the primary method to limit or minimize ex post opportunism is to monitor behavior, which is precisely the objective of the board of directors. Considering its mediating role in the principal-agent relationship, the board captures the interest of both officials and researchers. For example, U.S. Congress passed the Sarbanes-Oxley Act in 2002 in order to improve corporate governance, and there is no shortage of empirical research on its implicit and explicit impact on firm performance.[11]

Regarding board size, there are three perspectives of its impact on firm performance. The first perspective is positive: each director increases the amount of available information for both owners (monitoring) and managers (advising). By decreasing the two-way asymmetry of information, a larger board is assumed to have a larger positive impact on firm performance via interest alignment. Evidence

[9] The primary purpose of incentives is to align interests. Ex ante, the indifference curve of the agent regarding the consumption of work and leisure is suboptimal to the principal. As such, incentives reshape the indifference curve so that work consumption by the agent is optimal to the principal.

[10] In incomplete contract theory, the optimal degree of (in)completeness is where the marginal benefit of adding a contingency is equal to the marginal cost of the contingency times its probability.

[11] The Sarbanes-Oxley Act of 2002 served as a response to major scandals, including Enron, Worldcom, Adelphia, and other firms. In terms of its purpose, to improve governance is to improve investor protection by decreasing the asymmetry of information vis-à-vis shareholders, which is supported by the idea improved ex post profit allocation incentivizes ex ante investment.

in favor of the positive relationship is provided by Cheng (2008), who discovered the variability of performance is less when board size increases, as well as Larmou and Vafeas (2010), who studied a sample of firms with a history of poor performance and found increases in share price corresponded to increases in board size. The second and more common perspective is negative: the marginal director increases the cost of coordination and communication. As the number of skills, opinions, interests, and activities in the boardroom increases, the board will need more time to make decisions. Furthermore, size exacerbates the potential free rider problem as each individual contribution to monitoring is not observed. Both Bennedsen et al. (2008) and Guest (2009) observed a negative impact of board size on firm performance in Denmark and England, respectively. Yet another perspective is offered by Coles et al. (2008), who suggested the relationship of board size to firm performance is U-shaped, thus implying a very small or a very large board is optimal.

Another board characteristic of much societal and academic interest is the gender diversity of the board, as evidenced by board gender mandates in Spain, France, Norway, Iceland (all 40%), Italy (one third), Belgium, and the Netherlands (both 30%). Quotas are implemented not only in the interest of equality, but also governance and performance, where the female director is expected to add diversity in skills and opinions to the male-dominated board. Adams and Ferreira (2009) conducted a comprehensive study of the impact of female directors. The authors concluded the direct impact on performance to be ambiguous, while director attendance and CEO compensation are raised and lowered, respectively, by the addition of female directors. A similar conclusion is reached by Miller and Triana (2009), who also studied the mediators of the gender diversity to firm performance relationship. In Denmark, Rose (2007) discovered no impact of gender diversity on firm performance, and Carter et al. (2010) also found firm performance to be unaffected by board composition for S&P 500 firms. Ahern and Dittmar (2012) conducted an event study in Norway, which first introduced a gender mandate in 2003. When

comparing the sample of pre-quota firms to the sample of post-quota firms in Norway, the authors concluded the quota only worked to decrease the average age and experience of the board, as well as to decrease overall performance in comparison to firms in Sweden, Finland, and the U.S.

Together with size and gender diversity, "director independence continues to serve as the metaphorical lightning rod in corporate governance debates" (Dalton and Dalton, 2005). Ideally, in order to best mediate the principal-agent relationship, the director has no inside relationship with either the principal or the agent. In particular a direct connection with management is believed to negatively impact the incentive to advise and monitor. While board independence is associated with increased diversity in skills and resources, the decision making process is likely to be slower and less efficient. In Chile, Lefort and Urzua (2008) found a positive impact of board independence on firm value, yet Bhagat and Bolton (2008) noticed a negative relationship of board independence to firm performance in the U.S. Another type of relationship is uncovered by Ramdani and Witteloostuijn (2010), who determined board independence is not beneficial for low- and high-performing firms, yet positive for firms in the 0.3-0.7 percentile.

As evidenced by the cited sample of studies, the relationship of governance to performance is all but conclusive. Furthermore, almost every study recognizes the problem of endogeneity in the governance-performance relationship (Raheja, 2005; Boone et al., 2007; Linck et al., 2008; Schultz et al., 2010). Wintoki et al. (2012) discussed three types of endogeneity: (i) dynamic endogeneity, (ii) simultaneity, and (iii) unobserved heterogeneity. In addition to simultaneity, Roberts and Whited (2012) also discussed the impact of omitted variables and measurement error. Both Wintoki et al. (2012) and Roberts and Whited (2012) explained how OLS estimation, which assumes orthogonality of the

predictors to the errors, causes parameter estimates to be biased and inconsistent. Robust estimation of the governance-performance relationship thus necessitates the use of advanced empirical techniques.[12]

D. Cooperative Theory

Compared to firms, "peculiarly little attention has been spent on understanding the role of cooperatives and other non-corporate forms of organization" (Holmström, 1999). Yet, considering its long and continued relevance in the U.S. and elsewhere, Hansmann (1999) refused to consider the cooperative a peripheral or incidental organizational form.

Historically, the foremost reason for individual farm producers to engage in group action is some type of market failure. The most common type of market failure in the agri-food industry is monopsony, where a below-competitive price is offered at the downstream stage.[13] Individually, the bargaining power of farm producers vis-a-vis the monopsonist is limited, and the relationship is likely characterized by great asset specificity and both lock-in and hold-up problems. Hence, group action is justified by the exposure to rent appropriation by the monopsonist. The purpose of the classical cooperative is therefore to "defend the economic position of the patron relative to upstream or downstream transactors" (Cook and Plunkett, 2006). As a defense-oriented cooperative, its objective is to set a benchmark for the monopolist or monopsonist, to force honesty (Hogeland, 2006). In particular at the beginning, the cooperative is thus viewed as an extension of the farm with a general objective to decrease the market price of inputs or to increase the market price of outputs (Soboh et al., 2009).[14]

[12] Endogeneity is further discussed in the methodology section.

[13] Local and regional monopolies are also not uncommon in the agri-food sector. Farm producers often face a single seller of seed, feed, fertilizer, or other inputs, which warrants the formation of supply cooperatives.

[14] A look at the current landscape is telling of how many cooperatives are not seeking to set benchmarks for non-cooperatives. On the contrary, many cooperatives are apparently in pursuit of market domination (Cook, 1995).

As member-owned and member-controlled organizations, cooperatives face a "balancing act in terms of serving the needs of both the member and the business" (Harris et al., 1996). For example, the provision of input at cost is in the interest of the member but not in the interest of the cooperative. Generally, the CEO must choose between maximizing profit for the member and maximizing profit for the cooperative (Fulton and Giannakas, 2007). The problem of purpose ambiguity is exacerbated in the large cooperative with a diverse portfolio of interests and activities. Staatz (1987) observed "the manager may face discontented stockholders no matter what he or she decides", and Cook (1994) argued the manager of a cooperative must be comfortable with vagueness and complexity. Empirical evidence is delivered by Hernandez-Espallardo et al. (2013), who discovered member satisfaction is a function of both price, a neoclassical theory variable, and the ability of the cooperative to offer specified asset protection , which is a transaction cost theory variable.

The duality of purpose has consequences for the governance of the cooperative. Compared to the corporate board, it is typically more difficult for the cooperative board to monitor managerial behavior (Spear, 2004). In addition, there is no external pressure on management as the cooperative has no stock market presence (Cornforth, 2004). Finally, when considering the fact decision authority is often delegated to "decision specialists who are not residual claimants" (Vitaliano, 1983), ex post opportunism is a realistic problem to the governance of the cooperative.

Examples of offense-oriented cooperatives with large market shares are CHS (mixed), Dairy Farmers of America (milk), Land O' Lakes (butter), Ocean Spray (cranberries), and United Sugars Corporation (sugar).

III. Data

Two cross-sectional data sets are used to facilitate the comparison of agri-food firms and cooperatives. Secondary data is adopted from Burress et al. (2011; 2012) who surveyed the top 1,000 U.S. farmer, rancher, and fishery cooperatives in 2009. The survey yielded a total of 460 observations of board size, board independence, board gender diversity, director tenure, director ownership, and other governance characteristics. Overall, the sample comprises 265 marketing cooperatives, 184 supply cooperatives, and 11 service cooperatives. As illustrated by Table 1, the sample is representative of the full population, although marketing cooperatives and service cooperatives are somewhat over- and underrepresented, respectively (USDA, 2009). The survey data is augmented by financial data (net revenue, net income, assets, liabilities, equity) from USDA. As such, the full set is rather unique as cooperatives are not obligated to disclose information to the public.

The second set mirrors the first, but for firms. Generally, much more information is available on firms, but data collection is limited to facilitate comparison. The population is the total of U.S. public agri-food businesses in the year 2009.[15] The first part entailed extracting the full listing of public companies from the Compustat North America database, which yielded 10,986 observations. Next, the list is sorted by SIC code in order to only include agri-food sectors, which left 280 observations.[16] Another 152

[15] The populations of the first and the second set are different in terms of ownership type as well as operation. The first set comprises cooperatives at the upstream stages (input and production), while the second set comprises firms at all stages of the agri-food chain, from input to output at the retail stage. Although the first set lacks observations of retail cooperatives, retail firms are included to facilitate comparison by supply chain stage, as further explained in the empirical specification.

[16] The following three-digit SIC codes are included: 1 (agricultural production – crops), 2 (agricultural production, livestock), 7 (agricultural services), 8 (forestry), 9 (fishing), 20 (food manufacturing), 201 (food manufacturing – meat products), 202 (food manufacturing – dairy), 203 (food manufacturing, fruits and vegetables), 204 (food manufacturing – grain), 205 (food manufacturing – bakery), 206 (food manufacturing – confectionery), 207 (food manufacturing – fats and oils), 208 (food manufacturing – beverages), 209 (food manufacturing – miscellaneous), 514 (wholesale trade – groceries), 515 (wholesale trade – farm products), 54 (retail trade – food stores), 541 (retail

observations are removed for the following reasons: (i) 43 observations on the Canadian stock market, (ii) 64 observations with no primary operations in the U.S., (iii) 4 observations with no primary operations in the agri-food industry, (iv) 28 observations with no stock market presence in 2009, (v) 7 observations with revenue below $1 million, and (vi) 6 observations with missing information.[17,18] The final sample comprises 128 agri-food firms. The second part consisted of perusing SEC filings to get all the comparable governance data. The 10-K form served as the first option, but many firms instead presented information on the board of directors in the definitive proxy statement 14A.

Summary statistics of firm and performance characteristics are presented in panel A of Table 2. In terms of sheer volume, each income statement item is much greater for both the mean and the median firm. The median firm has just over $1 billion in revenue, while the median cooperative has almost $54 million. Net income for the median firm is almost nineteen times as large as for the median cooperative. The discrepancy in revenue and net income is in part explained by the balance sheet, which illustrates the mean firm has over $4.5 billion in total assets, approximately 62% of which is financed by debt. By comparison, the mean cooperative has under $90 million in total assets, the majority of which is equity-funded. For both firms and cooperatives, the mean is greater than the median, which suggests both samples are characterized by non-normal distribution with large outliers in the right tails. When observing the financial ratios, it is somewhat surprising to note both the mean and the median firm are

trade – grocery store), 542 (retail trade – meat and fish), 543 (retail trade – fruits and vegetables), 544 (retail trade – confectionery), 545 (retail trade – dairy), and 546 (retail trade – bakery).

[17] Although the agricultural market is assumed to be well-integrated, in particular the American-Canadian market, non-U.S. observations are deleted in order to facilitate the best possible comparison of firm governance and cooperative governance. Inclusion of such observations raises the chance variability in performance is explained by cross-country differences in income, population, and other variables.

[18] The seven observations with less than $1 million in revenue are deleted because of the large disproportionate impact on the sample. These observations are primarily of firms in the development stage with low revenue, negative income, substantial debt, and low equity. The exclusion of these observations likely contributes to a better empirical estimation. Also, to achieve consistency, observations with less than $1 million in revenue in the sample of cooperatives are also deleted. There are four such observations, so the final sample comprises 456 observations.

outperformed by the mean and the median cooperative. Return on sales (ROS) for the median firm and the median cooperative is the only exception.[19] T-tests for all financial and organizational characteristics in panel A indicate the null hypotheses of no mean difference are rejected at the 95% confidence level.

Panel B presents the summary statistics of the governance characteristics. Of first interest is board size, which is almost identical for the mean firm (9.09 directors) and the mean cooperative (9.07 directors). Indeed, the t-test confirms the means of the two samples are not significantly different. However, there exist significant differences in terms of diversity and independence. The mean cooperative only has 0.07 outside directors and 0.13 female directors on its board. Of all cooperative board directors in the sample, only 0.53% are independent and 1.36% are female. The comparable percentages are 68% and 13%, respectively, for the corporate board directors. A few general observations are to be made: (i) the boardroom of the mean cooperative is dominated by men with inside relationships, (ii) the mean corporate board is more diverse and independent as compared to the mean cooperative board, and (iii) women are outnumbered approximately 1 to 100 in both samples. On average, the cooperative director is eight years younger and has served one year longer, although the difference in director tenure is not characterized by statistical significance. The chairman of the mean cooperative, however, is not as tenured as his counterpart (6.49 to 9.28 years). The reverse is true for CEO tenure, which is higher for the mean cooperative (10.46 years) as compared to the mean firm (8.31 years). The total share of equity ownership by board directors of the mean firm is 25%.[20] The comparable figure is 10% for the mean cooperative, which implies the nominal financial investment of the mean corporate director is greater,

[19] The means and the medians of the financial ratios are based on the ratios of the individual observations, not the full sample. For example, the reported mean ROE is the mean of all ROE ratios, not the mean of cumulative net income divided by cumulative total equity, which explains why ROS is negative and ROA and ROE are positive for the firm sample.

[20] The percentage includes the equity ownership of both directors and executives as reported under the item Security Ownership of Directors and Executive Officers in either the 10-K form or the definitive proxy statement 14A. Full disaggregation of the total percentage by individual is often not reported. It is assumed the inclusion of executive equity ownership has no detrimental impact on the descriptive or empirical analysis.

especially when considering the profit and dividend of the mean firm.[21,22] The mean corporate board delegates more responsibility to committees. The mean firm has 3.43 committees, and the mean cooperative has approximately two. As predicted by theory, the data imply control of the cooperative is at the mean to a large extent retained by its member patrons via the board of directors. Except for board size, director tenure, and CEO tenure, the null hypothesis of no mean difference is rejected for each governance characteristic at $\alpha = 0.01$.

In addition to ownership and governance, another difference for firms and cooperatives is vertical coordination. Generally, the two samples represent two halves of the supply chain spectrum, where cooperatives are primarily operational in the upstream stages, input and production, and firms are primarily operational in the downstream stages, manufacturing and retail (see Table 3).[23] Few cooperatives are retailers (2 of the 456), and few firms are input suppliers (7 of the 128).[24] Furthermore, 57% of the cooperatives are characterized by vertical integration as compared to only 13% of the

[21] The matter of cooperative equity is not straightforward. Typically, equity contribution is based on patronage; a 20% share of patronage corresponds to a 20% share of equity. There is no public market for share trading, which implies ownership is fixed. However, outside investment in the cooperative is often accomplished by means of subsidiaries. To what extent the percentage in this sample reflects ownership in the cooperative and ownership in any subsidiaries is unclear.

[22] While the nominal financial investment of the mean corporate board director is larger, the literature recognizes the relative financial investment of the mean cooperative board director is in fact likely to be larger considering the dual role of supplier and transactor (Chaddad and Cook, 2004; Van der Krogt et al., 2007). Furthermore, the average investor has a diverse portfolio, while the majority of the wealth and income of the average member producer is tied to a single cooperative.

[23] For the agri-food chain, the input stage is comprised of all farm inputs: feed for livestock producers, seed and herbicide for crop producers, bull semen for dairy producers, et cetera. Production refers to the cultivation of soil for the growing of crops (corn, sorghum, coffee) and the rearing of animals to provide food (milk, eggs, meat) and other products (wool, fuel, fertilizer). Manufacturing is the value-added physical or chemical transformation of raw food materials. Finally, retail is the sale of end products, whether produced or manufactured, to end consumers.

[24] The extremely low number of retailers in the cooperative sample is by design. The original survey targeted farmer, rancher, and fishery cooperatives, but farmers and ranchers and fishers are not likely to own retail organizations. Instead, non-firm retail organizations are often owned by private individuals or by employees (Hyvee and others), none of whom are categorized as farmers or ranchers or fishers. As such, the cooperative form is underrepresented at the retail stage.

firms.[25] The data allow two observations to be made: (i) the relatively high producer-to-manufacturer and producer-to-retailer ratios suggest the original purpose of the cooperative to improve the collective bargaining power of its member producers is still valid, and (ii) in comparison to firms, cooperatives are more diverse, although vertical integration is likely easier at the upstream part of the agri-food chain as food manufacturing and food retail are two distinct processes.

For a first crude analysis of the data, the correlation matrices of the firm sample and the cooperative sample are presented in panels A and B of Table 4, respectively. The included variables are eight governance and management characteristics and three performance characteristics. For the firm sample, included performance characteristics are return on assets (ROA), return on equity (ROE), and return on sales (ROS). Board size, director age, and director tenure show a positive significant correlation to ROA. Except for board diversity, which is positively correlated with ROS, no other governance characteristic is correlated with performance. Correlation is determined to be non-significant for ROE and each governance characteristic. The correlation coefficients of the governance characteristics hint at weak, moderate, and strong correlation for various combinations.[26,27] For example, the correlation of chairman tenure and CEO tenure is 0.71, and the correlation of director tenure and chairman tenure is 0.61. While perfect multicollinearity is not evident, caution is warranted for the empirical analysis. Generally, considering the size and significance of the coefficients, the estimation errors for the predictors are expected to be higher (and the t-statistic to be lower) than in the absence of correlation.

[25] For cooperatives, the determination of vertical integration is independent of the farm level. For example, a cooperative whose primary purpose is the supply of oil and fertilizer is not considered to be active in production even if its owners are all corn growers. However, vertical integration is applicable if the supply cooperative also operates a grain elevator to handle and market bulk corn.

[26] Weak correlation is < 0.2, moderate correlation is $0.4 < ... < 0.6$, and strong correlation is > 0.6.

[27] No cause-and-effect relationship is implied at this juncture.

As for the cooperative sample, included performance characteristics are ROA, ROE, and the extra-value index (EVI), which is to be discussed later. For the most part, performance has limited correlation to governance. Board size is correlated with ROA (-0.11), chairman tenure with ROE (-0.13), and director age with EVI (-0.12). Whether significant or not, each correlation coefficient for the performance and governance characteristics is negative, which is the complete opposite for the firm sample. Also, in comparison to the firm sample, there is much less correlation between the governance characteristics. The highest correlation coefficient is exhibited by director age and director tenure (0.31), which is not unexpected, and next by director tenure and chairman tenure (0.27), which again is not unexpected. Overall, the stronger correlation between the governance characteristics in the firm sample may complicate the comparative interpretation of the empirical data.

IV. Methodology

A. Variables

The criterion in this paper is performance or profitability, which for the stereotypical firm is best indicated by ROA and ROE, where the former and the latter are most relatable to efficiency and profitability, respectively. However, cooperative performance is not as straightforward. Because of differences in ownership and governance, cooperatives serve a dual purpose of maximization at the farm level and maximization at the cooperative level (Soboh et al., 2009; Feng and Hendrikse, 2012). Therefore, cooperative performance is rather subjective and ambiguous, suggesting ROA and ROE are not necessarily the best indicators. Hence, in addition to ROA and ROE, which are included to facilitate

the best possible comparison, cooperative performance is also proxied by the extra-value index (EVI) (Ling and Liebrand, 1998).[28]

Firm characteristics are also included to help explain the variation in performance (see Table 5). Size is given by the natural logarithm of total employees, as well as the natural logarithm of total assets. For the cooperative sample, the natural logarithm of total members is included as yet another dimension of firm size. Leverage is included to capture the respective impact of debt and equity. There are two types of fixed effects. The first type is the state of incorporation, given by one binary variable per state, to capture the impact of the local business environment, in particular the tax system. There are 16 and 12 states with zero observations in the firm sample and the cooperative sample, respectively. The second type is the sector, which is the three-digit SIC code for firms and the primary commodity sector for cooperatives.[29] Six SIC sectors have zero observations.

B. Endogeneity

The endogeneity problem is recognized as well as addressed by many recent studies of the governance-performance relationship (Raheja, 2005; Boone et al., 2007; Linck et al., 2008; Schultz et al., 2010; Wintoki et al., 2012). Of the various sources of endogeneity, other studies most often address simultaneity bias. This paper is no exception as the governance-performance relationship for both

[28] Extra-value index = (extra value / operating capital) x 100. Extra value = net operating margin (before tax) – interest on equity. Operating capital = fixed assets + net working capital. Net working capital = current assets – current liabilities.

[29] Translation of the commodity sector to the SIC code is possible, but almost all cooperatives would fall into SIC 1 (agricultural production – crops), SIC 2 (agricultural production, livestock), or SIC 7 (agricultural services), which would disregard the specific impact of, for example, dairy or cotton production on performance.

samples is assumed to be characterized by two-way causation.[30] Put differently, governance is hypothesized to impact performance, yet performance is also hypothesized to impact governance. For example, the addition of a board director can cause a -1% change in ROA, while the same -1% change in ROA can cause the replacement of the board chairman and the addition of a board committee. Which governance characteristics are exogenous or endogenous is discussed later in this section.

Formally, the general model to be estimated is as follows,

$$y = \alpha + \beta' x + \mu \quad (1)$$

where y is the criterion, x is the predictor, β is the parameter to be estimated, and μ is the stochastic term with mean zero and variance σ^2. Simultaneity bias is possible when the predictor and the stochastic term are correlated, $cov(x,\mu) \neq 0$, which violates the exogeneity condition. While the correlation of the predictor and the stochastic term is unobservable, the possible presence of simultaneity bias is likely to cause OLS estimates to be biased and inconsistent.

The most common solution to simultaneity bias is the instrumental variables (IV) method. The purpose of the IV method is to purge the endogenous predictor of its correlation with the stochastic term, thus allowing unbiased and consistent estimation of its causal impact on the criterion. The IV method requires the selection and inclusion of instruments, denoted by z, which must meet the relevance condition, $cov(z,x) \neq 0$, as well as the exclusion condition, $cov(z,\mu) = 0$ (Wooldridge, 2012). While the exclusion condition cannot be tested ex ante, the relevance condition is tested empirically by regressing the endogenous predictor on the instrument,

[30] The other sources of endogeneity, namely dynamic endogeneity, unobserved heterogeneity, and measurement error, are assumed to be inapplicable or unimportant to this data.

$$x = \alpha + \beta' z + \varepsilon \quad (2)$$

which is estimated via OLS with the null hypothesis H_0: $\beta = 0$.

C. Three-Stage Least Squares

Confronted by the biased and inconsistent nature of the OLS model as caused by the endogeneity problem, several studies used the two-stage least squares (2SLS) approach to allow robust inferences of the governance impact on firm performance (Filatotchev et al., 2005; Bartholomeusz and Tanewski, 2006; Black et al., 2006; Bhagat and Bolton, 2013). Other researchers used three-stage least squares (3SLS) in the same context (Beiner et al., 2006; Jackling and Johl, 2009; Mersland and Strom, 2009; Carter et al., 2010).

For two or more equations to be estimated simultaneously, 3SLS is characterized by greater asymptotic efficiency than 2SLS (Greene, 2012). The primary difference is 3SLS also addresses the error correlations across the system of equations. In stage one, each endogenous predictor is regressed on its instrument(s) and other predictors by means of OLS regression. Assuming there are two endogenous predictors and multiple exogenous predictors,

$$x_1 = \alpha_0 + \alpha_1 z_1 + \alpha_2 w_1 + \ldots + \alpha_k w_k + \varepsilon_1 \quad (3)$$

$$x_2 = \pi_0 + \pi_1 z_2 + \pi_1 w_1 + \ldots + \pi_k w_k + \varepsilon_2 \quad (4)$$

where x_i are the endogenous predictors, w_i are the exogenous predictors, z_i are the instruments, α_i and π_i, are the parameters to be estimated, and ε_i are the errors. In stage two, the fitted values for each endogenous predictor, $\hat{x}_1$ and $\hat{x}_2$, are substituted for its observed values in each regression,

$$\hat{x}_1 = \alpha_0 + \alpha_1 z_1 + \alpha_2 w_1 + \ldots + \alpha_k w_k + \varepsilon_1 \quad (5)$$

$$\hat{x}_2 = \pi_0 + \pi_1 z_2 + \pi_1 w_1 + \ldots + \pi_k w_k + \varepsilon_2 \quad (6)$$

To address the correlation of ε_1 and ε_2, the fitted values of the errors from the stage two regression are included as predictors in the stage three regression, which is given as

$$y = \beta_0 + \beta_1 \hat{x}_1 + \beta_2 \hat{x}_2 + \beta_3 w_1 + \ldots + \beta_k w_k + \tau_1 \hat{\varepsilon}_1 + \tau_2 \hat{\varepsilon}_2 + \mu_1 \quad (7)$$

where each symbol is as before, τ is the new parameter to be estimated, and μ_1 is the error. See Greene (2012) for a more technical discussion of the 3SLS approach.

D. Model Specification

Following Beiner et al. (2006), Jackling and Johl (2009), Mersland and Strom (2009), and Carter et al. (2010), this paper addresses the endogeneity of governance and performance by means of 3SLS. Using backward induction, the third-stage equation is specified as

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon_1 \quad (8)$$

where α is the intercept, x_1 is the vector of endogenous governance characteristics, x_2 is the vector of exogenous governance characteristics, x_3 is the vector of firm characteristics, x_4 is the vector of industry characteristics, β_i are the parameters to be estimated, and ε_1 is the stochastic term with mean zero and variance σ^2. As discussed before, y is ROA and ROE for the firm sample and ROA, ROE, and EVI for the cooperative sample.

The vector of endogenous governance characteristics, x_1, is for both samples comprised of seven variables: board size, board diversity, board independence, director tenure, chairman tenure, CEO tenure, and director ownership. One other board characteristic, board committees, is not considered to be endogenous in relation to performance.[31] Binary variables for each type of board committee, six for the firm sample and three for the cooperative sample, comprise the vector of exogenous governance characteristics, x_2.

Hence, in addition to equation (8), the complete system of first-stage equations is further defined as

$$\text{Board Size} = \alpha + \psi_1 z_1 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_2 \quad (9)$$

$$\text{Board Independence} = \alpha + \psi_2 z_2 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_3 \quad (10)$$

$$\text{Board Gender Diversity} = \alpha + \psi_3 z_3 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_4 \quad (11)$$

$$\text{Director Tenure} = \alpha + \psi_4 z_4 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_5 \quad (12)$$

$$\text{Chairman Tenure} = \alpha + \psi_5 z_5 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_6 \quad (13)$$

$$\text{CEO Tenure} = \alpha + \psi_6 z_6 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_7 \quad (14)$$

$$\text{Director Ownership} = \alpha + \psi_7 z_7 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_8 \quad (15)$$

[31] Instead, committee formation is believed to be impacted by firm size, which is often proxied by assets or employees.

where each symbol is as before, z_i are the vectors of instruments, and ψ_i are the parameters to be estimated. For each equation, the number of included endogenous predictors is no greater than the number of excluded exogenous predictors so as to satisfy the order condition (Wooldridge, 2012). Consequently, the vector makeup is different for each regression. The included predictors for each regression will be reported when and where appropriate.

E. Instruments

Ideally, economic logic and theory inform the selection and collection of multiple instruments which unequivocally meet the relevance condition and exclusion condition. However, in practice, "good instruments are both rare and hard to find" (Roberts and Whited, 2012). This statement is particularly true for the cooperative sample. Burress et al. (2011; 2012) did not originally intend to empirically test the governance-performance relationship and therefore did not consider the collection of instruments. Thus, the pool of possible instruments for the cooperative sample is shallow at best. By comparison, the selection of instruments for the firm sample is less constrained, though the statement by Roberts and Whited (2012) still applies.

The instruments, z_i, for the endogenous predictors in (9-15) are the following. First, following Wintoki et al. (2012), lagged performance serves as an instrument for each endogenous predictor. However, lagged performance is very likely to impact current performance, which violates the exclusion restriction. Therefore, current performance is first regressed on lagged performance by means of OLS to see how many significant lags should be used as predictors in (8) and how many non-significant lags should be used as instruments in (9-14). As indicated in Table 6, the number varies by sample and by performance characteristic. The ROE and ROA models of the cooperative sample require the inclusion of one and two

lags as predictors, respectively. The OLS results for the EVI model of the cooperative sample and the ROE model of the firm sample are inconclusive, which leaves the number of lags to be determined.[32] Meanwhile, coefficients of lagged performance in the ROA model of the firm sample are all significant, indicating lagged performance cannot instrument the endogenous predictors. Second, director age serves as an instrument for director tenure, chairman tenure, and director ownership in the cooperative sample, while chairman age and CEO age are the unique instruments for chairman tenure and CEO tenure, respectively, in the firm sample. Third, following Bhagat and Bolton (2008), Jackling and Johl (2009), Carter et al. (2010), Schultz et al. (2010), and Wintoki et al. (2012), for the firm sample each endogenous predictor is instrumented by its own lagged observation (see Table 7).[33]

V. Results

A. OLS Estimation

Although 3SLS is the econometric method of choice, "It is at least of passing interest to examine what is estimated by ordinary least squares" (Greene, 2012). Therefore, (8) is first estimated by means of OLS (see Table 8). As before, three models are specified for the cooperative sample (columns 1-3) and two for the firm sample (columns 4-5).

Because OLS estimation is not the primary purpose, only several general observations will be made: (i) past performance is the best significant predictor of current performance in each model, (ii) for the cooperative sample, CEO tenure is negative and significant for the ROA and ROE models, yet the

[32] As will be proven during the 3SLS estimation, three lags is most appropriate for the EVI model of the cooperative sample, and two lags is most appropriate for the ROE model of the firm sample.

[33] As opposed to performance characteristics, lagged observations of governance characteristics are not available for the cooperative sample.

economic magnitude is low, (iii) the impact of director ownership on ROA is estimated to be strong and negative for the cooperative sample, (iv) the relationship of leverage to performance is negative for each sample but only significant for the ROA and ROE models of the cooperative sample, (v) neither measure of organizational size, the natural logarithm of total assets or the natural logarithm of total employees, is a strong or significant predictor of performance, (vi) while superior as compared to an empty model, none of the coefficients for the governance characteristics in the ROA and ROE models of the firm sample are characterized by statistical significance, and (vii) in contrast to the firm sample, relatively much variation in performance is explained by the sector binary variables.[34]

Overall, as measured and specified, the impact of governance on performance is estimated to be minimal. However, no conclusion is definitive as OLS estimates are assumed to be biased and inefficient.[35]

B. 3SLS Estimation

Equations (8-15) are now estimated for both samples. However, in the interest of space, only (8) is reported.[36] Also, results for the cooperative sample and the firm sample are reported separately in order to expand discussion to the sector binary variables. Table 9 presents the results for the

[34] With the bean sector as the base category, sector binary variables of statistical significance at $\alpha = 0.05$ in the ROA model are poultry (-0.211), marketing (-0.158), and cotton ginning (0.197), grain (0.029). As such, sector characteristics like asset structure and market competition may positively or negatively impact performance.

[35] Also, upon close inspection of the individual impact on each coefficient, the limited impact and significance is apparently in part explained by several influential observations in the sample. Indeed, the removal of such outliers increases the statistical significance of some predictors and also improves model fitness. However, there is no economic or econometric logic or theory to justify said removal, which is why the reported result applies to the full sample.

[36] Results of the full system of equations are available upon request.

cooperative sample. For each performance characteristic, only the model characterized by the best relative fit is reported.

Lagged performance is significant in each model, which justifies its inclusion as predictors and exclusion as instruments. Board size is also characterized by statistical significance in each model. Moreover, its direction and magnitude is similar in each case, suggesting the estimate is robust across different specifications. The negative impact on performance corresponds to findings by Bennedsen et al. (2008) and Guest (2009) in the context of firms and Bond (2009) in the context of cooperatives. The sign is indicative of the marginal director increasing the cost of coordination and communication.

The magnitude and significance of the coefficients for board independence are captivating. All else equal, an increase of one outside director is estimated to facilitate an increase of 0.713% in ROA, 1.163% in EVI, and 1.907% in ROE, which exceeds the estimated impact by Bhagat and Bolton (2013). The result is intriguing as the mean cooperative, with only 0.07 outside directors, is characterized by great inside control. If the estimate is robust, increasing the degree of external oversight is of no small importance to performance. Hence, adoption of NYSE and NASDAQ standards and recommendations of board independence is worthy of consideration.

Similar to conclusions by Adams and Ferreira (2009), the impact of board gender diversity on performance is less conclusive. The sign is negative for the ROA model yet positive for the ROE and EVI models. Also, statistical significance of the coefficient only applies to the ROE model. All else equal, the addition of one female director causes a 1.332% increase in ROE, which is of economic significance. Similar to board independence, the result intrigues as so few board directors of cooperatives are female.

However, more information is needed on the indirect impact of female directorship, perhaps in relation to director behavior (Miller and Triana, 2009).

In terms of director, chairman, and CEO tenure, the magnitude of the impact on performance is small, even when considering the mean tenure of chairmen and directors is approximately 6.5 and 10 years, respectively. Also, except for director tenure and chairman tenure in the ROA model and CEO tenure in the EVI model, none of the estimates are characterized by statistical significance, suggesting the causal relationship of tenure to performance is limited or even nonexistent. The low estimated impact is perhaps attributable to the complex relationship of tenure to performance, requiring the use of interaction terms and systems of equations (Simsek, 2007).

By comparison, the relationship of equity ownership to performance is characterized by great economic and statistical significance, which compares to Bhagat and Bolton (2013). The magnitudes of the coefficients are 0.377 for the ROA model, 0.800 for the EVI model, and 1.222 for the ROE model, indicating the right to claim profits is important to financial performance. The estimate is even more interesting when considering total director ownership for the mean cooperative is approximately 10%. The finding indicates it is important to increase opportunities to invest equity, whether in the cooperative or in its subsidiaries. Alternatively, tying equity investment to patronage is unwise.

Except for the finance committee in the ROE model, committee formation is estimated to have no causal impact on performance, which corresponds to findings by Carter et al. (2010). The general lack of statistical significance is perhaps explained by the vague definition or conceptualization of the characteristic. More information is needed on the exact function and behavior of each committee in hopes of yielding a better estimate of its direct or indirect impact on performance.

Each firm characteristic has the expected sign. Total assets is estimated to positively impact performance, indicating the establishment of size economies is beneficial to efficiency and profitability. The causal relationship of leverage to performance is negative, which underlines the importance of member equity acquisition (Hart and Moore, 1998; Cook and Iliopoulos, 2000). As the estimated impact of total employees is negative, marginal employee benefit is at the mean surpassed by its cost. Finally, the positive and significant impact of membership size on performance is observed for each model, suggesting the estimate is robust.

Because of the order condition, which requires the number of excluded exogenous predictors to be at least as large as the number of included endogenous predictors, not each sector binary variable is included in (8). Therefore, interpretation of each coefficient is not straightforward. The base category is comprised of six sectors for the ROA and EVI models: artificial insemination, bean, cotton ginning, fruit and vegetable, storage, and transport. For the ROE model, the base category also contains the livestock and rice sectors. Altogether, statistical significance is observed for four sectors. The impact on performance is positive for the dairy sector, and negative for the marketing sector, the poultry sector, the sugar sector, and the supply sector.

The result of equation (8) for the firm sample is reported in Table 10. Considering its primary function is to provide a yardstick, the discussion is not as thorough as for the cooperative sample. Except for the first lag in the ROE model, lagged performance is significant and likely responsible for explaining the majority of the observed variation in performance. The impact of board diversity and board independence on performance is estimated to be negative and significant, which is in stark contrast to the cooperative sample. The causal relationship of director tenure to performance is negative, although

the magnitude of the coefficient is not large. Similar to the cooperative sample, a one-percent increase in director ownership causes a significant 0.061% increase in ROA. As for the committees, the impact of the governance committee is negative and significant for the ROA model and the impact of the finance committee is positive and significant for the ROE model, while the estimated positive impact of the public responsibility committee is observed for both models.

C. The Differential Impact of Governance on Performance

As outlined in the introduction, the paper has two objectives: (i) to estimate the causal relationship of governance to performance, and (ii) to compare cooperative governance to corporate governance. Regarding the second objective, the Z-score method is employed in order to test the equality of coefficients for the governance characteristics across the two samples (Clogg et al., 1995). The Z-score formula is calculated as

$$Z = \frac{\beta_1 - \beta_2}{\sqrt{{\beta_{1SE}}^2 + {\beta_{2SE}}^2}} \tag{16}$$

and thus incorporates the variances for both samples. Table 11 reports the Z-scores for the ROA and ROE models in the far right column.[37] Equality of the coefficients is rejected at the 95% confidence level for board size and board diversity in the ROE model, board independence in the ROA model, and director ownership in both models. Equality is also rejected for board size and chairman tenure in the ROA model, and board independence in the ROE model if the confidence level is relaxed to 90%. The failure to reject the null hypotheses for other governance characteristics is in part attributable to the

[37] The EVI model is not included as the criterion is not comparable to ROA and ROE, which renders the Z-score method inappropriate.

low magnitude and significance of the coefficients, which raises the question if any conclusion on the matter is at all meaningful.

Overall, based on findings for firms and cooperatives in the agri-food industry, governance recommendations for the former do not uniformly extend to the latter. Specifically, board diversity, board independence, and director ownership seem to be of greater importance to cooperatives as compared to firms. Also, governance as proxied by board and management characteristics has a stronger causal relationship to performance for cooperatives, which is surprising when considering ROA and ROE are supposed to be superior indicators of firm performance, not cooperative performance.

VI. Summary and Conclusion

The relationship of governance and performance in the agri-food industry is studied in the context of investor-owned and farmer-owned business organizations. In terms of raw performance, agri-food firms are much larger in revenue and profit as compared to agri-food cooperatives, which indicates the separation of control and ownership is related to sheer scope. However, when taking differences in total assets and total equity into consideration, the mean cooperative is discovered to be more efficient and more profitable. The difference is perhaps in part explained by the two types operating at different stages of the value chain as firms are primarily active in food manufacturing and food retail, while cooperatives are far more prominent at the input stage and the production stage.

Compared to the mean firm, the board of the mean cooperative is characterized by relatively few female and few outside directors, suggesting the boardroom of the latter is likely to be more homogeneous in character, which may reflect the traditional lack of heterogeneity in input and

production. Another indication of strong inside control is the relatively low amount of committees for cooperatives, which implies control is to a large extent retained by the board of directors, who represent the residual claimants. Also, as compared to the mean corporate board director, the mean cooperative board director is younger, more experienced, and has less equity invested in the business. Thus, based on descriptive data analysis of board and management characteristics, corporate and cooperative governance are not identical.

The empirical analysis is based on unique governance and performance data of 128 agri-food firms and 456 agri-food cooperatives. Endogeneity of the governance-performance relationship is addressed via the 3SLS approach, which requires the selection and collection of instrumental variables. Five models are specified for the two samples. ROA and ROE serve as the main criteria for both samples, and EVI is included for the cooperative sample in order to address the ambiguous nature of cooperative performance. The 3SLS approach provides a new and interesting look into the governance-performance relationship for both firms and cooperatives. For example, the impact of board size is negative and significant for the cooperative sample, yet the impact is not estimated to be significantly different from zero for the firm sample. While board diversity and board independence have a negative causal relationship to performance for the firm sample, female and outside directorship have a significant non-negative impact on various indicators of cooperative performance, suggesting less homogeneity in the boardroom of agri-food cooperatives is to be recommended. The impact of director tenure, chairman tenure, and CEO is tenure is estimated to be small or nonsignificant for both samples. Director ownership, however, is characterized by a large positive and significant impact on performance for the cooperative sample, which informs the discussion of member equity investment and equity-patronage proportionality.

Overall, there is much consistency for the governance characteristics across the various proxies of performance, which is an indication of robust and unbiased estimates. Although the limited data constrained the ability to address endogeneity in the governance-performance relationship, the selected instruments passed the Sargan-Hansen and Stock-Yogo tests of weak instruments.

Several caveats and limitations must be addressed. First, the differential impact of governance on performance is in part attributable to the ambiguous nature of cooperative performance. Since efficiency or profitability at the cooperative level is not always the primary objective, ROA or ROE is not necessarily the best indicator of cooperative performance. Consequently, observed governance characteristics may impact non-financial performance, such as member satisfaction or member participation. Nonetheless, 3SLS results indicate a large causal impact of board and management characteristics on the financial performance of agri-food cooperatives.

Second, the available data is for the year 2009, a time which is very much characterized by the financial crisis of approximately 2008-2011. The crisis undoubtedly also impacted the agri-food industry, as evidenced by the great number of observations of negative income, in particular for the firm sample. Consequently, the estimated impact of governance is likely in relation to below-average performance. Considering the endogenous nature of the governance-performance relationship, it is not impossible the impact of governance is different for average or above-average performance. Relatedly, panel data is unavailable for the cooperative sample. Hence, the dynamic impact of governance on performance is unknown. Ideally, time-series analysis is performed to study the cause-and-effect relationship of board and management characteristics and financial performance.

Third, the conclusions only apply to the agri-food industry. Any findings or recommendations cannot be extended to firms or cooperatives in other sectors and industries. Also, in order to better analyze the differential impact of governance on performance in the agri-food industry, future research must address the heterogeneous nature of the agri-food value chain. Governance is likely to be similar yet different for the input stage and the manufacturing stage, which is not addressed in this study. Relatedly, the conclusions cannot be extended to non-firms and non-cooperatives. The impact of governance on performance for other modes of organization, such as sole proprietorships or joint ventures, is not addressed in this paper.

Fourth, the coefficients for the governance characteristics, the performance characteristics as well as the fixed effects show sensitivity to changes in the model specification. While coefficients are for the most part robust across various proxies of performance, at times minor changes to the model specification cause large changes in the estimates. Moreover, while 3SLS appears to address endogeneity of the governance-performance relationship with efficiency, the lack of reliable information on model fitness disallows full confidence in the method.

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Table 1 Sample Representativeness

	Burress et al. (2011; 2012)		USDA (2009)	
Cooperative Type	Total	% of Total	Total	% of Total
Marketing	265	58%	1,169	49%
Supply	184	40%	970	41%
Service	11	2%	250	10%
Total	460	100%	2,389	100%

Table 2 Summary Statistics

	Mean		Median		Standard Deviation		T-test
Indicator	Coop	IOF	Coop	IOF	Coop	IOF	p-value
Panel A (Performance)							
Employees	196.73	20,161.66	51.00	3,250.00	643.90	44,998.57	<0.0001
Revenue (thousands)	254,083.62	6,398,397.66	53,635.51	1,139,302.50	1,398,668.48	12,949,457.75	<0.0001
Net Income (thousands)	5,419.14	255,037.11	1,299.32	24,242.50	27,360.07	944,149.54	0.0033
Assets (thousands)	89,790.26	4,529,756.24	19,949.68	780,664.00	462,276.54	9,365,508.15	<0.0001
Equity (thousands)	51,580.26	1,688,925.93	10,626.75	289,812.50	262,520.78	3,930,950.74	<0.0001
Liabilities (thousands)	38,210.00	2,802,706.67	7,623.15	407,455.00	208,928.89	5,662,162.73	<0.0001
ROS	2.92%	-1.40%	2.43%	2.58%	5.05%	22.58%	0.0334
ROA	8.26%	0.52%	7.00%	4.44%	8.94%	19.89%	<0.0001
ROE	18.32%	5.83%	17.00%	10.81%	42.15%	43.46%	0.0034
Asset Turnover	3.40	1.70	2.66	1.44	5.90	1.14	<0.0001
Debt Ratio	42.29%	55.51%	40.97%	55.51%	17.77%	25.56%	<0.0001
Panel B (Governance)							
Board Size	9.07	9.09	8.00	9.00	4.24	3.22	0.9423
% of Outside Directors	0.01	0.67	-	6.00	0.41	3.34	<0.0001
% of Female Directors	0.11	0.12	-	1.00	0.37	1.22	<0.0001
Director Age	51.77	59.24	52.00	59.43	4.93	4.49	<0.0001
Director Tenure	9.87	9.19	9.00	8.26	5.61	5.83	0.2345
Chairman Tenure	6.49	9.28	4.50	5.00	5.81	10.99	0.0064
CEO Tenure	10.46	8.31	8.50	4.00	8.67	10.01	0.1086
Director Ownership	0.10	0.03	0.05	0.01	0.16	0.05	<0.0001
Committees	1.99	3.43	2.00	3.00	1.51	1.37	<0.0001

Table 3 Vertical Orientation by Ownership Type

Supply Chain Stage	# Firms	% of Total	# Cooperatives	% of Total
Input	7	5%	333	73%
Production	21	16%	330	72%
Manufacturing	95	74%	53	12%
Retail	25	20%	2	0%
Vertical Integration	16	13%	260	57%

Table 4 Correlation Matrix (Panel A: Firms)

	roa	roe	ros	size	inde	fmal	dage	dten	cten	ceoten	dequ
roa	1.00										
roe	0.17	1.00									
ros	**0.77**	0.07	1.00								
size	**0.19**	0.03	**0.19**	1.00							
inde	0.12	0.07	0.16	0.10	1.00						
fmal	0.12	0.02	**0.19**	**0.22**	0.17	1.00					
dage	**0.18**	0.04	0.12	0.10	**0.21**	-0.10	1.00				
dten	**0.23**	0.05	0.17	-0.16	**-0.20**	-0.08	**0.46**	1.00			
cten	0.14	0.04	0.14	**-0.28**	**-0.22**	-0.09	**0.24**	**0.61**	1.00		
ceoten	0.16	0.09	0.12	**-0.30**	-0.16	-0.11	**0.23**	**0.62**	**0.71**	1.00	
dequ	-0.14	0.04	-0.09	**-0.33**	**-0.24**	-0.16	0.11	**0.22**	**0.23**	**0.22**	1.00

bold denotes statistical significance at $\alpha = 0.05$

(continued) **Table 4** Correlation Matrix (Panel B: Cooperatives)

	roa	roe	evi	size	inde	fmal	dage	dten	cten	ceoten	dequ
roa	1.00										
roe	**0.55**	1.00									
evi	**0.60**	**0.75**	1.00								
size	**-0.11**	-0.04	-0.09	1.00							
inde	-0.05	-0.01	-0.03	**0.17**	1.00						
fmal	-0.05	0.01	0.02	0.00	0.08	1.00					
dage	-0.06	-0.07	**-0.12**	**0.19**	**0.10**	**0.11**	1.00				
dten	-0.02	-0.07	-0.08	0.06	0.04	**-0.10**	**0.31**	1.00			
cten	-0.06	**-0.13**	-0.04	0.00	-0.02	0.01	**0.18**	**0.27**	1.00		
ceoten	-0.01	-0.02	-0.04	-0.03	-0.06	0.01	0.08	**0.11**	**0.17**	1.00	
dequ	0.03	0.03	0.02	0.03	-0.01	-0.03	0.09	**0.15**	**0.12**	0.00	1.00

bold denotes statistical significance at $\alpha = 0.05$

Table 5 Variables

Variable Name	Variable Measurement	Variable Type
Firm Characteristics		
Size (employees)	Natural logarithm of the number of employees	Continuous
Size (assets)	Natural logarithm of total assets	Continuous
Leverage	Ratio of total liabilities to total assets	Continuous
State	Binary variables for the state of incorporation	Binary
Sector	Binary variables for the primary sector or industry	Binary
Performance Characteristics		
ROA	Ratio of net income to total assets in fiscal year 2009	Continuous
ROE	Ratio of net income to total equity in fiscal year 2009	Continuous
EVI	Ratio of extra value to operating capital in fiscal year 2009	Continuous
Governance Characteristics		
Board Size	Total number of board directors	Continuous
Board Independence	Ratio of outside directors to total directors	Continuous
Board Gender Diversity	Ratio of female directors to total directors	Continuous
Director Tenure	Average tenure of board directors in years	Continuous
Chairman Tenure	Tenure of the current board chairman in years	Continuous
CEO Tenure	Tenure of the current CEO in years	Continuous
Director Ownership	Percentage share of the board of directors of total equity	Continuous
Committees	Total number of board committees	Continuous

Table 6 OLS Regression of Current Performance on Lagged Performance

	COOP			FIRM	
Predictor	ROA	ROE	EVI	ROA	ROE
Intercept	0.180**	0.115	0.232*	0.032	-0.124
	(0.083)	(0.234)	(0.124)	(0.123)	(0.511)
$Performance_{t-1}$	0.344***	0.711***	0.580***	0.193**	0.000
	(0.073)	(0.080)	(0.058)	(0.075)	(0.002)
$Performance_{t-2}$	0.150*	-0.002	0.057	0.953***	0.187**
	(0.077)	(0.095)	(0.075)	(0.190)	(0.076)
$Performance_{t-3}$	0.088	-0.007	0.032	-0.290*	-0.012
	(0.083)	(0.074)	(0.074)	(0.146)	(0.145)
$Performance_{t-4}$	-0.004	0.001	0.168***	0.237***	-0.009
	(0.012)	(0.001)	(0.034)	(0.053)	(0.026)
$Performance_{t-5}$			-0.172***		
			(0.034)		
Total Assets	-0.004	0.013	-0.007	-0.009	-0.031
	(0.007)	(0.019)	(0.010)	(0.010)	(0.039)
Leverage	-0.153***	-0.213***	-0.077**	-0.013	-0.227
	(0.026)	(0.068)	(0.036)	(0.051)	(0.195)
Employees	-0.005	-0.010	-0.010	0.007	0.014
	(0.007)	(0.019)	(0.010)	(0.008)	(0.034)
Members	0.002	0.014	0.007		
	(0.004)	(0.012)	(0.006)		
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	445	445	445	108	108
Pr>F	<.0001	<.0001	<.0001	<.0001	0.0659
R^2	0.43	0.73	0.49	0.87	0.66

Standard errors are in parentheses, * denotes statistical significance at α = 0.01, ** denotes statistical significance at α = 0.05, *** denotes statistical significance at α = 0.10.

Table 7 Instrument Selection

		Sample	
Endogenous Predictor	Denotion	Coop	Firm
Board Size	z1	Lagged Performance	Lagged Board Size
			Lagged Performance
Board Independence	z2	Lagged Performance	Lagged Board Independence
			Lagged Performance
Board Diversity	z3	Lagged Performance	Lagged Board Diversity
			Lagged Performance
Director Tenure	z4	Lagged Performance	Lagged Director Tenure
		Director Age	Lagged Performance
			Director Age
Chairman Tenure	z5	Lagged Performance	Lagged Chairman Tenure
		Director Age	Lagged Performance
			Chairman Age
CEO Tenure	z6	Lagged Performance	Lagged CEO Tenure
			Lagged Performance
			CEO Age
Director Ownership	z7	Lagged Performance	Lagged Director Ownership
		Director Age	Lagged Performance
			Director Age

Table 8 OLS Estimation of Governance and Performance

	COOP			FIRM	
Predictor	ROA	ROE	EVI	ROA	ROE
Intercept	0.273***	0.005	0.060	0.186	0.153
	(0.098)	(0.388)	(0.314)	(0.149)	(0.641)
$Performance_{t-1}$	0.229***	1.059***	1.158***	0.211**	-0.004***
	(0.083)	(0.095)	(0.110)	(0.079)	(0.001)
$Performance_{t-2}$	0.287***			0.948***	0.254***
	(0.085)			(0.190)	(0.059)
$Performance_{t-3}$				-0.276*	
				(0.153)	
$Performance_{t-4}$				0.279***	
				(0.055)	
Board Size	0.001	-0.001	0.004	-0.004	0.007
	(0.001)	(0.005)	(0.004)	(0.005)	(0.019)
Board Independence	-0.112	-0.846	-0.437	-0.088	-0.007
	(0.163)	(0.655)	(0.530)	(0.055)	(0.211)
Board Diversity	-0.054	-0.331	-0.192	-0.127	-0.363
	(0.098)	(0.394)	(0.319)	(0.092)	(0.355)
Director Tenure	0.000	-0.004	-0.002	-0.003	-0.006
	(0.001)	(0.003)	(0.003)	(0.003)	(0.011)
Chairman Tenure	-0.001	-0.002	-0.001	-0.001	0.003
	(0.001)	(0.003)	(0.002)	(0.001)	(0.005)
CEO Tenure	-0.001**	-0.004**	-0.002	-0.001	0.000
	(0.000)	(0.002)	(0.001)	(0.001)	(0.005)
Director Ownership	-0.063***	-0.049	-0.058	0.145	-1.041
	(0.030)	(0.120)	(0.097)	(0.177)	(0.737)
Total Assets	-0.005	0.006	-0.020	-0.009	-0.035
	(0.008)	(0.031)	(0.025)	(0.011)	(0.043)
Debt Ratio	-0.155***	-0.214**	-0.111	-0.059	-0.333
	(0.028)	(0.103)	(0.083)	(0.055)	(0.221)
Employees	-0.013*	-0.037	-0.027	0.011	0.040
	(0.007)	(0.029)	(0.023)	(0.009)	(0.036)
Members	0.003	0.018	0.010		
	(0.005)	(0.018)	(0.015)		
Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	424	426	426	108	109
Pr>F	<.0001	<.0001	<.0001	<.0001	0.0009
R^2	0.43	0.62	0.42	0.90	0.75

Standard errors are in parentheses, * denotes statistical significance at α = 0.01, ** denotes statistical significance at α = 0.05, *** denotes statistical significance at α = 0.10.

Table 9 3SLS Estimation of the Governance-Performance Relationship (Cooperative Sample)

Predictor	ROA	ROE	EVI
Intercept	0.033	-0.338	-0.450**
	(0.101)	(0.316)	(0.201)
$Performance_{t-1}$	0.219**	0.655***	0.420***
	(0.091)	(0.081)	(0.088)
$Performance_{t-2}$	0.289***		0.066
	(0.093)		(0.127)
$Performance_{t-3}$			-0.267**
			(0.116)
Board Size	-0.018***	-0.048***	-0.051***
	(0.005)	(0.016)	(0.011)
Board Independence	0.713**	1.907**	1.163*
	(0.322)	(0.943)	(0.645)
Board Diversity	-0.155	1.332*	0.739
	(0.272)	(0.771)	(0.522)
Director Tenure	-0.007**	-0.014	-0.008
	(0.003)	(0.010)	(0.007)
Chairman Tenure	0.005**	0.007	-0.006
	(0.003)	(0.009)	(0.006)
CEO Tenure	0.000	-0.009	0.025***
	(0.002)	(0.008)	(0.006)
Director Ownership	0.377***	1.222***	0.800***
	(0.111)	(0.324)	(0.218)
Audit Committee	0.005	-0.044	-0.007
	(0.012)	(0.034)	(0.023)
Finance Committee	0.011	0.059*	0.019
	(0.011)	(0.031)	(0.021)
Executive Committee	0.014	0.006	0.077**
	(0.015)	(0.043)	(0.032)
Total Assets	0.024*	0.094**	0.068***
	(0.013)	(0.038)	(0.025)
Leverage	-0.184***	-0.303***	-0.061
	(0.034)	(0.091)	(0.066)
Employees	-0.016**	-0.027	-0.032**
	(0.008)	(0.023)	(0.015)
Members	0.015**	0.039**	0.047***
	(0.006)	(0.018)	(0.013)
Cooperative Members	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Cotton	-0.005	-0.005	0.050
	(0.059)	(0.166)	(0.117)
Dairy	0.066**	0.043	0.207
	(0.030)	(0.086)	(0.062)
Grain	-0.037	-0.090	-0.145**
	(0.029)	(0.070)	(0.064)

Livestock	-0.034		-0.175
	(0.054)		(0.110)
Nuts	-0.027	-0.153	-0.071
	(0.064)	(0.181)	(0.5769)
Poultry	-0.380***	-0.612*	-0.401*
	(0.120)	(0.350)	(0.236)
Rice	-0.093		-0.243
	(0.089)		(0.179)
Fish	0.033	0.095	-0.028
	(0.082)	(0.234)	(0.161)
Marketing	-0.200***	-0.361**	-0.110
	(0.052)	(0.145)	(0.101)
Sugar	-0.092*	-0.161	-0.110
	(0.048)	(0.138)	(0.095)
Supply	-0.064**	-0.169***	-0.157***
	(0.026)	(0.063)	(0.056)
State Fixed Effects	Yes	Yes	Yes
N	418	418	418
System Weighted MSE	1.053	1.068	1.0883
System Weighted R^2	0.2107	0.2933	0.2138
Sargan-Hansen Test	0.859	0.6134	0.7597

Standard errors are in parentheses, * denotes statistical significance at α = 0.01, ** denotes statistical significance at α = 0.05, *** denotes statistical significance at α = 0.10.

Table 10 3SLS Estimation of the Governance-Performance Relationship (Firm Sample)

Predictor	ROA	ROE
Intercept	0.250**	0.322
	(0.100)	(0.364)
$Performance_{t-1}$	0.209***	0.001
	(0.066)	(0.002)
$Performance_{t-2}$	0.968***	0.144***
	(0.140)	(0.047)
$Performance_{t-3}$	-0.291**	
	(0.124)	
$Performance_{t-4}$	0.225***	
	(0.040)	
Board Size	-0.005	0.001
	(0.005)	(0.019)
Board Independence	-0.101*	0.044
	(0.052)	(0.204)
Board Diversity	-0.154*	-0.609*
	(0.082)	(0.346)
Director Tenure	-0.005**	-0.020**
	(0.002)	(0.009)
Chairman Tenure	0.000	0.003
	(0.001)	(0.005)
CEO Tenure	-0.001	0.001
	(0.001)	(0.005)
Director Ownership	0.061**	0.134
	(0.029)	(0.123)
Audit Committee	-0.064	0.138
	(0.061)	(0.216)
Corporate Governance	-0.049*	-0.152
Committee	(0.026)	(0.100)
Finance Committee	0.037	0.203**
	(0.024)	(0.097)
Public Responsibility Committee	0.051*	0.262**
	(0.029)	(0.124)
Executive Committee	0.019	0.032
	(0.019)	(0.076)
Total Assets	0.001	-0.010
	(0.012)	(0.042)
Leverage	-0.042	-0.349*
	(0.048)	(0.191)
Total Employees	0.000	0.024
	(0.012)	(0.042)
SIC1	0.002	-0.110
	(0.039)	(0.160)
SIC2	-0.175	-0.179
	(0.108)	(0.427)

SIC7	-0.002	
	(0.057)	
SIC8	0.154	
	(0.096)	
SIC20	-0.005	-0.265
	(0.043)	(0.161)
SIC201	0.070*	
	(0.040)	
SIC202	0.036	-0.205
	(0.047)	(0.193)
SIC203	0.073*	0.290**
	(0.038)	(0.139)
SIC204	-0.056	-0.163
	(0.038)	(0.159)
SIC205	0.064	-0.086
	(0.046)	(0.190)
SIC206	0.046	0.104
	(0.034)	(0.129)
SIC209	0.032	0.167
	(0.040)	(0.202)
SIC514	0.019	0.042
	(0.032)	(0.129)
SIC515		-0.143
		(0.208)
SIC541	-0.015	-0.242*
	(0.035)	(0.124)
State Fixed Effects	Yes	Yes
N	106	106
System Weighted MSE	0.9932	0.9863
System Weighted R^2	0.9331	0.9335
Sargan-Hansen Test	0.9874	0.7065

Standard errors are in parentheses, * denotes statistical significance at α = 0.01, ** denotes statistical significance at α = 0.05, *** denotes statistical significance at α = 0.10.

Table 11 Testing the Equality of Corporate and Cooperative Governance

Panel A: ROA Model

	Coop		Firm		
	β	S.E.	β	S.E.	Z-Score
Board Size	-0.018	0.005	-0.005	0.005	-1.78
Board Independence	0.713	0.322	-0.101	0.052	2.50
Board Diversity	-0.155	0.272	-0.154	0.082	0.00
Director Tenure	-0.007	0.003	-0.005	0.002	-0.52
Chairman Tenure	0.005	0.003	0.000	0.001	1.95
CEO Tenure	0.000	0.002	-0.001	0.001	0.43
Director Ownership	0.377	0.111	0.061	0.029	2.75
Audit Committee	0.005	0.012	-0.064	0.061	1.11
Finance Committee	0.011	0.011	0.037	0.024	-1.00
Executive Committee	0.014	0.015	0.019	0.019	-0.19

Panel B: ROE Model

	Coop		Firm		
	β	S.E.	β	S.E.	Z-Score
Board Size	-0.048	0.016	0.001	0.019	-1.99
Board Independence	1.907	0.943	0.044	0.204	1.93
Board Diversity	1.332	0.771	-0.609	0.346	2.30
Director Tenure	-0.014	0.010	-0.020	0.009	0.43
Chairman Tenure	0.007	0.009	0.003	0.005	0.40
CEO Tenure	-0.009	0.008	0.001	0.005	-1.07
Director Ownership	1.222	0.324	0.134	0.123	3.14
Audit Committee	-0.044	0.034	0.138	0.216	-0.83
Finance Committee	0.059	0.031	0.203	0.097	-1.42
Executive Committee	0.006	0.043	0.032	0.076	-0.30