Journal of Cooperatives

Volume 35 *2020* *Page 1-39*

Estimating the Value of Local Ownership to a State's Economy: The Case of Kansas Farmer Cooperatives

Amanda M. Clymer, Brian C. Briggeman, and John C. Leatherman

Authors Affiliation:
Amanda M. Clymer, MS graduate student, Department of Agricultural Economics, Kansas State University
Brian C. Briggeman, Ph.D., Professor and Director, Arthur Capper Cooperative Center, Department of Agricultural Economics, Kansas State University (contact author)
John C. Leatherman, Ph.D., Professor and Director, Office of Local Government, Department of Agricultural Economics, Kansas State University

Funding for this research was partially provided by a contribution from CoBank through the CoBank Research Fellowship Program

Copyright and all rights therein are retained by author. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Estimating the Value of Local Ownership to a State's Economy: The Case of Kansas Farmer Cooperatives

Amanda M. Clymer, Brian C. Briggeman, and John C. Leatherman

Abstract

Farmer cooperatives positively contribute to the vitality of many rural communities. The objective of this research is to measure the total economic and local contribution of farmer cooperatives to the Kansas economy. This analysis utilizes a unique data set to create customized grain cooperative sectors within the IMPLAN economic modeling system. Results show that in 2017, Kansas farmer cooperative business activity contributed over 9,000 jobs, $630 million in labor income, and $1 billion in output. These contribution estimates decrease considerably if cash patronage is assumed to be spent as a corporate dividend, which highlights the value of local ownership.

Introduction

Farmer cooperatives provide services and products at competitive prices, merchandise and market commodities, support their local communities, create local jobs, and pay taxes. These activities contribute to the vitality and sustainability of the agricultural economy and communities across rural America. While these activities are often cited as the value of farmer cooperatives, there are methods to quantify this value. Economic contribution analysis is a method for understanding both the direct contribution of an industry, such as the farmer cooperative sector, and the strength of their economic linkages with other businesses, households, and the government. The purpose of this paper is to examine different approaches to estimating the economic contribution of farmer cooperatives to the state of Kansas, which has not been previously estimated.

A majority of cooperative economic contribution studies have been conducted at the state level. The commonality between these studies is that each one sought to increase the accuracy in modeling the unique economic relationship cooperatives have with their members and communities due to their purpose and principles as member-owned organizations. Zeuli and Deller (2007) argue that it is imperative to consider the uniqueness of the businesses structure and how patronage refunds are returned to members. They found that Wisconsin cooperatives do in fact contribute positively to the state. They also treated patronage refunds as a separate activity in their economic model. This distinction was an attempt to isolate the impact of patronage from other cooperative business activity when evaluating how the industry affects the overall economy.

Alternatively, Folsom's (2003) research for Minnesota cooperatives utilized an approach that treated patronage as profits from a sole proprietorship. Folsom viewed patronage as proprietary income. Using this allocation approach suggests patronage can represent the value of localized ownership and spending. Making this adjustment provided a larger positive economic contribution to

Minnesota than if patronage had been allocated in the economic contribution model as other income.

Research focusing only on the economic contribution of grain and farm supply cooperatives was completed by Park et al. (2009) for Texas and by Herian and Thompson (2016) for Nebraska. Park et al. (2009) chose to consider the economic contribution of Texas agricultural cooperatives in various combinations. Models included consideration of the value of commodities produced and localized ownership, as well as the reverse. Park et al. (2009) argue that the value of a cooperative could not be separated from the value of the commodities produced by members and marketed by the business. Herian and Thompson (2016) chose to consider the value of marginal sales output, labor income, member patronage, and employment utilizing a three-year average of cooperative operational performance. Further model adjustments included consideration of the industry's capital investments in equipment and facilities on urban versus rural areas of the state.

As shown in the literature, measuring the economic contribution of farmer cooperatives helps highlight the vital role cooperatives serve. However, there is considerable variation in what is counted as the direct contribution of cooperative activity and the approach taken to calculate the indirect economic activity. In this paper, we focus on the research methodology and offer a range of results representing upper and lower bounds of the total economic contribution that grain and farm supply cooperatives provide for the Kansas economy. A contribution of this paper is to demonstrate methods to estimate both the direct scale of economic activity and to create customized cooperative industry sectors utilizing an Input-Output (IO) and Social Accounting Matrix (SAM) framework. IMPLAN, an economic analysis software, uses IO and SAM to quantify economic and employment contributions. This approach is flexible and has been used in many applications such as estimating the economic impact of migrant farm workers on a local economy (Sills, et al. 1994); the impacts of a foot-and-mouth disease outbreak (Pendell, et al. 2007); and the value of localized food systems to a state's economy (Hodges, et al. 2014). In this paper, we provide a detailed approach to estimating the value farmer cooperatives provide to a state's economy.

Results show that farmer cooperatives positively contribute to the Kansas economy. Each job at a farmer cooperative helps support one additional job within Kansas. When considering the direct and indirect effects of output from cooperatives, a total of $1 billion of output was created. Finally, recognizing that patronage is indeed a local income that benefits the communities served by cooperatives provides a larger economic contribution. Cooperative management, boards of directors, and industry advocates can utilize this information to communicate the value of the sector.

Economic Contribution Methodology

Two methods can be used for quantifying the economic importance of an industry, event, or policy – contribution analysis and impact analysis. Watson et al. (2007) define contribution analysis as seeking to quantify the relative size of an existing industry in an economy. Measuring the contribution is accomplished by calculating the gross economic activity for a specific industry and then modeling how this industry is linked to other industries and institutions within the broader economy. The alternative, impact analysis, is more complicated and may not be as accurate because this approach requires the analyst to quantify the counterfactual, which may be highly speculative. Impact analysis seeks to measure the net change in the economy had the associated activity of the industry, event, or policy not occurred (Watson et al., 2007). Given the uncertainty of alternative resource allocation, the approach selected for this research is the economic contribution of farmer cooperatives to Kansas.

For cooperatives, Zeuli and Deller (2007) suggest that research should first consider a cooperative's ability to improve market performance and provide products or services that would otherwise be unavailable in the community. Remembering the multifaceted purposes of the cooperative structure provides a foundation for measuring and quantifying the economic contribution of cooperatives. Folsom (2003) also points to less tangible impacts including changes in community leadership capacity, access to information, or the availability of goods.

The IMPLAN economic modeling system was used to assess the economic contribution of farmer cooperatives to the local economy. IMPLAN utilizes an input-output (I-O) and social accounting matrix (SAM) framework (Miller and Blair, 2009). This type of modeling describes and quantifies the economic linkages between industries and institutions in an economy for a given period (Deller et al., 2009). The I-O framework maps the interdependence of industries, and SAM is an extension that accounts for economic relationships among households, the government, investment, and trade in an economy.

These relationships are expressed in a tabular or matrix form as described by Miller and Blair (2009). The framework begins with the assumption that a regional economy consists of many producing or selling industries denoted by $i = 1, 2, \ldots n$ and many purchasing sectors denoted by $j = 1, 2, \ldots n$. The intermediate demand or sales by industry i to industry j during the year is represented by z_{ij}. The total value of sales to the final consumer by industry i is represented by y_i. The total value of goods produced by industry i during the year is then denoted by x_i and expressed as a combination of n buying sectors and the final consumer demand such that:

$$(1) \qquad x_i = z_{i1} + z_{i2} + \ldots + z_{in} + y_i$$

where each producing or selling sector (i = 1, 2,…n) then has its respective equation.

Similarly, the purchasing sectors (j = 1, 2,…n) have associated economic relationships. The demand by industry j for goods produced by industry i is expressed by z_{ij}. Purchasing sectors must also pay for other factors of production including labor, capital, and taxes. These costs are termed value added payments expressed as va_j. Additionally, purchasing sectors may import needed goods and services from outside the subject area as represented by m_j. Thus, the relation of purchasing sector j can be written as:

$$(2) \qquad x_j = z_{1j} + z_{2j} + \ldots + z_{nj} + va_i + m_i$$

These equations exist for each purchasing sector (j = 1, 2,…n). Each of these variables in the respective equations explain the unique selling-purchasing relationships in the economy and collectively represent what is known as an input-output transactions table. To construct a predictive model, the individual industry or sector equations and associated variables are used to define a proportional relationship. Technical coefficients of production represent such connections and are represented by $a_{ij} = z_{ij}/x_j$. The coefficient, a_{ij}, is representative of the value of good i that is used in producing a dollar's worth of output j (Miller, 1998).

From the technical coefficient, the interrelationship can be written as $z_{ij} = a_{ij}x_j$. This allows the previous equation for the producing sector *i* to be rewritten as:

$$(3) \qquad x_i = a_{i1}x_1 + a_{i2}x_2 + \ldots + a_{in}x_n + y_i$$

A system of equations for *n* industries is then represented by:

$$(4) \qquad \begin{aligned} x_1 &= a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n + y_1 \\ x_2 &= a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n + y_2 \\ &\vdots \\ x_n &= a_{n1}x_1 + a_{n2}x_2 + \ldots + a_{nn}x_n + y_n \end{aligned}$$

The coefficients from the system of equations can be arranged in a technical coefficient or direct requirements matrix. Matrix **A** is formed from all the fixed ratios of a_{ij}. Collectively, this matrix represents the proportional values of inputs regionally supplied for every dollar of regionally produced output (Miller, 1998). Matrix **A** arranges the coefficients as such:

$$(5) \qquad \mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

The sum down the column represents the total amount sector *j* spent on inputs from the region for each dollar worth of output. Although this is not comprehensive of all input purchases by sector *j*, it indicates the intraregional input requirements.

Also, from the system of equations the final demand and total output can be written as column vectors. The *n* final demand is written such that **y** = $\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}$.

For *n* sectors the total output is represented by **x** = $\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$. Utilizing these column vectors and matrix **A**, the system of equations can then be written as:

$$(6) \qquad \mathbf{x}=\mathbf{A}\mathbf{x} + \mathbf{y}$$

This dynamic model can be utilized to understand how a change in one sector, such as changes in tax policies or foreign export orders, influences the final demand in the economy (Miller, 1998). As a "demand driven" model, the impact of the change in demand is indicated by the **y** column vector. The level of goods produced, **x**, is then determined by the new level of demand (Miller, 1998). This model is solved utilizing the matrix **I,** an (*n* x *n*) identity matrix made up of ones across the diagonal and the remaining values as zeroes. The equation of matrices can then be written as:

$$(7) \qquad (\mathbf{I} - \mathbf{A})\, \mathbf{x} = \mathbf{y}$$

The *Leontief Inverse*, $(\mathbf{I}\text{-}\mathbf{A})^{-1}$, is used to capture the response of **x** due to the change in demand **y** such that:

$$(8) \qquad \mathbf{x}= (\mathbf{I}\text{-}\mathbf{A})^{-1}\mathbf{y}$$

The matrix $(\mathbf{I}\text{-}\mathbf{A})^{-1}$ is also known as the total requirements table or matrix of multipliers (Miller, 1998). The sum of a column within this inverse matrix is the multiplier for a particular industry (Zeuli and Deller, 2007). The multipliers represent the degree of interdependency between a specific industry and the rest of the industries in a region (Deller et al., 2009).

The SAM framework carries the model forward to not only include these inter-industry purchases and the interregional monetary flow, but also income distribution, and the relationship of a specific region with other external economies. This process then provides a complete depiction of the interdependencies or circular flow in an economy (Adelman and Robinson, 1986). With all transactions accounted for, supply must equal demand (Deller et al., 2009). The theoretical framework, as presented by Adelman and Robinson (1986) and Thorbecke (1998), then uses the interdependencies represented by the coefficients in matrix **A** of the Input-Output model with other matrix accounts to form matrix $\mathbf{A}^*$ such that:

$$(9) \qquad \mathbf{A}^* = \begin{bmatrix} \mathbf{A\,0\,C} \\ \mathbf{V\,0\,0} \\ \mathbf{0\,Y\,0} \\ \mathbf{0\,0\,T} \end{bmatrix}$$

where the matrices that make up $\mathbf{A}^*$ include: **A**, matrix of input-output direct coefficients for production activities (*n, n)*; **V**, matrix of value-added coefficients (*m, n)*; **Y**, matrix of income distribution coefficients (*k, n*); **C**, the matrix of household expenditure coefficients (*n, k)*; **T**, matrix of inter-institutional transfer coefficients (*k, k)*; with *n* the number of sectors; *m* the number of value-added categories; and *k* the number of endogenous institutions.

Furthermore, Matrix $\mathbf{A}^*$ is the SAM matrix of the direct coefficients ($n + m + k, n + m + k$), indicating the monetary linkages and flow within a modeled economy. Drawing from the I-O framework, the value-added coefficients or factor income coefficients, represented by **V** indicate the monetary flow for production including labor, land, and capital. The income distribution coefficients (**Y**) map the flow of income to institutions including households, companies, and the government. The household expenditure coefficients (**C**) finish the loop by mapping income from institutions back to producing sectors (Adelman and Robinson, 1986). The input-output direct coefficients for production activities (**A**) and the inter-institutional transfer coefficients (**T**) represent the intraregional interdependencies. With the expanded number of relationships accounted for, the dynamic model can now be written as:

$$(10) \quad \begin{bmatrix} x \\ v \\ y \end{bmatrix} = \mathbf{A}^* \begin{bmatrix} x \\ v \\ y \end{bmatrix} + \begin{bmatrix} e^x \\ e^v \\ e^y \end{bmatrix}$$

where x is the vector of sectoral supply (n, 1); v is the vector of value added by categories (m, 1); y is the vector of institutional incomes, (m, 1); e^x is the vector of exogenous sectoral demand (n, 1); e^v is the vector of exogenous value added (m, 1); and e^y is the vector of exogenous institutional income (k, 1).

Utilizing the identity matrix **I** and the inverse of matrix $\mathbf{A}^*$ to create the SAM inverse multiplier matrix, $(\mathbf{I} - \mathbf{A}^*)^{-1}$, or simply **M**, the model can now be written as:

$$(11) \qquad \begin{bmatrix} x \\ v \\ y \end{bmatrix} = \mathbf{M} \begin{bmatrix} e^x \\ e^v \\ e^y \end{bmatrix}$$

where **M** is representative of the total requirements table. The model enables the economic impact of any exogenous change in sector supply (x), value added (v), and institutional incomes (y) to be derived proportionally through the model and expressed in terms of regional sectoral supply, value added, and incomes (Adelman and Robinson, 1986).

Data

Data necessary to estimate the economic contribution of farmer cooperatives to Kansas include indicators of economic activity such as jobs, wages, income, and taxes. These details about the Kansas grain and farm supply cooperative sector were gathered from an industry survey, the CoBank Risk Analyst database, and the Kansas Department of Labor's quarterly census of employment and wages. Information was gathered for the 77 farmer cooperatives that had upright grain locations in Kansas as of the end of 2017. Some of these cooperatives are headquartered outside of Kansas, in Nebraska, Oklahoma, and Texas. However, only the economic activity generated in their Kansas business operations was included in the final data. Specialized grain marketing limited liability companies owned by cooperatives and their members were excluded from this analysis to avoid the potential of double counting activity and overstating value.

A survey was constructed and sent to all CEOs of farmer cooperatives in Kansas (Clymer 2019). Information collected included economic activity from the 2017 fiscal year-end financial and payroll documents. In addition, the amount of business activity conducted within Kansas was collected. This information was especially important for those cooperatives with headquarters outside of Kansas. According to the survey of business conducted in Kansas, approximately 87 percent of the cooperatives' members resided in Kansas. This information provided an estimate of the Kansas cooperative sector total economic activity. A total of 47 cooperatives responded to the survey, which equates to a 61 percent response rate.

To supplement the survey, the CoBank Risk Analyst data were used for additional financial information. The CoBank data provided 2017 financial information for 60 cooperatives headquartered in Kansas. In the context of contribution analysis, the financial data provided enough detail for a dynamic analysis. For example, revenue was broken down by enterprise such as commodities, feed, fertilizer, chemical, seed, fuel, and other business. Expense line items were also broken out, including employee wage and benefit payments, lease or rent expenses, utilities, repairs and maintenance expenses, insurance costs, trucking expenses, interest, income taxes, property taxes, and cost of goods sold by enterprise. Additional financial information included storage revenue, income from patronage or joint ventures, cash patronage payments, and net earnings retained by the business.

In comparison to our defined population of 77 cooperatives, 11 Kansas cooperatives and the 6 cooperatives that are headquartered out of state were either absent or not identifiable within the CoBank data. Identifying the specific names of the missing cooperatives was not possible as the entities in the CoBank data are anonymous and confidential. To overcome this limitation, it was necessary to extrapolate the data to represent these "missing" 17 cooperatives in the data. Utilizing the survey data and the Kansas Department of Labor's Quarterly Census of Employment and Wages, we had an accurate count of employees for each of the 77 grain marketing and farm supply cooperative operating in Kansas. Table 1 details the breakdown of Kansas cooperative employment data by where the cooperatives were headquartered.

The employment data provides the mechanism for extrapolating from the existing data to represent the missing economic data. Doing so is important because that will provide the most complete data for estimating the economic contribution of farmer cooperatives to Kansas. As Table 1 indicates, the Kansas jobs from the missing cooperatives headquartered outside of the state were 493 when aggregated from the survey. The remaining 11 Kansas cooperatives were accounted for by multiplying by the average employment, 58.58 jobs, of the 71 cooperatives headqartered in Kansas. These 11 missing Kansas cooperatives account for an estimated 644.4 jobs. The estimated representation of missing Kansas employment from the 17 cooperatives was then 1,136.4 jobs. This missing employment was then used to create a coefficient, based on employment, to increase the financial data not present in the CoBank dataset. The result was that an estimated 27.3 percent of the sector's financial value was absent from the CoBank dataset.

The state totals from the CoBank data were then increased by 27.3 percent to establish to a more complete estimate of sectoral activity. Table 2 shows the resulting summary statistics about the cooperative industry after extrapolating the data.

The next step was to identify what financial data are necessary to align with how IMPLAN categorizes industry economic activity. Understanding the description of each of the IMPLAN categories assists in appropriately allocating the financial information. Table 3 presents these definitions and how the financial information about the Kansas cooperative sector was organized.

All financial information available in the CoBank data were allocated according to Table 3. In the first IMPLAN model, patronage is recorded as proprietor income, following the work of Folsom (2003) and Park et al. (2009). This method assumes a high level of localized cooperative ownership. Unlike dividends paid by publicly traded companies, patronage payments most likely have a higher value-added impact since membership is more locally concentrated, allowing less money to seep out of the economy of interest (Zeuli and Deller, 2007). This localized spending therefore aligns closer to how profits from a sole proprietor is modeled in IMPLAN. The second model relaxes the localized ownership assumption, allocating cash patronage as a dividend.

Customization of Industry Sectors within IMPLAN

The majority of Kansas farmer cooperatives operate as both a grain marketing entity and as a retail supplier. In the context of economic analysis within IMPLAN, these types of businesses should have different purchasing or direct requirement needs. Choosing to model farmer cooperatives as one sector could create aggregation bias. Therefore, the cooperative industry activity was split into grain storage operations and agricultural input sales for greater accuracy in modeling the actual relationships of the cooperative sector with the greater Kansas economy.

The decision rule for segmenting the industry was based on business activity contribution to output. IMPLAN views output as the monetary amount available for paying operating expenses, distributing patronage, and retaining business profits. The two segments within a farmer cooperative that match best within IMPLAN are the warehousing and storage sector and the wholesale sector. Storage revenues and margins represented 14 percent of the income available for cooperative operations. The gross margin from sales of commodities, feed, fertilizer, chemicals, fuel, and other income accounted for the remaining 86 percent of output. These gross margins were considered wholesale activity to ensure that the supply chain was correctly attributed to the cooperative sector. Table 4 breaks down the financial information into these two sectors for each of the models.

This separation of cooperative industry activity was applied to each of the models as two new sectors in IMPLAN known as grain storage operations and wholesale sales. Although one might align these cooperative activities with the operations of the warehousing and storage sector and the wholesale sector within the North American Industry Classification System, it is necessary to separate the activity from these generic sectors to understand the contribution of only cooperative activity, not the total warehousing and wholesale sector activity in Kansas.

Four steps were required to model cooperatives in the IMPLAN system. We first constructed a Kansas state model through the region data. Then, we customized the study area data by deducting our state-total estimates from Table 4 of employment, output, and value added from the wholesale trade and warehousing and storage sectors respectively. These values would instead be used to create our custom cooperative sectors. We then completed building the state model through the multipliers.

To create custom cooperative business sectors, two industry sectors without any activity in Kansas were selected from the study area data and renamed for our cooperative sectors. After entering our estimates of total cooperative employment, output, and elements of value added in the data fields, the model was rerun. It was then necessary to model the linkages these new sectors have with other industries by customizing industry production. This process includes accounting for the categorized expenses of the industry recorded by CoBank, including lease/rent expense, utilities, repairs and maintenance, insurance, trucking, and other operating expenses. These expenses can be utilized to create proportions as the value of the good or service purchased divided by output. These ratios, known as absorption coefficients, are assigned to the IMPLAN input sectors to indicate the purchasing relationships of the cooperative sector. Collectively, the absorption coefficients for one industry are like a "production recipe" indicating the direct requirements necessary for an industry to operate. The total absorption value plus the value added coefficient creates the total production function for an industry. Table 5 shows the coefficients for the known cooperative sector business expenses and the associated sector. The interpretation of these values suggests that cooperatives spend approximately 36.4 percent of their expenditures for inter-industry inputs, and about 63.6 percent for value added.

Ideally, we would have unique coefficients for each of our two cooperative sectors, but the budget information available only allows us to separate wholesale and storage revenues. On the expenditure side, we are constrained using a "blended" expenditure pattern when customizing the absorption coefficients.

To create each cooperative sector's custom absorption table, we imported the absorption tables from the wholesale and warehousing sectors respectively, overwriting the existing tables for our empty sectors. We then overwrite the commodities purchase coefficients for our known expense categories as shown in Table 5. The other operating expenses do not have an associated IMPLAN sector because the type of input and associated value are unknown. For this reason, the remaining 22.44 percent of output was distributed across each new sector's production function using the Balance function. This procedure distributed tiny bits of the other operating expenses across a broad range of inputs.

These new production functions now represent intermediate expenditure relationships with 200 plus industries including the proportions of what is known and an estimation of what is unknown about the actual monetary relationship between these industries and farmer cooperatives. The sum of these technical coefficients is known as the total absorption value. The portion of output that goes toward the other categories of employee compensation, proprietor income, other property type income, and taxes on production and imports is the value added coefficient. Together, the absorption value and the value added coefficient must add to one. This indicates that all monetary relationships of an industry are considered. IMPLAN then utilizes this new information to build the total requirements table, adjusting for the newly introduced industries. Following modification of the absorption coefficients, the model was rerun.

With the two new cooperative industry sectors built into the model and the activity deducted from the sectors from which they were broken out, the final step was to analyze the activity of our cooperative sectors. We created new events for each sector, entering the total employment and industry sales for each. We analyzed these values for a single region (Kansas) to obtain the values for the associated indirect and induced effects. The entire modeling exercise was replicated for the two scenarios treating patronage payments as proprietary income or as other property income.

Results

Results are summarized in a way that closely aligns to the aggregated category information entered into IMPLAN. Contribution results are broken down into the following categories: (1) employment (total number of full-time and part-time jobs); (2) labor income (total employee compensation plus proprietary income); (3) total income (labor income plus other property type income plus taxes on production and imports); and (4) output (gross margin).

Each of these four categories are also broken down into the type of effect (direct, indirect, and induced effects). Direct effects are the activity of the industry that is known from the primary data and are the inputs into the model. Indirect effects are the inter-industry revenue generated in the economy due to the purchase of inputs of goods or services from various industries by the cooperative sector. Induced effects are the spending by institutions such as households and the government due to the total income generated both directly and indirectly by the cooperative business activity.

Multiplier values are also formulated from the calculation of the total effects of the category divided by the direct effects. Multipliers are commonly presented for output, income, and employment. The output multiplier indicates the additional contribution in the state's economy for each dollar of cooperative sector output. The same interpretation applies to income or jobs in the cooperative sector.

The size of the multiplier is also an indicator of model validity. Swenson (2006) argues that multiplier exaggeration occurs in a variety of industrials sectors due to double counting. An industry specific multiplier should only represent the marginal effects of the industry of interest. When completing a state-level analysis, multipliers usually range between 1.0 and 3.0 (Miller, 2009). Multipliers, though, are dependent on the geographic region, industry of interest, and where the modeled industry commonly purchases inputs (Miller, 2017).

Economic Contribution of Farmer Cooperatives to Kansas

Although cooperatives provide value in various ways, the results generated by this research begin to quantify their economic contribution to the Kansas economy. The modeling process was completed twice to produce two sets of results that together indicate a range of contribution with the upper bound of the range assuming all cooperative ownership is local and the lower bound relaxing the localized ownership assumption in the model. The model then produces results in terms of direct, indirect, and induced effects. Table 6 provides an estimate of the contribution of the Kansas grain marketing and farm supply cooperative sector.

Given that the two models were identical with the exception of how certain income payments were modeled, we expect the direct and indirect effect to be the same. The exception is having moved $71 million of patronage out of labor income to other property income. The difference between the two models would be observed in the induced effects. Further, we expect the scenario of patronage as proprietor income generally to have larger induced effects than patronage as dividends. The vast majority of proprietary income stays in the state whereas a large proportion of dividends leaves the state.

The upper bound results (Model One) assume one hundred percent localized ownership by allocating patronage as proprietor income. These results include $679 million in total income derived directly from the cooperative sector and an additional $426 million in indirect and induced income. Total income accounts for the contribution of patronage in addition to other types of income. Employment for the cooperative industry is 4,652 jobs with 5,219 additional jobs closely related to the direct employment. Direct output reached just over $1 billion with an additional $780 million in indirect and induced effects.

The multiplier values represent interdependency in the economy. The total income multiplier, representing income from employee compensation, proprietary income (patronage), other property income, and indirect business taxes is 1.63. This suggests that one dollar of income generated in the cooperative sector stimulates the generation of an additional $0.63 in total income throughout the economy. The output multiplier is 1.73, indicating that for each dollar of output generated by the cooperative sector, an additional $0.73 of output is generated in other sectors. The employment multiplier is 2.12, which signifies that for each job in the cooperative sector, another 1.12 jobs were closely tied to cooperative employment.

The second model relaxes the assumption of localized cooperative ownership, signaled by higher monetary leakage in successive rounds of spending. The results of this model include the same direct and indirect effects as the previous model as both are tied to the same business activity. The induced and total effects differ due to patronage being treated like a dividend, which results in smaller levels of contribution.

The two sets of results provide a range of induced effects generated by the cooperative sector in Kansas. The ranges for the two models vary by category. When comparing total effects, the output range is $51 million less in induced effects. Similarly, the results are 377 fewer jobs, $16 million less labor income, and $28 million less total income when patronage is treated as dividends rather than proprietary income.

The economic multipliers generally reflect the strength of the economic linkages associated with keeping more money in the state. The labor income multipliers seem rather anomalous, with model two's larger value. The value is somewhat deceptive, and is due to shrinking the denominator in the calculation by $71 million. Multipliers from this study are comparable to other economic contribution studies in other states. Although methodologies for calculating multipliers differ, our results for Kansas are similar to those estimated for North Dakota (McKee, 2011), Wisconsin (Zeuli et. al, 2003), Minnesota (Folsom, 2003), and Nebraska (Herian and Thompson, 2016).

Conclusion

Cooperatives provide value in many ways including holding the "yardstick position" in the market, providing services, supporting the community philanthropically, and serving as a rural employer and taxpayer. The purpose of this research was to identify the economic contribution of some of these activities by the Kansas grain marketing and farm supply cooperative sector. As agriculture continues to evolve, producers have alternatives of where to source their inputs or sell their grain. With the increased competition, measuring the economic contributions of cooperatives can be valuable for market influence, public policy, and community support.

The methodology for this research carefully considers the challenge of modeling the different and unique relationship cooperatives have with local economies. Furthermore, the methodology discussion provides a clear explanation of how IMPLAN models are estimated using social accounting matrices. Our analysis utilized primary survey data and secondary data from the 2017 CoBank Risk Analyst data to estimate an IMPLAN model. Results show that output, employment, and total income are all higher when localized ownership is assumed. Distribution of cash patronage and the resultant localized spending is a key assumption driving these results and a unique aspect of the cooperative business model.

Measuring the economic contributions of cooperatives helps illustrate the role cooperatives serve within the Kansas economy. In Kansas, just over 4,600 full-time and part-time jobs are attributed to farmer cooperatives. When the multiplier effect of how these jobs help support other industries is considered, the number of jobs reaches nearly 10,000. Furthermore, farmer cooperatives contribute a total value of roughly $1 billion in all types of income and more than $500 million in labor income.

IMPLAN modeling does have its limitations. The linear accounting system employed within IMPLAN assumes constant returns to scale, which causes many of the modeling assumptions to be fixed. In addition, the input-output model is derived from national income and product accounts, which could lead to aggregation bias. However, the steps taken within this research attempted to limit these weaknesses. The survey of farmer cooperatives and the CoBank data are used to refine the technical coefficient estimates to better reflect the farmer cooperative industry. The results from IMPLAN modeling provide straightforward estimates that can be used by individuals and groups to show the broader contributions of cooperatives in Kansas.

Cooperative management, boards of directors, and industry advocates can utilize these results to communicate the value of the Kansas farmer cooperative sector. When communicating the value of farmer cooperatives in Kansas, the "ripple effect" or multiplier effect cooperatives have throughout the state of Kansas also should be recognized. These results should help communicate the value of cooperatives to farmer-members during a period of elevated competition, or as policy makers decide whether to fund initiatives supporting rural agribusiness. In short, farmer cooperatives provide economic support to their farmer-owners as well as the local communities they serve.

References

Adelman, I. & S. Robinson (1986). "US agriculture in a general equilibrium framework: Analysis with a social accounting matrix." *American Journal of Agricultural Economics*, 68(5), 1196-1207. Retrieved from https://www.jstor.org/stable/1241875

Deller, S., A. Hoyt, B. Hueth, & R. Sundaram-Stukel (2009). Research on the economic impact of cooperatives. University of Wisconsin–Madison. Retrieved from http://reic.uwcc.wisc.edu/

Folsom, J. (2003). *Measuring the economic impact of cooperatives in Minnesota*. (RBS Research Report 200). United States Department of Agriculture Rural Development. Retrieved from http://www.uwcc.wisc.edu/pdf/RR200.pdf

Herian, M. & E. Thompson (2016). The economic impact and tax revenue impact of Nebraska supply/marketing and regional cooperatives. Nebraska Cooperative Council. Retrieved from http://www.nebr.coop/economic-impact-study/

Hodges, A.W., T.J. Stevens & A.F. Wysocki (2014). Local and regional food systems in Florida: Values and economic impacts. *Journal of Agricultural and Applied Economics*, 46(2): 285-298.

IMPLAN Group (2018). Retrieved from https://implanhelp.zendesk.com/hc/en-us

McKee, G.J. (2011). The economic contribution of North Dakota cooperatives to the North Dakota state economy. (Agribusiness & Applied Economics Report No. 687). North Dakota State University. Retrieved from http://ageconsearch.umn.edu/record/117167/files/AAE687.pdf

Miller, R.E. (1998). Regional and interregional input-output analysis. Pp. 41-133 in W. Isard, I.J. Azis, M.P. Drennan, R.E. Miller, S. Saltzmen and E. Thorbecke (eds.) *Methods of Interregional and Regional Analysis*. Ashgate.

Miller, R.E. & P.D. Blair (2009). *Input-Output Analysis: Foundations and Extensions* (2nd ed.). Cambridge.

Park, J.L., J.R. Baros & R.M. Dudensing (2009). Communicating the value of Texas cooperatives. College Station, TX: Roy B. Davis Cooperative Management Program. Retrieved from https://agecoext.tamu.edu/wp-content/uploads/2013/08/Communicating_Cooperative_Value.pdf

Pendell, D., J. Leatherman, T. Schroeder & G. Alward (2007). The economic impacts of a foot-and-mouth disease outbreak: A regional analysis. *Journal of Agricultural and Applied Economics*, 39(1), 19-33.

Sills, E.O., J.R. Alwang & P.J Driscoll (1994). Migrant farm workers on Virginia's eastern shore: An analysis of economic impacts. *Journal of Agricultural and Applied Economics*, vol. 26(1), pages 1-15.

Swenson, D.A. (2006). Input-outrageous: The economic impacts of modern biofuels production. Ames, IA: Department of Economics Iowa State University. Retrieved from http://www2.econ.iastate.edu/research/webpapers/paper_12644.pdf

Thorbecke, E. (1998). Social accounting matrices and social accounting analysis. Pp. 281-331 in W. Isard, I.J. Azis, M.P. Drennan, R.E. Miller, S. Saltzmen and E. Thorbecke (eds.) *Methods of Interregional and Regional Analysis.* Ashgate.

Watson, P., J. Wilson, D. Thilmany & S. Winter (2007). "Determining economic contributions and impacts: What is the difference and why do we care?" *Journal of Regional Analysis and Policy*, 37(2), 15-19. Retrieved from http://www.jrap-journal.org/pastvolumes/2000/v37/F37-2-6.pdf

Zeuli, K. & S. Deller (2007). "Measuring the local economic impact of cooperatives." *Journal of Rural Cooperation*, 35(1), 1-17.

Zeuli, K., G. Lawless, S. Deller, R. Cropp, & W. Hughes (2003). *Measuring the economic impact of cooperatives: Results from Wisconsin*. (RBS Research Report 196). United States Department of Agriculture Rural Development. Retrieved from http://www.uwcc.wisc.edu/pdf/RR196.pdf

Table 1. Kansas Farmer Cooperative Employment

Employment Detail	Total Jobs in Kansas
KS jobs of cooperatives headquartered in KS (n=71)	4,159
KS jobs of cooperatives headquartered outside of KS (n=6)	493
Total KS farmer cooperative jobs (n=77)	4,652

Sources: Kansas grain cooperative economic impact survey; Kansas Department of Labor (DOL) Quarterly Census of Employment and Wages

Table 2. Kansas Farmer Cooperative Summary Statistics, 2017

Variables[a]	Cooperative Average[b] ($ in thousands)	Total in Kansas[c] ($ in thousands)
Total Sales Revenue and Income	$128,133	$9,866,237
Cash Patronage Paid	$923	$71,080
Net Profit after Patronage	$2,676	$206,040

Table 3. Necessary Financial Information for use in IMPLAN

Economic Category and Definition	Data Organization for Model 1	Data Organization for Model 2
Output		
▪ Annual value of industry production expressed in producer prices ▪ Retail and wholesale trade output, such as for cooperatives, is represented by gross margin.	▪ Gross margins for grain, feed, fertilizer, chemical, fuel, and other sales ▪ Other business revenue including storage and other operating revenue; income from joint ventures; cash patronage income; and miscellaneous income	▪ Gross margins for grain, feed, fertilizer, chemical, fuel and other sales ▪ Other business revenue including storage and other operating revenue, income from joint ventures, cash patronage income, and miscellaneous income
Employee Compensation		
▪ Value of wages, salary, all benefits, and payroll taxes paid by the employer	▪ Employee compensation	▪ Employee compensation
Proprietor Income		
▪ Income of self-employed individuals or unincorporated business owners in the industry	▪ Portion of income taxes ▪ Cash patronage paid	▪ Portion of income taxes
Other Property Type Income (Other Property Income)		
▪ Corporate profit distributions such as dividends, business profits, business transfer payments, and net interest	▪ Net interest ▪ Net earnings after patronage ▪ Portion of income taxes	▪ Net interest ▪ Net earnings after patronage ▪ Portion of income taxes ▪ Cash patronage paid
Taxes on Production and Imports		
▪ Sales and excise taxes, duty payments, property taxes, and licensing fees - recorded as less subsidies	▪ Property taxes	▪ Property taxes

Table 3. Necessary Financial Information for use in IMPLAN (cont.)

Employment		
▪ Full- and part-time workers in the industry	▪ Annual average of jobs for the industry	▪ Annual average of jobs for the industry

Source: IMPLAN Group, 2018 implanhelp.zendesk.com/; CoBank Kansas cooperative sector income statement

Table 4. Aggregated Cooperative Financial Values by Sector and Model (2017$)

Economic Category	Cooperative Wholesale Sector[a]	Cooperative Storage Sector[b]	Total Aggregate Category
Model One[c]			
Employment	4,001	651	4,652
Output	$918,236,443	$149,480,351	$1,067,716,794
Employee Compensation	$265,332,152	$43,193,606	$308,525,758
Proprietor Income	$61,705,388	$10,045,063	$71,750,451
Other Property Type Income	$238,184,280	$38,774,185	$276,958,465
Taxes on Production and Imports	$18,829,108	$3,065,204	$21,894,312
Model Two[d]			
Employment	4,001	651	4,652
Output	$918,236,443	$149,480,351	$ 1,067,716,794
Employee Compensation	$265,332,152	$43,193,606	$308,525,758
Proprietor Income	$576,387	$93,830	$670,218
Other Property Type Income	$299,313,281	$48,725,418	$348,038,698
Taxes on Production and Imports	$18,829,108	$3,065,204	$21,894,312

Note: [a] Cooperative Wholesale Sector activity represents an estimated 86 percent of cooperative business activity in Kansas.
[b] Cooperative Storage Sector activity represents an estimated 14 percent of cooperative business activity in Kansas.
[c] Model one aggregated cooperative cash patronage as proprietor income.
[d] Model two aggregated cooperative cash patronage as other property type income.
Source: 2017 CoBank Kansas cooperative sector income

Table 5 Technical Coefficients for Known Cooperative Expense Categories

Expense	IMPLAN Sector[a]	Values[b] ($ 2017)	Coefficients[c]
Output		$ 1,067,716,794	
Lease/Rent Expense	440- Real Estate	$ 19,996,268	0.018728
Utilities	49- Electric and Power Transmission	$ 42,679,997	0.039973
Repairs and Maintenance	62- Repairs and Maintenance for Non-residential Property	$ 40,443,448	0.037878
Insurance Expense	437- Insurance Carrier	$ 26,981,927	0.025271
Trucking Expense	411- Truck Transportation	$ 18,857,876	0.017662
Other Operating Expenses	Balance[d]	$ 239,628,292	0.224431

Note: [a] IMPLAN sector based on the North American Classification System.
[b] Values are the aggregate sector expenses from the 2017 CoBank Kansas cooperative sector income statement.
[c] Coefficients are calculated as the expense value divided by output.
[d] The remaining .224421 of coefficient values is allowed to balance in the model, distributed to 200-plus industries.
Sources: IMPLAN Group; 2017 CoBank Kansas cooperative sector income statement

Table 6. Cooperative sector contribution to Kansas (2017$)

	Model One	Model Two	Absolute Difference
Employment			
Direct Effect	4,652	4,652	-
Indirect Effect	2,373	2,373	-
Induced Effect	2,846	2,470	377
Total Effect	9,871	9,495	377
Multipliers[a]	2.12	2.04	0.08
Total Output[b] ($ Millions)			
Direct Effect	$1,067.72	$1,067.72	-
Indirect Effect	$393.97	$393.97	-
Induced Effect	$386.90	$335.97	$50.93
Total Effect	$1,848.58	$1,797.65	$50.93
Multipliers[a]	1.73	1.68	0.05
Labor Income ($ Millions)			
Direct Effect	$380.28	$309.20	$71.08
Indirect Effect	$135.76	$135.76	-
Induced Effect	$120.97	$105.11	$15.86
Total Effect	$637.01	$550.28	$86.73
Multiplier[a]	1.68	1.78	0.10
Total Income[c] ($ Millions)			
Direct Effect	$679.13	$679.13	-
Indirect Effect	$212.03	$212.03	-
Induced Effect	$214.54	$186.20	$28.33
Total Effect	$1,105.69	$1,077.36	$28.33
Multipliers[a]	1.63	1.58	0.05

Note: [a] The implicit multipliers calculated are state-level multipliers and should not be applied to an individual cooperative or sub-state region.
[b] Total output is the value of industry production.
[c] Total income is the difference between an industry's total output and the cost of its intermediate inputs.