Haywood County’s Economic Dependence on Agriculture:

An Input-Output Analysis

A Thesis Presented for the Master of Science Degree

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Abstract

The purpose of this study was to measure the impact that agriculture and agriculturally related industries have on the economy of Haywood County. One motivation for this study was to gauge the validity of classifying Haywood County as not “farm dependent,” which is the determination using the typology codes developed by the USDA’s Economic Research Service. The method used was to collect data on the expenditures of the agricultural industry in 2010 and incorporate those into the ready-made IMPLAN input-output model. The data were primarily collected from the Bureau of Economic Analysis and the Haywood County USDA Farm Service Agency. The revised model with the new data was then run to produce the multipliers used to show the total impacts of agriculture on the economy. Using those multipliers an impact on proprietor income was run to show the impacts of a change in that value. The results showed that despite the large differences in agriculture data there was not a substantial difference between the models in several respects. When compared with the rest of the industries in the county, the proportions of income and employment from agriculture were consistent with the ERS typology classification. However, including the agriculturally related industries would classify Haywood County as “farm dependant.” Lastly, the results showed that agriculture had a higher impact on the rest of the economy per dollar of industry output than most other goods producing industries.

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Chapter 1. Introduction

The proportion of farm income to total income and people employed in agriculture in the United States has been steadily declining over the past several decades. This trend in agriculture has led many to believe that, "although agriculture continues to be the predominant land use in most U.S. nonmetro counties, it is relatively unimportant as a direct or indirect source of jobs and income in most rural communities" (Jackson-Smith and Jensen 2009). Also reflecting this trend, a number of researchers and rural economic practitioners have documented a steady decline in the number of places that are dependent on farming for their livelihood (Kassel and Carlin 1999; Salsgiver and Hines 1993; Schluter and Edmundson 1999; Jackson-Smith and Jensen 2009). As a result of this perceived decline in the importance of farm income, federal farm and rural development programs have undergone a fundamental reorientation (Whitener 2005; Jackson-Smith and Jensen 2009).

In response to this increased attention to the economic diversity in rural areas, in the early 1980s the USDA's Economic Research Service (ERS) developed "economic dependency" codes establishing the typology of nonmetro counties (Bender et al. 1985). These codes were based on whichever economic sector provided an unusually high percentage of personal income in the county. According to the ERS, a county was "farm-dependent" (FD) if the annual average of labor-and-proprietor income (LPI) from farming between 1975 and 1979 exceeded 20% of the total LPI in the county. It was then revised in the early 1990s using 1989 data after a decade that brought many changes to rural America through events such as the farm crisis and the growth of the service sector (Jackson-Smith and Jensen 2009). The new data showed a decrease in farm-dependent counties by 26.3 percent (Cook and Mizer 1994). The last time this typology was revised was in 2004 in which the requirements for FD counties were lowered to 15 percent of either total employment or proprietor income. Again, this was an annual average over 3 years from 1998-2000. The results of this study showed that 440 total and 403 nonmetro counties of the 3,141 U.S. counties, boroughs, independent cities, parishes, and other county equivalents were farm dependent (USDA-ERS 2004).

However, this analysis based purely on net farm income and employment percentages in rural counties does not paint the whole picture of the importance of farming in rural areas. An example of this problem is depicted in the rural, heavily agricultural counties of West Tennessee. None of these counties were determined by the ERS to be farm dependent, despite a large agricultural sector in the region. It is for this reason that Haywood County, Tennessee was specifically chosen for this study. Agriculture may be a relatively smaller source of income in rural areas like that of Haywood County these days, but it has many indirect contributions to rural economies beyond the farm gate. These secondary contributions can be in the form of business revenues generated in the county from input and service suppliers, and through related industries such as transportation, processing, and marketing of agricultural commodities (Jackson-Smith and Jensen 2009). Farm-related industries also provide many other direct and indirect impacts on rural economies through the amount of employment created by each in the county. Incorporating factors beyond net farm income and direct farm employment into the analysis should provide a better picture of farm dependency in the area. However, there are still many differences in data and methods used in the existing literature. Much of it is also outdated as the most recent study used 2006 data. Therefore, this study aims to use the most recent data available as well as the most inclusive definition of farm-related industries within each county in the selected region. Furthermore, in order to accurately prescribe policies for rural areas, a study that incorporates more direct and indirect impacts of agriculture is both timely and necessary in understanding the true scope of the agricultural industry in rural counties.

Overview of Haywood County and its Economy

Haywood County was chosen for this study due to various reasons beyond its large agricultural industry. The primary reasons were its relatively small population and that its largest city, where the majority of the business and industry is located, is centrally located within the county thus minimizing economic leakage to other counties. Haywood County is considered by the U.S. Census to be a part of the Brownsville micropolitan statistical area. A micropolitan statistical area is a geographic area that includes an urban center with a population of at least 10,000 but less than 50,000 which would include Brownsville in this case. According to the 2010 Census the population of the county was 18,787 which ranked 67th out of 95 counties in Tennessee which shows that the county's population is small relative to the rest of the state. The majority of the population resides in Brownsville, whose population was 10,292 according to the 2010 Census. The other city with a relatively sizable population is Stanton, whose population was less than 500 according to the Census.

The industry makeup of Haywood County is fairly diverse with a mix of agriculture, manufacturing, services, retail and wholesale trade, tourism, etc. According to the Tennessee Department of Economic and Community Development (ECD) Haywood County is home to over 340 firms from a variety of industries. The largest employer is the manufacturing industry according to 2009 data from the ECD which showed employment of 1,723. However, the manufacturing industry is primarily an exporting industry from the county so its main economic contribution is through employment. The largest employers according to Tennessee Economic and Community Development data are Teknor Apex/Haywood Company, a PVC garden hose and tread rubber manufacturer; Lasco Fittings Inc., a plastic pipe fittings manufacturer; Dynametal Technologies, a powered metal components manufacturer; and Pictsweet, a frozen food distribution center. According to the ERS's County Typologies the county is manufacturing dependent because 25 percent or more of earnings in the county come from manufacturing according to BEA data.

Beyond manufacturing there is a large service industry as well as a large retail and wholesale trade industry in the county. Most of the businesses are located within Brownsville which is geographically located close to the center of the county, so local retail and wholesale trade businesses and services can draw business from all around the county. According to a study done for the Haywood County Chamber of Commerce the county had total retail, food and drink sales in 2010 of approximately $123 million from 131 businesses, but according to the study the demand was approximately $140 million so there was approximately a 7 percent leakage to other areas. These places include the Jackson and Memphis market areas due to the fact that Brownsville is located just off of interstate 40 and has two exits that provide easy access to markets outside the county. The county is also served by one railroad which runs through Brownsville and carries grain, cotton, and other goods directly to and from industry locations in town.

Agricultural Economy of Haywood County

Haywood County has a vibrant agricultural industry due to its fertile soils and large proportion of land in farms. For this reason the Haywood County Chamber of Commerce claims agriculture as the county's largest industry. According to the Chamber of Commerce agriculture and agriculturally-related business contributed over $150 million to the county's economy in 2009. According to the 2007 Census of Agriculture done by the USDA's National Agriculture Statistics Service (NASS), the county had 491 farms on 214,336 acres of land. However, while NASS reports that number of farms there are actually fewer farmers in the county that account for the majority of the agricultural activity according to interviews with local businesses and producers. According to interviews there are approximately 15 farmers who account for around 95 percent of the agricultural economy with another 10 to 15 who account for the majority of the rest of the farming activity. Therefore, according to interviews, only 15 to 20 percent of the farm land is farmer owned with the majority of the rest being in share programs with the land owners. The total land area for the county is 341,220 acres, so the proportion of the land being farmed amounts to approximately 63 percent.

The major commodities produced in the county include cotton, soybeans, corn, wheat, and sorghum, but there are also a small number of livestock, fruits, flowers, etc. grown in the county. However, cotton is by far the predominant commodity produced in the county. Its planted acreage ranked first in the state at 95,040 acres according to the 2007 Census of Agriculture. However, that number has fluctuated across years as acres are rotated between cotton and mainly soybeans. In 2011, 96,734 acres of cotton were planted with 49,034 in soybeans, but in 2010 only 79,873 acres of cotton were planted with 66,423 acres in soybeans. Haywood County also produces more bales of cotton than any other county in the state. It produced 161,550 bales in 2010 according to NASS. To gin that amount of cotton, the county has 7 cotton gins located throughout the county that gin the majority of the county's cotton as well as cotton from surrounding counties. To supply the inputs for this vast agriculture industry, Haywood County has four input suppliers that sell seed, fertilizer, chemicals, etc. The county also has two farm machinery dealerships located in Brownsville.

Haywood County also has a large amount of federal farm program payments and ranks near the top in the state. The majority of these payments are direct and counter-cyclical payments. In 2010 over $4 million was paid under commodity program payments with the rest of payments coming from the Conservation Reserve Program which accounted for over $1 million.

Objective

The focus of this study was to determine the level of Haywood County's economic dependence on the agricultural industry as a whole. This would include the economic activity of the primary agriculture industry as well as agricultural inputs, forestry, and secondary agriculture, which includes value-added food processing industries. Furthermore, the motivation for this study was to gauge the validity of the typology codes developed by USDA's Economic Research Service (ERS) which classified Haywood County is "farm dependent" despite an abundant agricultural industry.

Chapter 3. Review of Literature

A History of Studies in Economic Dependence on Agriculture

There have been many studies aimed at identifying the scope of the farm sector in rural America even before the ERS released its first county typology codes in the early 1980s. Each study contributes to the literature in different ways using many different methods and data sources.

One of the earliest studies that linked farming to the rural economy was done in 1947 by a rural sociologist. This study located in California showed that regions with large, corporate farms had rural communities that were less viable than ones with more small farms (Goldschmidt 1947). While this study was aimed more at socioeconomic conditions it still shows early attempts at linking the farm sector to the rural economy. In 1979 the first major study of economic dependencies by the ERS was conducted. This study used Census data to establish "economic dependency" codes to establish the typology of nonmetro counties (Bender et al. 1985). According to the ERS a county was "farm-dependent" (FD) if the annual average of labor-and-proprietor income from farming between 1975 and 1979 exceeded 20% of the total labor-proprietor income in the county. Using that methodology the ERS determined that of 2,443 counties classified as nonmetro, or rural, approximately 716 were farm dependant. This code was then revised in 1985 to show further changes in rural counties. Upon revising the code the data showed a significant decline in farm dependent counties which then totaled approximately 516 counties. During this same time period a couple of studies were done using an input-output analysis to establish linkages between agriculture and the rest of the rural economy. One study done in Oklahoma (Woods and Doeksen 1983) used an input-output (IO) model that showed impacts on agricultural input manufacturers from changes in the agricultural sector and changes in population that affected demand for local services. Another done by Otto and Meyers (Otto 1986) also used IO to examine the long-run agricultural outlook for non-agricultural sectors in Iowa. This study also incorporated policy effects based on an analysis of the 1985 Farm Bill by the Food and Agricultural Policy Research Institute. Using that methodology accounted for the influence of macroeconomic policies at the national level and econometrically linked the Iowa markets to national commodity markets (Otto 1986). Using the results of the analysis of the agricultural sector based on the Farm Bill, the nonagricultural sector impacts were estimated using the IO model (Otto 1986).

Furthermore, in the 1990s more studies were conducted to attempt to measure the scope of agriculture in counties and at the national level. Salsgiver and Hines (1993) did a study using employment and income-based measures to profile farming counties to build on the work done by the ERS. Furthermore, the ERS updated their county typologies again in the early 1990s adding a few more dependency codes. However, this study showed that the number of farm dependent counties had decreased by 26.3% (Cook and Mizer 1994).

In 1994 a study by Leones, Schluter, and Goldman (1994) looked further into the importance of agriculture in interindustry analysis. The study looked at other studies done in 27 states in which 14 used input-output analysis, and of those 14 states 11 used the Impact Analysis for Planning Model (IMPLAN). Furthermore, they identified two common approaches to define agricultural activity at the national level. The first approach was to start with the consumption of food and fiber and then work backwards through the industry sectors that help to meet that demand for food and fiber. The second approach was to use the value of raw agricultural products and the value added to these products by looking back at input suppliers and forward through processors and distributors (Leones, Schluter, and Goldman 1994). State studies that used these definitions showed significant differences in multipliers between the two. One study in California showed total income, value added, and employment impact estimates for the first definition to be 15.5%, 14.2%, and 18.5% respectively. On the other hand use of the second definition produced impacts of 8.8%, 7.9%, and 9.9% respectively. Beyond choosing which sectors to include, the study also suggested using primary data sources to improve technical coefficients and regional purchase coefficients.

The late 1990s brought a couple of studies that focused on calculating the impact of agriculture on individual counties. In 1997 a study was conducted in Dade County, Florida that once again used input-output analysis to determine the economic impact of various subsectors of agriculture in the county including fruit, vegetables, and nurseries (Degner et al. 1997). While most prior studies had been on rural counties that produced traditional commodities, Dade County is a metro county with a non-traditional agricultural sector that actually ranked second in the state in its value of commodities produced. Furthermore, this study went beyond published data sources to include unpublished sources including interviews with growers, shippers, packers, and extension personnel (1997). These sources were used to estimate the acreage and value of commodities for which there were no official published estimates, and to provide estimates of the "proportion of all commodities shipped out of the county" (1997). These sources were also used to verify the accuracy of published sources and to refine the data so it could be used in the IO model. The IO model used was the Regional Input-Output Modeling System (RIMS II) produced by the Bureau of Economic Analysis (1997). This model produced the direct, indirect, and induced multipliers that showed that total impact of the agricultural sector on the economy as a whole. Results from the input-output analysis showed that agriculture contributed $834 million to the output and $200 million to the income of Dade County both of which were significant contributions.

Around the same time that the Dade County study was done, a similar study in Huron County located in Canada was done using an “input-output like” analysis. The basic methodology for this study was to first use published secondary data sources to determine the direct impacts of agriculture which included sales and employment from agriculture. These values included the value of sales at the farm gate and the number of farm owners, operators, and laborers. The indirect impacts were also calculated using primary data from telephone interviews conducted with agriculturally-related businesses, which included any business that sold to or bought from farms (Cummings et al. 1998). The interviews determined the gross sales and employment of these businesses and the proportion of each that was related to agriculture. Beyond these impacts the induced impacts were also calculated using a multiplier calculated by an earlier study that showed for every dollar spent by agricultural businesses, 73% was spent in the region. Induced jobs were classified as service jobs that were “supported by services purchased by agricultural employees.” Results from the study showed that direct, indirect, and induced calculations showed agriculture and agriculture-related businesses support over 20,000 of just over 30,000 total jobs in the county with an estimated $2 billion in agricultural and related sales were calculated. Furthermore, this study also used an economic base model which classifies the sectors in the local economy as either basic or non-basic. Basic sectors are ones that export their products out of the region while non-basic sectors sell their final products locally (Cummings et al. 1998). The theory behind this approach is that the exporting sectors support all other sectors in the local economy and are the "engine of growth" by bringing new dollars into the economy (1998). This analysis determined that the agriculture and related sectors were basic and thus contributed new income to the county. So, overall this study determined that agriculture had a substantial impact on Huron County's economy.

More recent studies have been geared toward using the employment and income data used by the ERS to estimate farm dependency. Once again the ERS updated its county typologies using 2000 Census data. However, this time the methods used to identify farm dependent counties were changed by lowering the threshold to 15% of either total employment or proprietor income in the county coming from agriculture (USDA 2006). This study showed that of the more than 2000 U.S. nonmetro counties, 420 were farm dependent which was down from 618 in 1990 (Ghelfi and McGranahan 2004). Going beyond the strict definition of farming employment and income used by the ERS, a study was done in 2009 using less restrictive definitions of both (Jackson-Smith and Jensen 2009). This study classified counties as "agriculturally important" (AI) using total agricultural sales for each county as the main indicator and complemented it with sales per acre of total farmland and cropland (Jackson-Smith and Jensen 2009). It used two criteria to determine if a county was AI. First, it ranked all counties by total agricultural sales in which the top quartile (over $72.5 million in 2002) was AI. The second criteria included counties in the second quartile (between $36.1 and $72.5 million), but they also had to be in the top quartile for sales per acre (over $366 per acre)

(Jackson-Smith and Jensen 2009). This yielded many more agriculturally important counties than the ERS farm dependent counties. In fact, it showed that almost half of the U.S. population lived in AI counties, whereas only 2% lived in "farm dependent" counties.

The most recent study conducted in Tennessee by Burton English, Kim Jensen, and Jamey Menard was done in 2009 using 2006 data. The study utilized input-output analysis using the Tennessee Agri-Industry Model (TNAIM) created from the Impact Analysis for Planning model (IMPLAN) (Olson and Lindall 1999). Also, rather than using the strict definition of farm occupation used by the ERS, this study used a broader one that includes primary and secondary agriculture, as well as agricultural input industries according to the North American Industrial Classification System (NAICS) (U.S. Census Bureau 2002). Using this broader definition all 21 West Tennessee counties examined were determined "agriculturally dependent" whereas the ERS determined none were "farm dependent" (Menard, English, and Jensen 2009).

The Evolution of Input-Output Analysis

A common model that was utilized by many of the studies in the agricultural dependence literature was the input-output model. Input-output analysis is a technique for modeling the economic interdependence of sectors within an economy. The theory of interdependence first appeared in the 1700s with Franzois Quesnay who developed a device that graphically showed "the successive rounds of wealth producing activity which resulted from a given increment in output" (Miernyk 1965). However, input-output analysis as it is used today was not developed until the 1930s when Wassily Leontief "developed a general theory of production based on the notion of economic interdependence" (Miernyk 1965). He later turned his theory on input-output economics into the first input-output table for the American economy.

This table showed transactions among industries in the U.S. for 1947. It was aggregated into 42 major sectors of production, distribution, transportation, and consumption, which were organized into a matrix of columns and rows (Leontief 1966). The rows showed how the output of each sector is dispersed among all other sectors in the economy, and the columns showed how it purchased its inputs from the other sectors. Each element in the output row was also an entry in a column which showed that the output of a sector can be the input of another sector. So basically when reading horizontally across the table the numbers represented what each sector shipped to other sectors, and reading vertically down the table the numbers represented what each sector consumed from the other sectors. Tracing these linkages within a sector is the basis of input-output analysis, which is based on the notion that the volume of output for a single industry depends on the size of each input to that industry (Leontief 1966). According to Leontief "these relationships reflect the structure of our technology." These relationships are also expressed in input-output analysis as the ratios of each input to the total output for that particular sector, also known as technical coefficients. Using these coefficients the input requirements for any level of output can be determined.

While the application of the input-output table is fairly simple, the challenge in constructing the table is accumulating the underlying data. As Morrison and Smith pointed out, "the successful implementation of an input-output model demands an extensive data set which few other models need" (Morrison and Smith 1974). Early tables like that of Leontief's were primarily constructed using national data sources and thus limited the input-output analysis to the national level. For instance, Leontief's table primarily used data from the Census Bureau and the Bureau of Labor Statistics. This limitation meant that early input-output studies aimed at modeling regional economies required the analyst to collect all or some of the data through surveys (Morrison and Smith 1974). However, as input-output analysis has been used more widely and refined it has led to the development of non-survey techniques that can be used to model smaller and smaller regions.

A common approach in constructing small area or regional input-output models has been to regionalize the technical coefficients from the national level down to the regional level using various estimation techniques. Schaffer and Chu pointed out some common techniques for constructing regional interindustry models which included the location quotient technique and supply-demand pooling (Scaffer and Chu 1969). The basic aim of each of these techniques is to estimate the gross flows, imports, exports, and value added for a given region (1969). The location-quotient technique is basically used to determine the exports of a region, and thus this technique has been commonly used in economic base studies. The ratio itself shows the output of an industry in a region as a proportion of the total output for the region over the national output of that industry as a proportion of the total national output. A quotient of greater than one means that the region exports a portion of that industry's output; while a quotient of less than one means that the region imports a portion of that industry's output. While this technique in its simplest form is a good starting it has some limitations which led to the development of modified purchases-only and cross-industry location quotient techniques (1969).

The next common approach outlined by Scaffer and Chu is the supply-demand pool technique. The basic technique involved is to first calculate total input requirements for each industry by multiplying the national production coefficients by the local output estimates. You then calculate the commodity balances, which is the difference between the input requirements and the locally produced supply. If the value is positive then the national coefficient is substituted for the local coefficient, imports are set to zero, and then exports are calculated. If the value is negative then the regional coefficient is computed and imports are calculated (Schaffer and Chu 1969). This technique has also been used to provide upward bounds for calculating regional coefficients.

An approach to creating regional input-output models that is used in various ways today is the regional purchase coefficient (RPC) technique. The basic definition of an RPC is "the proportion of a good or service used to fulfill demands in a region which is supplied by the region itself rather than being imported" (Stevens et al. 1983). The technique developed by Stevens et al. essentially uses an econometric equation to estimate RPCs for a region. Their study then used the estimated RPCs to construct a 500 sector model for Washington and West Virginia.

The spread of non-survey approaches to regional modeling led to the development of so-called ready-made regional input-output models. While many models have been developed there are three common models that are primarily used for economic impact studies. Use of these ready-made models has greatly reduced the time and cost of doing economic impact analysis at the regional level. Rickman and Schwer (1995) laid out a brief overview of the most common ready-made models in a study that compared the multipliers of each model. The three most common models are the IMPLAN model, the REMI model, and the RIMS II model.

The IMPLAN model is an input-output model that was developed by the U.S. Forest Service. This model is a static, nonsurvey based model that uses the national technical coefficients from the U.S. input-output accounts (Rickman and Schwer 1995). To regionalize the model IMPLAN uses the econometric RPC approach, and its most recent version 3 software also uses a national trade-flows model to determine the RPCs (Olson et al. 2006). The model also uses the supply-demand pooling technique to provide upward bounds for the RPCs. For the purposes of analysis the model gives type I, type II, and type SAM multipliers for output, employment, value-added, and labor income (Lindall and Olson 1999).

The REMI model was developed by Regional Economic Models, Inc., and can be considered a model that links an input-output model with an econometric model (Rickman and Schwer 1995). Unlike the static IMPLAN model this is a dynamic model so it can trace the "time path of economic impacts" and thus can be used to forecast economic growth (1995). The input-output component of this model uses the national technical coefficients that are derived from the Bureau of Labor Statistics, which is benchmarked to the Bureau of Economic Analysis' U.S. input-output accounts. To regionalize the model REMI uses the econometric RPC technique developed by Stevens et al. (1983).

The RIMS II model was developed by the Bureau of Economic Analysis. However, unlike the IMPLAN and REMI models which provide usable models to users, the BEA only provides tables of multipliers derived from the RIMS II model for a region. This model is static and is based on the U.S. input-output tables, and, unlike the other models, RIMS II uses the location quotient technique to regionalize the technical coefficients, which assumes that local demand is met first and the rest of each industry's output is exported. Using this method a good can only be exported or imported but not both so it constrains the accuracy of the model by not allowing cross hauling which is a good that is both imported and exported (Jensen 1990). For this reason this model has limitations.

As mentioned earlier most early regional input-output models were limited to survey-based procedures. However, due to the high costs of these procedures analysts were forced to develop non-survey techniques, but as the construction of regional models has developed a new hybrid approach has evolved (West 1990). The hybrid approach incorporates survey and non-survey techniques into construction of the model to obtain a balance between cost and time. To elaborate further West gives definitions of survey and non-survey based techniques. According to West survey-based models ideally would calculate trade coefficients by sampling various government institutions, businesses, and consumers to determine the amount, type, and source of goods and services purchased. On the other hand purely non-survey techniques estimate regional trade without using any primary data, but instead use "procedures that are largely mechanical in nature" (West 1990). As mentioned earlier these techniques include location-quotient, supply-demand ratios, and econometrically estimated RPCs. The survey-based approach would provide the most accurate table, but it requires high construction costs and time lags. On the other hand, non-survey techniques reduce the cost and construction time, but they are believed to be less accurate. So, anything that lies between these two extremes would be considered a hybrid approach, and the more primary data included the more accurate the model (West 1990). Jensen (1990) made the argument in his study of the evolution of regional input-output modeling that the future of regional modeling would be the hybrid approach and could be incorporated into the ready-made regional models that are widely used these days.

While the use of input-output modeling has evolved greatly over a relatively short time period, the literature points out that there is still room for improvements. The input-output model has evolved from a strictly national model to models that can estimate coefficients for a single county, but the methods in order to do so have varied and have some inherent errors. Furthermore, the question of the accuracy of regional models has led to a persistent debate over striking a balance among cost, time, and accuracy when determining whether to use survey, non-survey, or hybrid approaches.

Chapter 3. Methods and Procedures

The basic methodology of this study was to use a "ready-made" input-output model to model the local economy of Haywood County, Tennessee. The input-output model utilized by the study was the IMPLAN model developed by the U.S. Forest Service and the Minnesota IMPLAN group, MIG Inc. The model was run using IMPLAN's databases for the county and the results of that model were used as a baseline for comparison with a model run using other sources of data for the county that were both published and unpublished. The data used in the revised model were annual figures from 2010. While the overall aim of the study was to determine Haywood County's economic dependence on agriculture, using the IMPLAN baseline model for comparison also sought to validate the model or show areas where it was lacking in precision. The incorporation of different sources of data was utilized to develop the most precise model possible. While much of the data came from secondary sources these were checked for validation by local contacts within the county.

It should also be noted that IMPLAN uses a 440 sector classification scheme based on the North American Industry Classification System (NAICS) developed by the U.S. Census Bureau. However, for this study the 440 sectors were aggregated into 13 industry aggregations in order to simplify the input-output table. The 13 sectors included primary agriculture, forestry, agriculture inputs, mining, transportation and utilities, construction, secondary agriculture, manufacturing, retail and wholesale trade, services, finance, government, and miscellaneous. All of the industries included in each aggregation are laid out in the Appendix. Furthermore, the lawn and garden manufacturing sector ($130 million output) was zeroed out in the revised model in order to reflect the closure of the one plant in the county that manufactured that product.

Primary agriculture includes sectors that are typically associated with agriculture including crop farming and livestock production. Forestry includes industries typically associated with that sector including logging, forest nurseries and timber tracts, etc., but it also includes value-added sectors for forestry including sawmills and other wood and paper product manufacturing. Agriculture inputs includes support activities for agriculture as well as manufacturing industries of typical agriculture inputs which include fertilizer manufacturing, pesticide and other agricultural chemical manufacturing, lime and gypsum product manufacturing, and farm machinery and equipment manufacturing. Secondary agriculture includes value-added sectors of agriculture products including various food manufacturing industries as well as various textile and clothing manufacturing industries.

IMPLAN Data Sources and Procedures

To begin, the various data sources and procedures for estimating certain cells within the input-output accounting framework must be laid out in order to show how the original model was constructed by IMPLAN. The IMPLAN model utilizes various national secondary sources including data sets from the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau among others. While some of these sources provide county level data that are incorporated into the model by IMPLAN, for most of the entries in the input-output framework national level data are adjusted to the state and county levels using various estimation techniques.

The basic input-output model can be broken down into several parts. These parts include the transactions table, the value added sectors, and the final demand sectors which all add up to the total industry output. The transactions table consists of the intermediate demands for commodities produced by each industry. In other words this includes the inter-industry purchases made to produce final demands within the economy being modeled. In estimating the transactions table IMPLAN utilizes BEA's Benchmark Input-Output Study of the U.S. Make Table and makes price adjustments each year. The value added sectors include labor income, which can be broken down into proprietor income and employee compensation, indirect business taxes, and other property type income. The final demand sectors include household purchases, government purchases, capital consumption, inventory additions/deletions, and trade broken down into imports and exports.

The total industry output (TIO) for each industry sector is the basis on which all coefficients for the model are calculated using benchmark national input-output accounts that are regionalized by the model. The total industry output is the value of production by an industry for a certain time period. For IMPLAN this output is based on the annual calendar year and can be defined as total intermediate demand plus final demand or as total intermediate outlays plus value added (MIG 2011). For IMPLAN most of the national output data except for a few special industries including agriculture comes from the BEA's Output series and the Annual Survey of Manufacturers.

IMPLAN uses more than one source to estimate employment and value-added figures which include wage and salary workers as well as self-employed jobs. No one single source provides all the employment figures used in the model so IMPLAN uses Covered Employment and Wages (CEW) data from the Bureau of Labor Statistics (BLS); the Regional Economic Information System (REIS) developed by the Bureau of Economic Analysis (BEA); and County Business Pattern (CBP) data from the U.S. Census bureau. For more information on IMPLAN data sources and methods refer to MIG Inc. links in the references.

Data Used for Adjusting the IMPLAN Model

This study focused on the inter-industry transactions, value-added and total industry output sectors. Since primary agriculture was the focus of the study and was the only one with complete data it was the only industry that was adjusted. There were too many gaps in the data for other industries to justify including them in the study so it will be assumed that the IMPLAN estimations are accurate.

The data for total industry output (TIO) came from the Haywood County Farm Service Agency office. It was derived by the FSA using the planted acreage for the county for each commodity multiplied by the average price received for each commodity in 2009 to get the total value of production or total industry output. According to the FSA, the total value of production for cotton, soybeans, wheat, corn, and sorghum totaled approximately $88.2 million for 2010. However, this was only for the crop commodities, so data from the Bureau of Economic Analysis' (BEA) farm income and expenses dataset (BEA 2009) was used to include livestock sales, but this was a small proportion of the total output. The BEA data had a total value of livestock sales of almost $1.5 million for 2009. So, the total industry output used for this study amounted to approximately $89.8 million for 2009. The original model that included exclusively IMPLAN data had a TIO of approximately $66.6 million which was a difference of about $27.7 million, an increase of almost 42 percent. The difference could be attributed to the fact that IMPLAN derived the TIO based on an output-per-worker ratio that was multiplied by the county employment (MIG 2011). Whereas, the figure used in the adjusted model came directly from data in the county. It is important to note this difference, because the total industry output determines the dollar figures of inter-industry purchases which are derived from the gross absorption coefficients that are proportional to the TIO. The TIO also determines the proportion of gross absorption-to-output and value-added-to-output for the industry.

The value-added sectors for the primary agriculture industry were also adjusted in the IMPLAN model. The data for the employee compensation and proprietor income sectors which were aggregated into the "labor income" sector also came from the county level Farm Income and Expenses data from the Bureau of Economic Analysis. However, data from the FSA county office was also used to adjust the value of government payments included in the BEA data. Furthermore, the total value of production numbers from the FSA office were also used in deriving the proprietor income. The total value of production plus government payments and other miscellaneous and imputed income were used as the total income. The total costs of production figures from the BEA data were subtracted from that to get the realized net income. Then the value of inventory change was added to get the total net income. Finally, the net income of corporate farms was subtracted to get the net farm proprietors' income. The net income of corporate farms, which amounted to approximately $1.2 million, was subtracted, because it was used as the other property type income in the model which according to

IMPLAN includes corporate profits. The resulting proprietor income value used in the model was approximately $28.6 million which was much higher than the negative $1.2 million figure that the original IMPLAN data showed. Lastly, the BEA's data for farm wages and perquisites as well as farm supplements to wages and salaries were used for the employee compensation sector. However, there was less of a difference between the employee compensation figures in the models. The original IMPLAN model had employee compensation of $3.5 million while the revised model using the BEA data had employee compensation of $3.9 million. With these differences the total labor income between the models was quite different. The original IMPLAN labor income amounted to $2.3 million, while the revised model had labor income of approximately $32.5 million. These large differences can have a bearing on the importance of agriculture relative to the rest of the economy, so it is important to highlight the differences. The labor income figures and other value-added sectors for both models are laid out in table 1.

Table 1. Comparison of Output and Value-Added Sectors, Haywood County, TN, 2009

	Original	Revised
Employee Compensation	$ 3,494,632	$ 3,914,000
Proprietor Income	$ (1,234,063)	$ 28,575,121
Labor Income	$ 2,260,569	$ 32,489,121
Indirect Business Tax	$ 994,544	$ 1,693,972[b]
Other Property Income	$ 25,775,186	$ 1,208,000
Total Value-Added	$ 29,030,299	$ 35,391,093
Total Industry Output	$ 66,562,095	$ 89,758,369[a]

a) Revised figures are based on BEA and FSA data while the original is IMPLAN data
b) Calculated from Tennessee Comptroller, Division of Property Assessment and Haywood County Trustee data

The indirect business tax sector in the model was estimated using data from the Tennessee Comptroller as well as information from the Haywood County Trustee's office. However, the total property tax revenue figures were not available, so the approximate value of property tax revenues had to be calculated with the available data. Agricultural land in Tennessee is valued for its use instead of market value which leads to a discount on the assessment and thus a discount on property taxes for farmers. Therefore, the first step was to find the total value of agricultural property assessed in the county. The data for this portion came from the Tennessee Comptroller of the Treasury, Division of Property Assessments. The total agricultural land assessments for Haywood County, Brownsville, and Stanton were $70,556,925, $725,725, and $132,325 respectively. The next step was to calculate the amount of the assessment that was "taxable" by dividing the total assessment value by 100. This was done because property is taxed per $100 of value. Once that figure was calculated it was then multiplied by the property tax rate for Haywood County, Brownsville, and Stanton. For Haywood County the rate was $2.38 per $100; for Brownsville $1.80; and for Stanton $1.25. Using this methodology the resulting value used in the model for indirect business taxes was approximately $1.7 million while the original IMPLAN model had a value of roughly $995 thousand. Furthermore, the IMPLAN model also includes sales and excise taxes in the indirect business tax sector. However, there is no sales tax on agricultural inputs in Haywood County and excise taxes were minimal relative to property taxes. For these reasons and the lack of data on any other taxes, property taxes were the only taxes used for the purposes of this study as they account for the largest portion of taxes from agriculture in the county.

The coefficients in the inter-industry transaction table were calculated primarily using data from the Bureau of Economic Analysis. The derived figures were also checked for accuracy with UT extension personnel in the county as well as business owners and farmers. The data from the BEA came from the farm income and expenses dataset for the county level. The basic method for deriving all coefficients in the primary agriculture industry was to take each dollar amount for inputs purchased from each industry and divide that by the total industry output to get the "gross absorption coefficient" (GAC) for each input industry. This coefficient is the amount per dollar of output that goes to each intermediate industry and does not account for imports at this point. However, for certain industries in the agriculture production function a margin was applied to get the "producer prices" for those industries, then the margin value was added to the retail/wholesale trade sector. The margin used for this adjustment was approximately 10 percent which was based on data from input supplier operating statements located in the county. The sectors that were margined included the primary agriculture sector which included seed purchases and the agricultural inputs sector which included fertilizer, lime, and chemicals. For these sectors the 10 percent was subtracted from the total expense and allocated to the retail/wholesale sector with the remaining going to that producing industry. The resulting inter-industry gross absorption coefficients had some notable differences. The revised model had higher coefficients for three of the four industries that were adjusted in the primary agriculture industry production. The agriculture inputs industry had the largest change of the gross absorption coefficients. The original IMPLAN model had an agriculture inputs coefficient of 0.121061 which was almost half of the coefficient calculated for the revised model. The coefficient in the revised model was 0.207621 and was by far the largest coefficient in the intermediate gross absorption sector. While these figures are referred to as coefficients in the model they can also be interpreted as proportions of the total outlays for the industry. So, the 0.121061 coefficient for agriculture inputs can be interpreted as 12.1 percent of total industry outlays for primary agriculture go to agriculture input industries. The rest of the industries that were adjusted had smaller differences. The primary agriculture industry in the original model had a coefficient of 0.115622 which was actually the only coefficient that was higher than the adjusted coefficient which ended up being 0.111917. The finance sector showed a slight increase in the revised model of 0.091960 while the original coefficient was 0.084413. The retail and wholesale trade sector also showed a slight increase from 0.031131 to 0.037488. Furthermore, the rest of the coefficients were proportionally adjusted by the software which ultimately led to a decrease in the rest of the coefficients in the revised model compared to the original model. The various changes in the coefficients are presented in table 2. Overall, the sum of these coefficients and the value added coefficients equals the total industry output for agriculture, and those proportions are highlighted in table 2.

Now that all of the total industry output, value-added sectors, and gross absorption coefficients have been calculated they must be put into the IMPLAN model before it is run. The gross absorption coefficients are adjusted in the IMPLAN model under the “modify industry production” section while the value added and total industry output sectors are adjusted in the “edit industry detail” section of the model. Once the coefficients have been adjusted and locked in the industry production, the rest of the coefficients that weren’t adjusted are balanced proportionally by the software. These coefficients are automatically adjusted, because as mentioned earlier the gross absorption coefficients plus value-added sums to one, or total industry output. For this model with the adjusted industry data the proportion of intermediate absorption to total output was 0.605707, so the coefficients must add up to that amount. Since the primary agriculture, agriculture inputs, retail/wholesale trade, and finance

Table 2. Gross Absorption Comparison, Haywood County, TN, 2009

	Original		Revised	
	GAC	Outlays	GAC	Outlays
Pri Ag	0.115622	$ 7,696,050	0.111917	$ 10,045,487
Forestry	0.002530	$ 168,429	0.001889	$ 169,568
Ag Inputs	0.121061	$ 8,058,097	0.207621	$ 18,635,722[a]
Mining	0.002149	$ 143,023	0.001604	$ 143,991
Trans & Utilities	0.043257	$ 2,879,260	0.032295	$ 2,898,747
Construction	0.002481	$ 165,115	0.001852	$ 166,233
Sec Ag	0.076448	$ 5,088,506	0.057075	$ 5,122,943
Manuf	0.064820	$ 4,314,543	0.048394	$ 4,343,742
Retail/Wholesale Trade	0.031131	$ 2,072,149	0.037488	$ 3,364,862[b]
Services	0.015063	$ 1,002,626	0.011246	$ 1,009,412
Finance et al	0.084413	$ 5,618,735	0.090678	$ 8,139,108[c]
Government	0.003734	$ 248,554	0.002788	$ 250,236
Misc	0.001152	$ 76,709	0.000860[d]	$ 77,228
Total Absorption	0.563861	$ 37,531,796	0.605707	$ 54,367,279
Labor Income	0.033962	$ 2,260,569	0.361962	$ 32,489,121
Indirect Business Tax	0.014942	$ 994,544	0.018873	$ 1,693,972
Other Property Income	0.387235	$ 25,775,186	0.013458	$ 1,208,000
Total Value-Added	0.436139	$ 29,030,299	0.394293	$ 35,391,093
Total Industry Outlays	1.000000	$ 66,562,095	1.000000	$ 89,758,369

a) Revised Primary Ag and Ag Inputs coefficients are based on BEA data
b) Calculating by margining the Primary Ag and Ag Inputs sectors
c) Based on NASS Farm Production Expenses data for Haywood County
d) The remainder of the revised coefficients were adjusted proportionally by the IMPLAN software

sectors were increased than the rest of coefficients had to be proportionally adjusted downward to stay within the set proportion of intermediate absorption. However, these coefficients are small relative to the others, because the adjusted coefficients accounted for the majority of the industry absorption. These figures are also laid out in Table 2.

The other aspect that was adjusted in the model was the trade flows data for the retail and wholesale trade sector and the finance sector. This was done to reflect the agricultural industry's utilizing all of the local supply of these input industries. It was necessary to do this because the retail and wholesale trade gross absorption coefficient was derived from margining the primary agriculture and agricultural inputs absorption coefficients, so in order to capture all of those margins the regional use was adjusted. Furthermore, interviews with local banks indicated that the local farmers primarily used the local banks and adjusting the regional use for that industry would better reflect that use. In order to make those adjustments in the model, the "local use of local supply" in the trade flows sector of the model was raised to equal the local supply for that input for the retail and wholesale trade sector and the finance sector. This adjustment ultimately set the "regional use coefficient" (RSC) of those two sectors to 100 percent for the primary agriculture industry which adjusted the average RSC across those industry rows. The original RSCs in the IMPLAN model were 0.696867 for the retail/wholesale trade sector and 0.877821 for the finance sector. The RSCs in the revised model for the two sectors were 0.955722 and 0.985738 respectively. The differences in the trade flows data are laid out in Table 3.

The intermediate input purchases from the other industries have been regionalized at this point using the trade flows data. The remaining portions of each input purchase derived from the gross absorption coefficients are accounted for as imports into the county. While the proportion of imports to total output changed only slightly from 0.447 in the baseline model to 0.473 in the revised model, the increased output in the revised model led to a larger figure for imports. This was also despite the larger regional use coefficients for the retail/wholesale trade industry and the finance industry, which would decrease imports for those industries. Imports in the original model amounted to $29.8 million and were $42.5 million in the revised model. This is largely due to the fact that imports are based on the regional purchase coefficients that are estimated by the model to regionalize the gross absorption coefficients. The RPCs remained fairly unchanged between the models except for slight differences in the primary agriculture and agricultural inputs sectors which were slightly lower in the revised model. However, the two sectors with the adjusted RSCs showed larger differences due to the higher use of the local supply for those industries. The RPCs for the retail/wholesale trade sector and finance sectors in the original model were 0.440 and 0.566 respectively while the RPCs increased in the revised model to 0.598 and 0.628 respectively. The regionalized outlays for Haywood County are presented in Table 4.

While these changes were within the column outlays of the primary agriculture sector, there were also slight changes across the output row for agriculture. Obviously, the increased output would have led to slightly higher sales to intermediate demands from other industries in the county as well as final demand sectors, but these changes were relatively small. Exports accounted for the vast majority of the agricultural industry in the county so that figure increased by a substantial amount proportionally to the new increased output. Exports in the baseline model amounted to $64.2 million while they increased to approximately $87.2 million in the revised model.

Table 3. Comparison of Trade Flow Coefficients, Haywood County, TN, 2009

	RPC[a]			RSC[b]	
	Original	Revised		Original	Revised
Pri Ag	0.105126	0.092407		0.026154	0.019672
Forestry	0.084498	0.084494		0.058184	0.057763
Ag Inputs	0.102348	0.094322		0.587564	0.581256
Mining	0.000039	0.000039		0.000281	0.000281
Trans & Utilities	0.459058	0.458944		0.711291	0.711291
Construction	0.526634	0.526610		0.635085	0.635085
Sec Ag	0.021973	0.021961		0.050163	0.050163
Manuf	0.001970	0.001969		0.001333	0.001333
Retail/Wholesale Trade	0.440458	0.597705		0.696867	0.955722
Services	0.292671	0.292666		0.595932	0.595539
Finance et al	0.566212	0.628288		0.877821	0.985738
Government	0.761350	0.761334		0.634820	0.634820
Misc	0.217359	0.217355		0.257740	0.257740

a) Regional Purchase Coefficient: defined as the proportion of local demand that is met by local producers
b) Regional Use Coefficient: defined as the local use of the local supply

Table 4. Total Outlays for Primary Agriculture in Haywood County, TN, 2009

	Original		Revised	
	Coefficient	Outlays	Coefficient[a]	Outlays
Pri Ag	0.011890	$ 791,421	0.010744	$ 964,335
Forestry	0.000204	$ 13,587	0.000154	$ 13,813
Ag Inputs	0.010671	$ 710,316	0.016685	$ 1,497,614
Mining	0.000001	$ 60	0.000001	$ 111
Trans & Utilities	0.016546	$ 1,101,346	0.012350	$ 1,108,525
Construction	0.001306	$ 86,955	0.000975	$ 87,540
Sec Ag	0.001635	$ 108,815	0.001220	$ 109,491
Manuf	0.000407	$ 27,089	0.000468	$ 41,977
Retail/Wholesale Trade	0.013697	$ 911,714	0.022383	$ 2,009,038
Services	0.004210	$ 280,202	0.003175	$ 284,947
Finance et al	0.047374	$ 3,153,340	0.056439	$ 5,065,917
Government	0.006531	$ 434,712	0.005072	$ 455,268
Misc	0.000123	$ 8,194	0.000092	$ 8,249
Labor Income	0.033962	$ 2,260,569	0.361962	$ 32,489,121
Indirect Business Tax	0.014942	$ 994,544	0.018873	$ 1,693,972
Other Property Income	0.387235	$ 25,775,186	0.013458	$ 1,208,000
Households	0.000075	$ 4,990	0.000056	$ 5,024
Government/Enterprises	0.000214	$ 14,263	0.000174	$ 15,582
Capital	0.000047	$ 3,123	0.000035	$ 3,144
Inventory	0.001808	$ 120,344	0.002188	$ 196,370
Imports	0.447121	$ 29,761,324	0.473497	$ 42,500,335
Total Outlays	1.000000	$ 66,562,095	1.000000	$ 89,758,372

a) The absorption coefficients have been regionalized by multiplying the RPC by the GAC

Chapter 4. Results

Agriculture and the Economy as a Whole

It was important to note the changes made to the basic IMPLAN model and the resulting model that should be more accurate, but the real focus of this study was to determine Haywood County's economic dependence on the agricultural industry as a whole. This was done by comparing the value-added sectors and the total industry output for primary agriculture to the rest of the county's economy, and also by including the economic activities of the forestry, agricultural inputs, and secondary agricultural industries located in Haywood County. It is also important to highlight the interactions with other industries and institutions in the county to show the true scope of the agricultural industry in the county. However, the labor income sector and employment figures were most important in drawing a comparison with the study done by the USDA's Economic Research Service to determine the economic dependence of Haywood County.

As mentioned in the introduction, the ERS developed county typologies based on either employment or labor and proprietor income as a percentage of the total employment or labor and proprietor income for the county. That study using only net farm income determined that Haywood County was not "farm dependant," because neither of those figures passed the 15 percent threshold required to be dependent on agriculture. The results of this study, which are displayed in Table 5, showed that employee compensation and proprietor income for primary agriculture was approximately $32 million which was close to 10 percent of the total labor income for Haywood County which was approximately $335 million. On the other hand, the original model had a labor income for primary agriculture of roughly $2.3 million, which was less than 1 percent of total labor income for Haywood County. So, based on that measurement, this study was consistent with the ERS typology using both model versions. However, that figure doesn't quite paint the whole picture of the direct impacts of the agricultural economy in Haywood County. Including the forestry, agriculture inputs, and secondary agriculture sectors was the first step in broadening the focus on the agricultural industry as it relates the economy as a whole in Haywood County.

Table 5. Labor Income by Industry for Haywood County, TN, 2009

	Original		Revised	
	Labor Income	% of Total	Labor Income	% of Total
Pri Ag	$ 2,260,569	0.74%	$ 32,489,121	9.69%
Forestry	$ 4,544,186	1.49%	$ 4,544,186	1.35%
Ag Inputs	$ 10,887,473	3.57%	$ 10,887,473	3.25%
Sec Ag	$ 2,305,021	0.76%	$ 2,305,021	0.69%
Total Ag and Ag-Related	$ 19,997,249	6.55%	$ 50,225,801	14.97%
Retail/Wholesale Trade	$ 34,739,282	11.38%	$ 34,739,282	10.36%
Government	$ 56,288,178	18.44%	$ 56,288,178	16.78%
Manuf	$ 61,801,001	20.25%	$ 61,801,001	18.42%
Services	$ 89,798,383	29.42%	$ 89,798,383	26.77%
Finance et al	$ 17,174,323	5.63%	$ 17,174,323	5.12%
Trans & Utilities	$ 12,393,503	4.06%	$ 12,393,503	3.69%
Construction	$ 6,924,969	2.27%	$ 6,924,969	2.06%
Misc	$ 5,450,885	1.79%	$ 5,450,885	1.62%
Mining	$ 660,854	0.22%	$ 660,854	0.20%
Total	$ 305,228,626		$ 335,457,178	

a) Revised labor income for Pri Ag was based on BEA and FSA data

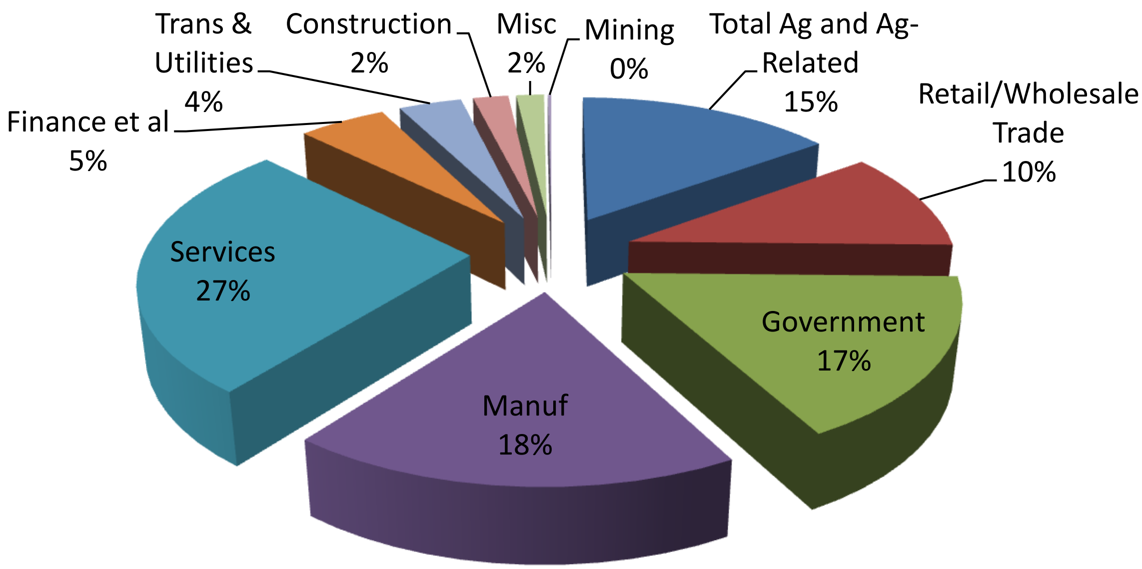

Figure 1. Labor Income by Industry for Haywood County, TN, 2009

Including the agriculture related sectors beyond the primary agriculture industry broadens the proportion of labor income for the county. Combining the labor income for all of these sectors resulted in a labor income of approximately $50 million, which accounted for roughly 15 percent of total labor income for the county. Whereas, the original model had a combined labor income for these sectors of roughly $20 million which accounted for only 6.5 percent of the total labor income for Haywood County. So using the revised figure, based on the 15 percent threshold used by the ERS this would classify Haywood County as "farm dependant" if this broader definition of agriculture were used.

Beyond the labor income figures, employment in agriculture was also another important indicator of its size relative to the rest of the economy in Haywood County. The employment figure was also used by the ERS as an indicator of economic dependence with the same 15 percent threshold as the labor income figures. The employment for primary agriculture according to the IMPLAN data amounted to 1097 which was roughly 13.6 percent of total employment for the county. However, if you again include the forestry and agricultural related industries that figure rose to 1714 which was roughly 21.2 percent of total employment. Based on these measurements Haywood County would again be classified as “farm dependant” using the ERS threshold for employment.

While the labor income and employment figures were the focus of the ERS study, they are still only part of what the agriculture industry contributes to the economy of Haywood County. Another important indicator of economic activity is the total output of each industry. The figures for total industry output for all of the industries in Haywood County are displayed in

Table 6. Employment by Industry for Haywood County, TN, 2009

	Original	
	Employment	% of Total
Pri Ag	1098	13.58%
Forestry	111	1.38%
Ag Inputs	458	5.67%
Sec Ag	47	0.58%
Total Ag and Ag-Related	1714	21.20%
Retail/Wholesale Trade	959	11.87%
Manuf	1100	13.61%
Government	1268	15.69%
Services	1840	22.76%
Finance et al	484	5.99%
Misc	266	3.29%
Trans & Utilities	221	2.73%
Construction	199	2.46%
Mining	32	0.40%
Total	8085	

a) All employment figures were from original IMPLAN data, no revisions were made with new data

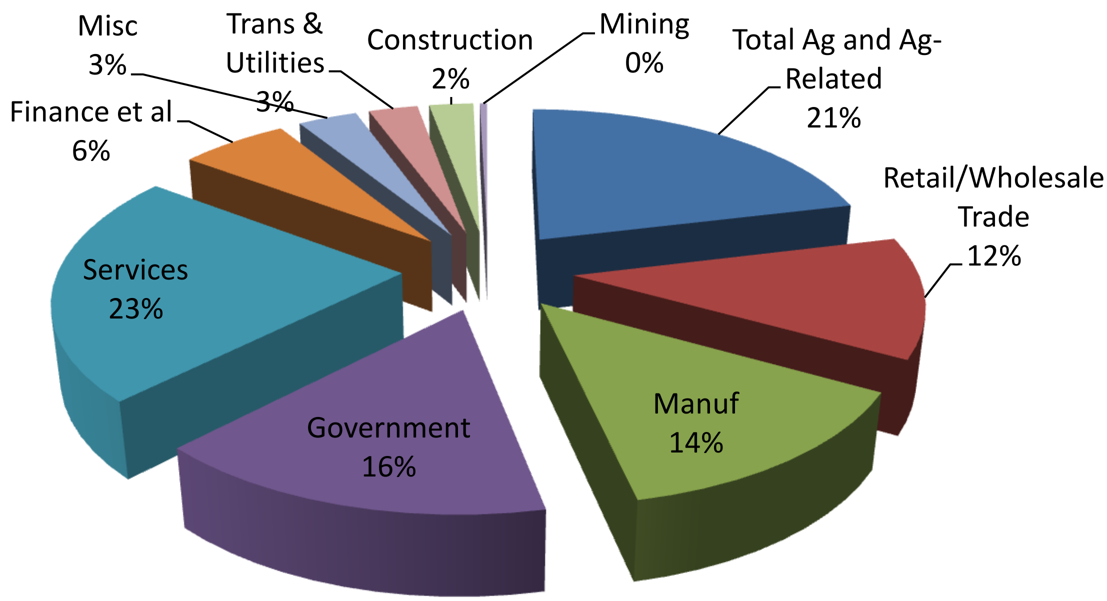

Figure 2. Employment by Industry for Haywood County, TN, 2009

Table 7. Primary agriculture alone accounted for almost $90 million of total industry output which was approximately 7 percent of total industry output for Haywood County. Whereas, the original TIO for primary agriculture was roughly $67 million or 5.5 percent of total industry output for the county. However, if again you broaden the agriculture industry to include forestry, agriculture inputs, and secondary agriculture the combined output for these industries was over $166 million which was approximately 13 percent of total industry output.

While the primary agriculture industry accounted for only 7.3 percent of total industry output it had a larger share of exports in the county. It was actually the second highest exporting industry located in the county behind manufacturing. Exports for primary agriculture amounted to over $87 million and accounted for approximately 11 percent of total exports which was second only to manufacturing who had 62 percent of the total exports. If you add in the forestry, agriculture inputs, and secondary agriculture sectors then the total exports

Table 7. Total Industry Output by Industry for Haywood County, TN, 2009

	Original		Revised	
	TIO	% of Total	TIO	% of Total
Pri Ag	$ 66,562,094	5.5%	$ 89,758,369	7.3%
Forestry	$ 30,556,611	2.5%	$ 30,556,611	2.5%
Ag Inputs	$ 19,118,119	1.6%	$ 19,118,119	1.5%
Sec Ag	$ 26,662,438	2.2%	$ 26,662,438	2.2%
Total Ag and Ag-Related	$ 142,899,263	11.8%	$ 166,095,538	13.4%
Services	$ 172,617,487	14.2%	$ 172,617,487	14.0%
Finance et al	$ 137,008,841	11.3%	$ 137,008,841	11.1%
Government	$ 105,146,782	8.7%	$ 105,146,782	8.5%
Retail/Wholesale Trade	$ 76,675,009	6.3%	$ 76,675,005	6.2%
Manuf	$ 496,362,654	40.9%	$ 496,362,654	40.2%
Mining	$ 7,179,420	0.6%	$ 7,179,420	0.6%
Trans & Utilities	$ 42,356,457	3.5%	$ 42,356,457	3.4%
Construction	$ 20,397,270	1.7%	$ 20,397,270	1.7%
Misc	$ 11,758,536	1.0%	$ 11,758,536	1.0%
Total	$ 1,212,401,717		$ 1,235,597,989	

a) Revised TIO was based on FSA value of production data for Haywood County

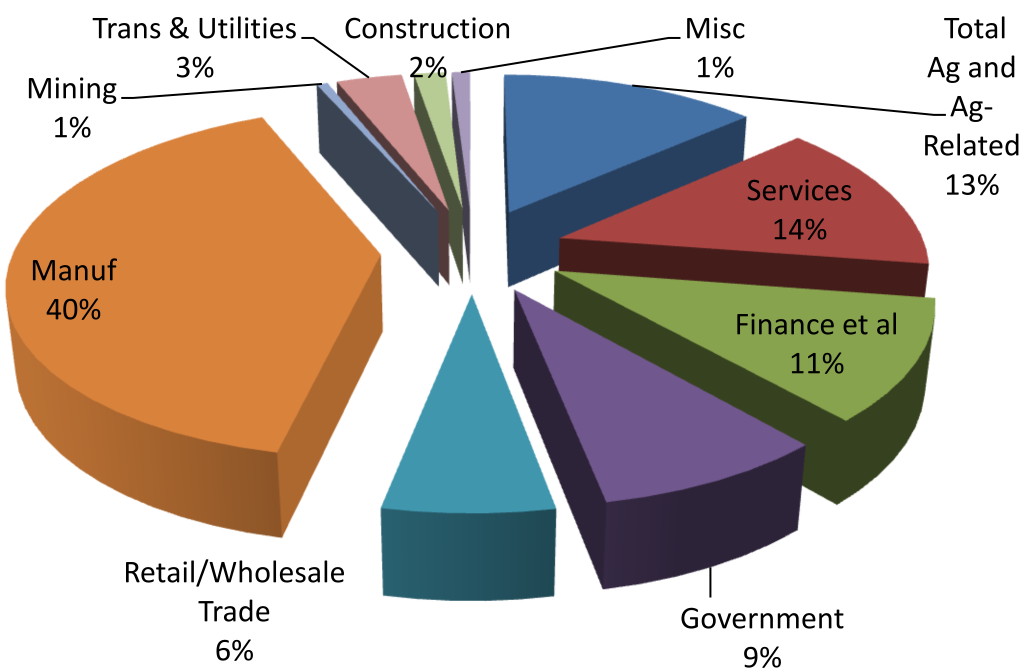

Figure 3. Total Industry Output by Industry for Haywood County, TN, 2009

amounted to over $149 million which accounted for approximately 18.9 percent of total exports from Haywood County. It is important to highlight the industry exports, because according to economic base theory exporting industries are the drivers of the regional economy. This is because these industries bring new revenue into the county's economy from outside areas. Using this theory further highlights the importance of the agriculture industry in Haywood County. The trade balance of agriculture in the county is also important to highlight as exports far outweigh imports. This also reflects the larger use by the agriculture industry of local suppliers relative to other industries especially the manufacturing industry. Imports for primary agriculture amounted to approximately $42.5 million which was less than half of exports. On the other hand, imports for the manufacturing industry amount to roughly $338.6 million which accounted for approximately 68 percent of total outlays for that industry while primary agriculture imports were roughly 47 percent of total outlays. The exports for each all of the industries are laid out in table 8.

Table 8. Exports by Industry for Haywood County, TN, 2009

	Original		Revised	
	Exports	% of Total	Exports	% of Total
Pri Ag	$ 64,222,603	7.99%	$ 87,176,825	11.00%
Forestry	$ 28,798,072	3.58%	$ 28,813,202	3.64%
Ag Inputs	$ 8,155,637	1.01%	$ 8,295,984	1.05%
Sec Ag	$ 25,339,091	3.15%	$ 25,339,096	3.20%
Total Ag and Ag-Related	$ 126,515,403	15.74%	$ 149,625,106	18.88%
Services	$ 69,694,047	8.67%	$ 69,751,834	8.80%
Government	$ 37,485,651	4.66%	$ 37,338,251	4.71%
Trans & Utilities	$ 12,232,240	1.52%	$ 12,232,240	1.54%
Misc	$ 8,727,893	1.09%	$ 8,727,893	1.10%
Mining	$ 7,176,175	0.89%	$ 7,176,184	0.91%
Construction	$ 7,443,271	0.93%	$ 7,443,271	0.94%
Retail/Wholesale Trade	$ 23,242,735	2.89%	$ 3,395,019	0.43%
Finance et al	$ 17,529,794	2.18%	$ 3,047,994	0.38%
Manuf	$ 493,812,749	61.43%	$ 493,816,786	62.31%
Total	$ 803,859,957		$ 792,554,578	

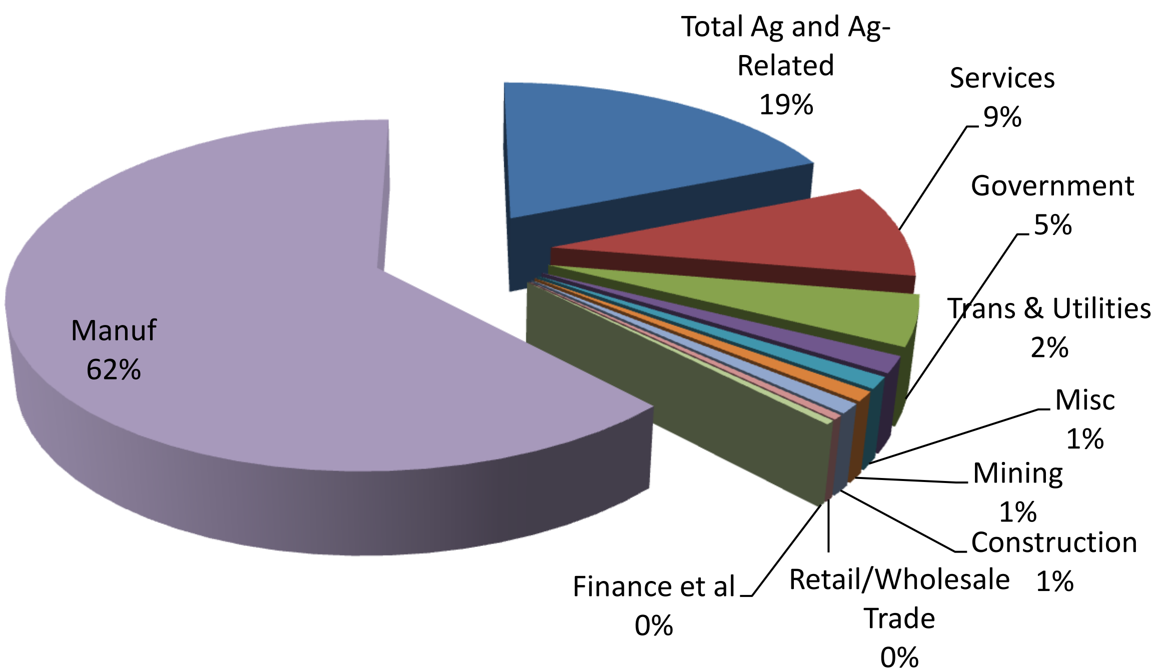

Figure 4. Exports by Industry for Haywood County, TN, 2009

Total Impacts of the Agriculture Industry

To this point the focus has been on the direct impacts of the agriculture industry on Haywood County through its labor income, output, and total value-added as a proportion of the entire economy for each of those indicators. However, utilizing the input-output analysis through the IMPLAN model also shows the indirect, induced, and total impacts of the agriculture and agriculture related industries in Haywood County. Incorporating these measurements should provide the full scope of the agriculture industry in the county. An impact scenario was also run using IMPLAN that affected the primary agriculture industry's proprietor income sector. The impact was a decrease in proprietor income resulting from the loss of direct government payments which amounted to over $6 million for 2009. Running the impact showed the direct, indirect, induced, and total impacts on all other industries in the county.

To begin it is important to present the multipliers for each industry which were used to estimate the total impacts that each industry had on the entire economy of Haywood County. The IMPLAN model provides multipliers for various aspects, but the focus for this study will be on the output, labor income, employment, and indirect business taxes. The detail of the multipliers are laid out in table 9, however the main focus is the total impacts which include the direct impacts plus the indirect and induced impacts. The indirect impacts are on the other industries in the county while the induced impacts include household and institution expenditures. Primary agriculture has a total output multiplier of roughly 1.33 which means that for every dollar spent on producing its output an additional 33 cents of economic activity is created throughout the rest of the county. So for the approximately $90 million worth of output for the primary agriculture industry almost $30 million in economic activity was created throughout the economy of Haywood County for a total economic impact of over $119 million. On the other hand, the original model had lower total impacts on the county's economy for agriculture. The total impact multiplier for primary agriculture was 1.157, so the impact per dollar of output created by agriculture was less than half of that in the revised model. This amounted to a total impact of approximately $77 million in the original model. Furthermore, the combined total impacts of the ag and ag related industries amounted to almost $192 million in the revised model, while it was just over $171 million in the original model. The total impacts of the other industries in the county were also smaller in the original model than in the revised version. All of the impacts from the original model are laid out in table 10.

When comparing the multipliers for each industry it can be seen that agriculture has a fairly high impact relative to other industries. It is important to note the difference between agriculture and manufacturing whose multiplier was roughly 1.18. This shows that the manufacturing industry may have a larger output, but it has a lower impact per dollar of output on the rest of the economy of Haywood County than the primary agriculture industry.

Table 9. Total Industry Output Impacts by Industry, Haywood County, TN, 2009

	Direct	Indirect		Induced		Total	
	Impact	Mult.	Impact	Mult.	Impact	Mult.	Impact
Pri Ag	$ 89,758,369	0.151	$ 13,522,235	0.180	$ 16,181,485	1.331	$ 119,462,089
Forestry	$ 30,556,611	0.150	$ 4,587,037	0.082	$ 2,503,340	1.232	$ 37,646,988
Ag Inputs	$ 19,118,119	0.104	$ 1,995,421	0.245	$ 4,680,472	1.349	$ 25,794,012
Sec Ag	$ 7,179,420	0.168	$ 1,204,937	0.061	$ 435,236	1.228	$ 8,819,593
Total Ag and Ag Related	$ 146,612,519		$ 21,309,630		$ 23,800,533		$ 191,722,682
Mining	$ 42,356,457	0.158	$ 6,698,691	0.064	$ 2,711,032	1.222	$ 51,766,180
Trans & Utilities	$ 20,397,270	0.119	$ 2,431,320	0.136	$ 2,773,923	1.255	$ 25,602,512
Construction	$ 26,662,438	0.134	$ 3,583,919	0.161	$ 4,283,605	1.295	$ 34,529,963
Manuf	$ 496,362,654	0.116	$ 57,789,737	0.069	$ 34,393,699	1.186	$ 588,546,091
Retail/Wholesale Trade	$ 76,675,009	0.108	$ 8,254,871	0.198	$ 15,205,760	1.306	$ 100,135,640
Services	$ 172,617,487	0.146	$ 25,265,351	0.230	$ 39,676,340	1.376	$ 237,559,178
Finance et al	$ 137,008,842	0.253	$ 34,605,478	0.073	$ 9,946,773	1.325	$ 181,561,094
Government	$ 105,146,782	0.129	$ 13,530,604	0.231	$ 24,261,396	1.359	$ 142,938,782
Misc	$ 11,758,536	0.290	$ 3,413,847	0.214	$ 2,521,538	1.505	$ 17,693,921

Table 10. Original Total Industry Output Impacts by Industry, Haywood County, TN, 2009

	Direct	Indirect		Induced		Total	
	Impact	Mult.	Impact	Mult.	Impact	Mult.	Impact
Pri Ag	$ 66,562,094	0.133	$ 8,864,386.42	0.024	$ 1,613,663.01	1.157	$ 77,040,143.88
Forestry	$ 30,556,611	0.136	$ 4,162,455.79	0.071	$ 2,160,409.32	1.207	$ 36,879,476.21
Ag Inputs	$ 19,118,119	0.098	$ 1,869,446.20	0.217	$ 4,141,177.88	1.314	$ 25,128,742.88
Sec Ag	$ 26,662,438	0.154	$ 4,107,588.53	0.049	$ 1,311,606.41	1.203	$ 32,081,633.34
Total Ag and Ag Related	$ 142,899,263		$ 19,003,877		$ 9,226,857		$ 171,129,996
Mining	$ 7,179,420	0.150	$ 1,075,515.88	0.056	$ 400,996.36	1.206	$ 8,655,931.76
Trans & Utilities	$ 42,356,457	0.113	$ 4,782,051.55	0.120	$ 5,097,344.23	1.233	$ 52,235,852.52
Construction	$ 20,397,270	0.118	$ 2,416,256.63	0.140	$ 2,865,345.49	1.259	$ 25,678,871.74
Manuf	$ 496,362,654	0.104	$ 51,690,932.06	0.060	$ 29,664,477.69	1.164	$ 577,718,063.91
Retail/Wholesale Trade	$ 76,675,009	0.099	$ 7,581,077.03	0.175	$ 13,444,058.03	1.274	$ 97,700,144.10
Services	$ 172,617,487	0.137	$ 23,625,119.62	0.204	$ 35,128,717.72	1.340	$ 231,371,323.99
Finance et al	$ 137,008,841	0.229	$ 31,399,761.70	0.063	$ 8,655,974.37	1.292	$ 177,064,576.71
Government	$ 105,146,782	0.120	$ 12,658,998.92	0.204	$ 21,489,974.59	1.325	$ 139,295,755.42
Misc	$ 11,758,536	0.266	$ 3,122,466.76	0.189	$ 2,223,203.38	1.455	$ 17,104,206.48

Impact of a Change in Primary Agriculture Proprietor Income

In order to simulate the impacts on Haywood County through a reduction in proprietor income an impact was run on the model in which the proprietor income portion of the labor income sector was impacted with approximately $6.4 million, which was the amount of government payments to agriculture in 2009 in Haywood County. This was done to simulate the economic impacts of direct government payments under commodity and conservation programs which accounted for the majority of government payments to the primary agriculture industry in the county.

The lack of direct and indirect impacts reflects the fact that those multipliers are based on input purchases from other industries while the induced impacts include expenditures by households, which would be the recipients of labor income. The total impacts on labor income, value-added, and output across all industries were $889 thousand, $1.7 million, and $2.7 million respectively. The results of the impact are laid out in tables 11 and 12.

Table 11. Induced Impacts of a Change in Labor Income, Haywood Co., 2009

	Direct	Indirect	Induced	Total
Total	0.0	0.0	127,615.6	127,615.6
Pri Ag	0.0	0.0	1,691.1	1,691.1
Forestry	0.0	0.0	61.5	61.5
Ag Inputs	0.0	0.0	3.7	3.7
Sec Ag	0.0	0.0	2.6	2.6
Total Ag and Ag Related	0.0	0.0	1,759.0	1,759.0
Mining	0.0	0.0	0.2	0.2
Trans & Utilities	0.0	0.0	13,473.4	13,473.4
Construction	0.0	0.0	1,721.7	1,721.7
Manuf	0.0	0.0	0.9	0.9
Retail/Wholesale Trade	0.0	0.0	38,245.9	38,245.9
Services	0.0	0.0	44,962.3	44,962.3
Finance et al	0.0	0.0	27,134.8	27,134.8
Govt	0.0	0.0	90.2	90.2
Misc	0.0	0.0	227.3	227.3

Table 12. Total Impacts of a Change in Labor Income, Haywood County, TN, 2009

ImpactType	Employment	LaborIncome	TotalValueAdded	Output
Direct Effect	0.0	0.0	0.0	0.0
Indirect Effect	0.0	0.0	0.0	0.0
Induced Effect	21.4	889,043.4	1,690,845.5	2,730,337.5
Total Effect	21.4	889,043.4	1,690,845.5	2,730,337.5

Chapter 5. Summary and Conclusion

The focus of this study was on the economic dependence of agriculture for Haywood County using the most accurate measurements for such an analysis. A brief history of the other various studies that were aimed at this same objective was also laid out. Furthermore, this study utilized input-output analysis which has seen its own evolution through the years just as the ways to measure the agricultural economy of a region has evolved. This evolution of input-output analysis ultimately led to development of non-survey ready-made models like that of IMPLAN which was the model used in this study. However, the use of these non-survey models consisting of all secondary data sources as well as the derivation of regional models using national figures has led to skepticism by some analysts in the field. For this reason, the IMPLAN model used in this study was modified using more precise data both from secondary sources and from sources within Haywood County. This methodology also provided for a comparison between the original IMPLAN model and the "hybrid" version that incorporated the revised data in order to gauge the accuracy of the model.

As mentioned earlier the aim of this study was to measure the scope of agriculture in Haywood County. According to Haywood County's Chamber of Commerce agriculture is seen as the largest industry in the county. The county's abundant agricultural economy based on its land in farms and value of production relative to other counties in the state made it an ideal county in which to measure the agricultural economy. Its diverse industry make-up, which includes multiple businesses that support agriculture, is located primarily in the largest city of Brownsville and thus also made it a good fit. The fact that it was not considered dependent on agriculture by the USDA's Economic Research Service despite the large agriculture sector also made Haywood County worth analyzing.

In order to capture the full scope of agriculture beyond basic labor and proprietor income and employment figures, this study utilized input-output analysis. This method of modeling the inter-dependencies within an economy has evolved from the early survey based models to the more recent models that use various non-survey estimation techniques to model the economy. This has greatly reduced the time and cost associated with input-output analysis and thus made it useful for this analysis. However, questions about the accuracy of the ready-made model led to researching whether data adjustments could improve the model's estimates of agriculture's economic impact on Haywood County. The adjustments were primarily made within the production function for the primary agriculture industry. The data used for these adjustments came from the Bureau of Economic Analysis' farm income and expenses dataset, the county FSA office, and the State Comptroller for Tennessee, as well as interviews with local extension, farmers, and business leaders.

These data revisions resulted in some substantial differences between the two model representations, especially in the total industry output and value-added sectors for primary agriculture. The largest differences ended up being between the total industry output, or value of production, for primary agriculture which was approximately $66 million in the IMPLAN data, but increased to almost $90 million using the new data. The labor income figure also showed significant differences where the IMPLAN data had a value of $2.3 million while the revised data had a value of $32.5 million. While there were other differences in the outlays of agriculture including input purchases from other industries in the county, these two changes were the most notable. However, despite these relatively large data adjustments for the agricultural industry there ended up not being a substantial difference in the broader sectoral aggregations between the original and revised versions of the model.

The impacts of the agriculture industry as whole which incorporated the forestry, agriculture inputs, and secondary agriculture industries were estimated using the original and revised model. Comparing these impacts to earnings and employment figures used by the ERS County Typology study was also a focus of the analysis. Using only the direct labor income and employment of the primary agriculture industry did not result in proportions that passed the ERS's 15 percent threshold for either version of the model. The original and revised versions had labor income proportions of 0.74 percent and 10.8 percent respectively, and the employment proportion for both versions was approximately 13.6 percent. However, including the other agriculture related industries in the employment proportion (21.2%) did pass that threshold. As for the labor income proportions, only the revised version (15%) passed, as the original version had much lower proportions for primary agriculture (6.6%). Furthermore, the total impacts for these industries were also estimated which included interaction with other industries in the county as well as households and institutions. The total impacts, which were derived from the multipliers for each industry, further calculated the inter-dependencies of the agriculture and agriculture related industries. These multipliers showed that agriculture had an impact per dollar of output of $0.33 on the rest of the economy. Another important indication from the multipliers was that the large manufacturing industry had the smallest impact per dollar of output ($0.19) than the rest of the industries in Haywood County. Lastly, an impact was run on the model to simulate the impact of direct government payments to proprietor income in the primary agriculture sector. The $ 6.4 million impact resulted in approximately $2.7 million in induced impacts on the output of Haywood County.

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Appendix

Pri Ag

1 Oilseed farming
2 Grain farming
11 Cattle ranching and farming
14 Animal production, except cattle and poultry and eggs
18 Commercial hunting and trapping

Forestry

15 Forestry, forest products, and timber tract production
95 Sawmills and wood preservation
100 Wood container and pallet manufacturing
111 Sanitary paper product manufacturing

Ag Inputs

19 Support activities for agriculture and forestry
130 Fertilizer manufacturing

Sec Ag

55 Fluid milk and butter manufacturing
59 Animal (except poultry) slaughtering, rendering, and processing

Mining

20 Extraction of oil and natural gas

Trans & Utilities

31 Electric power generation, transmission, and distribution
332 Transport by air
335 Transport by truck
336 Transit and ground passenger transportation
337 Transport by pipeline
338 Scenic and sightseeing transportation and support activities for transportation
340 Warehousing and storage

Construction

34 Construction of new nonresidential commercial and health care structures
35 Construction of new nonresidential manufacturing structures
36 Construction of other new nonresidential structures
37 Construction of new residential permanent site single- and multi-family structures
38 Construction of other new residential structures
39 Maintenance and repair construction of nonresidential structures
40 Maintenance and repair construction of residential structures

Manuf

134 In-vitro diagnostic substance manufacturing
138 Soap and cleaning compound manufacturing
141 All other chemical product and preparation manufacturing
144 Plastics pipe and pipe fitting manufacturing
148 Plastics bottle manufacturing
149 Other plastics product manufacturing
161 Ready-mix concrete manufacturing

Retail/Wholesale Trade

319 Wholesale trade businesses
320 Retail Stores - Motor vehicle and parts
321 Retail Stores - Furniture and home furnishings
322 Retail Stores - Electronics and appliances
323 Retail Stores - Building material and garden supply
324 Retail Stores - Food and beverage
325 Retail Stores - Health and personal care
326 Retail Stores - Gasoline stations
327 Retail Stores - Clothing and clothing accessories
328 Retail Stores - Sporting goods, hobby, book and music
329 Retail Stores - General merchandise
330 Retail Stores - Miscellaneous
331 Retail Nonstores - Direct and electronic sales

Services

341 Newspaper publishers
342 Periodical publishers
348 Radio and television broadcasting
349 Cable and other subscription programming
351 Telecommunications
352 Data processing, hosting, ISP, web search portals and related services
363 General and consumer goods rental except video tapes and discs
364 Video tape and disc rental
365 Commercial and industrial machinery and equipment rental and leasing
366 Lessors of nonfinancial intangible assets
367 Legal services
368 Accounting, tax preparation, bookkeeping, and payroll services
369 Architectural, engineering, and related services
370 Specialized design services
371 Custom computer programming services
374 Management, scientific, and technical consulting services

377 Advertising and related services
379 Veterinary services
380 All other miscellaneous professional, scientific, and technical services
381 Management of companies and enterprises
382 Employment services
384 Office administrative services
386 Business support services
387 Investigation and security services
388 Services to buildings and dwellings
390 Waste management and remediation services
391 Private elementary and secondary schools
393 Other private educational services
394 Offices of physicians, dentists, and other health practitioners
395 Home health care services
396 Medical and diagnostic labs and outpatient and other ambulatory care services
397 Private hospitals
398 Nursing and residential care facilities
399 Child day care services
400 Individual and family services
401 Community food, housing, and other relief services, including rehabilitation services
402 Performing arts companies
404 Promoters of performing arts and sports and agents for public figures
407 Fitness and recreational sports centers
409 Amusement parks, arcades, and gambling industries
410 Other amusement and recreation industries
411 Hotels and motels, including casino hotels
413 Food services and drinking places
414 Automotive repair and maintenance, except car washes
416 Electronic and precision equipment repair and maintenance
417 Commercial and industrial machinery and equipment repair and maintenance
418 Personal and household goods repair and maintenance
420 Death care services
421 Dry-cleaning and laundry services
422 Other personal services
426 Private household operations

Finance et al

354 Monetary authorities and depository credit intermediation activities
355 Nondepository credit intermediation and related activities
356 Securities, commodity contracts, investments, and related activities
357 Insurance carriers

358 Insurance agencies, brokerages, and related activities
360 Real estate establishments
361 Imputed rental activity for owner-occupied dwellings

Government

427 US Postal Service
428 Federal electric utilities
430 State and local government passenger transit
431 State and local government electric utilities
432 Other state and local government enterprises
437 * Employment and payroll only (state & local govt, non-education)
438 * Employment and payroll only (state & local govt, education)
439 * Employment and payroll only (federal govt, non-military)
440 * Employment and payroll only (federal govt, military)

Misc

425 Civic, social, professional, and similar organizations

Vita

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