

**The Economic Impact of the Local  
Health Care System  
On the Livingston County Economy**

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## **Executive Summary**

Health Care represents an important part of rural economies. In an era when rural economies are struggling to keep pace with their urban counterparts, the health care sector (which includes hospitals, nursing homes, medical personnel and other resources) represent a bright spot in the economic landscape. There are four major roles for health care in rural economic development through financial and non-financial linkages: 1) keeping local health care dollars at home and closing the supply-demand gaps, 2) attracting external dollars into the community, 3) attracting and retaining new industry and 4) promoting a healthy and productive workforce.

The study examines the economic impact of the health care sector in Livingston County. Currently, Livingston County's health sector represents \$15,442,106 dollars in labor income and 525 jobs of Livingston County's economy. However, further opportunities for local health care services may exist in the local economy. If the local health care system expands, there will be a broad range of corresponding economic effects throughout the community. In Livingston County, every health care job creates an additional .26 jobs in the local economy. For example, one hundred new health care jobs would generate 26 jobs in the community.

## **Preface**

This report is being furnished to the citizens and community leaders of Livingston County. The Kentucky Rural Health Works Program (a program of the University of Kentucky Department of Agricultural Economics, Cooperative Extension Service, Kentucky State Office of Rural Health and Center for Rural Health) was contacted to conduct an economic impact study. The Kentucky Rural Health Works Program offers information and assistance that rural health care providers, local community leaders and policymakers need in order to make the best possible decision about the impact that health care will have upon the economy in rural areas. This is carried out through market demand studies, feasibility studies, policy research studies and economic impact studies. The Kentucky Rural Health Works Program combines the health care knowledge and strengths of the UK Center for Rural Health with economic development expertise of the UK College of Agriculture.

Questions or concerns regarding this analysis should be directed to Dr. Eric Scorson, Assistant Professor of Agricultural Economics at the University of Kentucky College of Agriculture.

## **Introduction**

Over the last two decades, health care services have become a critical engine of growth in rural Kentucky. In 1980, health care industry earnings represented 6.7 percent of all industry earnings. By the late 1990's, health care's share of industry earnings had risen to 12.3 percent in rural Kentucky. These statistics indicate that health care is the second largest industry category in rural Kentucky trailing only local government. Furthermore, medical transfer payments, such as Medicare and Medicaid, now represent more than 9 percent of rural Kentucky's personal income. This is contrast to 1980 when these payments only represented 2.9 percent of personal income.

Health services include a wide range of resources, from facilities such as nursing homes to personnel such as physicians. Why are health care services growing so quickly? The health care industry is in part responding to the growing levels of retirement and medical transfer payments from Social Security and Medicare in rural Kentucky.

Very few rural communities have realized the full potential of local health care as an economic and community development tool. Rural communities have an extraordinary opportunity to improve their local economies and develop health care as a local business. The "warms you twice" adage of wood chopping also can be applied to health care. Every health care service provided locally benefits the rural community twice. First, it improves people's health and second, it improves the health of the local economy.

This report documents the economic impact of Livingston County's health care system. This impact is measured by the number of jobs and income directly and indirectly associated with the local health care system. This study is divided into five major sections. The first section describes the role of health care in rural economic development. The second section examines the current status of the local economy and the relative place of the health care industry. The third section demonstrates the direct and indirect economic impact of the health care system on the local economy. Finally, the appendix explains the methodology used in this report and provides a review of the literature on the economic role of rural health care.

## **The Role of Rural Health Care in Economic Development**

The role of health care in economic development is based on financial and non-financial linkages with the rest of the local economy. Financial linkages are based on the link between the health care providers' expenditures and revenue and other local firms' expenditures and revenue. Health care and other industries often mutually support one another through purchases and sales. These financial linkages create a larger local economy.

Non-financial linkages are based on the health care sector's role in keeping local physicians, promoting a more productive workforce and attracting and retaining industry. Although these may be measured through financial outcomes, generally the link is more indirect. Nevertheless, a strong health care system can promote economic development in a variety of non-financial ways.

### *Financial Linkages*

#### *Keeping Local Health Care Dollars At Home*

The most important financial role for a local health care system is to "keep local health care dollars at home". There are many sources of local health care dollars including private insurance, consumer out-of-pocket payments, and Medicare and Medicaid transfer payments. If these expenditures leave the community, they represent a real loss of potential jobs and income to local residents. Out-shopping, that is, payment for services that are outside of the local area, remains an important issue for many rural health care providers and rural communities.

However, it is not only health care jobs that are at stake. Health care employers and employees are important purchasers of goods and services supporting many local business establishments. Those people who work in health care, such as nurses, physicians, dentists and pharmacists, provide an important source of income for other members of the community who may work in housing construction, retail establishments, restaurants and other local services. Hospitals and other health care facilities are also important purchasers of local inputs, that is, goods and services, such as laundry and waste management services. Increased employment in health care and other areas depends upon capturing the private and public sources of local medical expenditures.

#### *Exporting Services*

If health care providers can attract patients from outside their community, the health care industry can act as an export industry. In essence, the local health care industry exports its reputation and services, while attracting outside patients and outside dollars into the local community. This "exporting" may be based on, for example, a state-of-the art facility or a physician's reputation. Regardless, "export" or external dollars from these outside patients represent an in flow of new dollars into the community's economy. These export dollars then allow a community to purchase a wider variety of goods and services from other communities. The spending linkages created by these export or external dollars in turn generate new jobs and sources of income in the community.

### *Supply-Demand Gaps: Keeping Health Care Dollars at Home*

Identification of a community's supply-demand gap will assist a community in "keeping health care dollars at home". A supply-demand gap occurs when a local economy does not supply (provide) the goods or services demanded (needed or wanted) by an individual or a community. Consequently, residents are then forced to out-shop and make purchases outside their own community. The non-local purchases represent leakages from the local economy and reduce the number of potential employment and income opportunities in a community. In some cases, a community cannot provide these goods or services because of market or financial limitations. However, there may be circumstances that allows local businesses to provide the demanded goods or services locally, which would close the supply-demand gap and keep local dollars at home. This potential should be explored by a community to determine if opportunities are being missed. This may be especially true when key demographic or economic changes occur. These changes can generate new opportunities that did not exist in the community previously.

### *Non-Financial Linkages*

#### *Attracting and Recruiting Industry*

An often-overlooked aspect of the health care system in economic development is the ability to attract and recruit firms based on community services. Company surveys reveal that managers often look at health care as an important issue in locating facilities. The existence of a strong health care network can lower health care costs for firms and their employees and provide value-added services for firms such as occupational health. Also, retirees and workers are more likely to choose a location that has access to quality health care.

#### *Promoting a Healthy and Productive Workforce*

In today's economy, a productive workforce is critical to attracting new firms and retaining existing firms. The health status of local workers can be an important ingredient in productivity. Local health care providers can improve the health and productivity of the local workforce by promoting preventive care, thus leading to long-term economic benefits. On the contrary, if a community's workforce is substantially less healthy than other communities, this may be considered a cost burden by some industries.

The combination of changing demographics, growth in health care service employment and the increase in medical transfer payments implies that the health care system will be a major player in future economic development for rural Kentucky. This fact was recognized in the Kentucky Appalachian Commission's strategic plan, "State Goal 5.2: Kentucky will recognize health care as a substantial economic sector and pursue strategies to grow the sector" (Kentucky Appalachian Commission, 2000). Economic development agencies, businesses groups and local governments should play a more active role in promoting the health care sector as a key partner and primary sector in generating new economic opportunities.

## The Livingston County Local Economy

An examination of the sources of personal income in the community can lead to a better understanding of the potential sources of revenue for local health care providers. Table 1 indicates that 64.9% of the total personal income for Livingston County was from total earnings. Total earnings were adjusted to reflect earnings by place of residence. Table 1 also shows that 20.6% of the total personal income was from transfer payments, such as social security and Medical payments. Of the total personal income for the year 2000, retirement based transfer payments alone contributed 45.3% while medical payments contributed 39.5%.

**Table 1**  
**Economic Data for Livingston County,**  
**The State of Kentucky, and the Nation for 2000 (Thousands of Dollars)**

Source of Income, Earnings Transfer Payments	County Total (\$)	County Percent (%)	State Percent (%)	National Percent (%)
<b>Total Personal Income (2000)</b>	227,934	-----	-----	-----
Earnings by Place of Residence	147,978	64.9	65.2	69
Transfer Payments	46,855	20.6	17.1	13
<b>Total Earnings by place of work (2000)</b>	91,019	-----	-----	-----
Wages and Salaries	64,682	71.1	79.2	80
Proprietor's Income	17,562	19.3	10.7	12
Other Labor Income	8,775	9.6	10.1	9
<b>Transfer Payments (2000)</b>	46,855	-----	-----	-----
Retirement and Disability	21,221	45.3	41	40
Medical Payments	18,523	39.5	38.2	40
Other transfer payments	99	0.2	0.77	0.5

*Source: Bureau of Economic Analysis (2000 Data)*

Table 2 indicates that the 2000 average per capita income for Livingston County was \$23,216 as compared to \$24,085 for the State of Kentucky and \$29,469 for the nation. A disparity in per capita income between the region and the state and the nation indicates that the local health sector may be smaller than expected given the population base of the county. However, growth in per capita income, particularly driven by Medicare and Medicaid, may potentially lead to higher medical expenditures in the community. Growth in industry and private earnings may also lead to greater medical expenditures depending on private insurance coverage.

**Table 2**  
**Per Capita Income for Livingston County,**  
**Kentucky, and the Nation for 2000**

Source	County Total (\$)	State Total (\$)	National Total (\$)
Per Capita Income	\$23,216	\$24,085	\$29,469

*Source: Bureau of Economic Analysis (2000 Data)*

The Livingston County economy is comprised of a diverse group of industries including manufacturing, agriculture, retail and wholesale trade, finance, transportation and services. Table 3 indicates the industries that are present in Livingston County and the personal income by industry for the county. Livingston County's local economy is largely dependent upon Government with \$17,260,000 dollars, the Retail industry with \$10,966,000 dollars, and the Health Care industry with \$8,657,000 dollars. The Service sector is among the largest industries in the local economy. The Health Care industry is comprised within and is part of the Service sector. Over the past decade, the Health Care sector increased by 45.0%.

**Table 3**  
**Livingston County Economy: Personal Income by Industry (Thousands of Dollars)**

<b>Industry Category</b>	<b>1990 Income (\$)</b>	<b>2000 Income (\$)</b>	<b>Percent Change (%)</b>
<b>Private Industry</b>	32,922	68,666	108.6
Agriculture	538	NA	NA
Mining	3,726	NA	NA
Construction	5,658	7,610	34.5
Manufacturing	1,260	4,397	249.0
Transportation	3,459	7,906	128.6
Wholesale	1,459	2,503	71.6
Retail	4,843	10,966	126.4
Finance	2,398	1,239	-48.3
<b>Services</b>	9,581	NA	NA
<i>Health Care</i>	5,972	8,657	45.0
<b>Government</b>	8,228	17,260	109.8
<b>TOTAL</b>	80,044	129,204	61.4

Source: Bureau of Economic Analysis (2000), N/A = Not Available

Table 4 shows Livingston County's transfer payments by type for 1990 and 2000. Comparing Table 3 to Table 4, it is evident that the growth in private industry was less than the growth in federal and state transfer payments to individuals. While private industry grew by 108.6 %, the total transfer payments for Livingston County increased over 96%. The increase in transfer payments is primarily driven by Social Security, Medicare and Medicaid payments. Of the total transfer payments, the medical payments, which includes Medicare and Medicaid, increased by 159%. Once again from Table 1, transfer payments represent nearly 20.6 % of total personal income. The rapid growth of medical transfer payments signifies the potential for health care expansion and represents an important source of revenue for local health care providers and the community.

**Table 4**  
**Livingston County Transfer Payments (thousands of Dollars)**

<b>Transfer Payment</b>	<b>1990 (\$)</b>	<b>2000 (\$)</b>	<b>Percent Change (%)</b>
Medical payments	7,140	18,523	159
Retirement benefits	12,412	21,221	71
Income (welfare) benefit	1,729	3,057	77
Unemployment insurance	636	955	50
<b>Total transfer payments</b>	<b>23,928</b>	<b>46,855</b>	<b>96</b>

Source: Bureau of Economic Analysis (2000)

## **Economic Impact Analysis**

### *Basic Introduction*

A local economy can be conceived of as a barrel with inflows and outflows. The inflows represent external dollars coming into the community that expand the size and strength of the region's economy. Inflows of external dollars represent, for example, federal and state expenditures, money spent by tourists and other people from outside the community who spend within the local economy. The outflows represent leakages out from the economy that does not create jobs or local income. Outflows include state and federal taxes, non-local purchases of goods and services and people traveling to other sites for vacation or receiving medical care in another county or urban area. Local taxes are not an outflow as they are spent on creating local public goods such as roads, schools and police and fire protection.

The economic impact of the health care sector is dependent on a number of factors. In determining the economic impact of a large institution, there are two major purchasing categories to consider: local purchases and non-local purchases. In effect, non-local purchases represent a leakage or loss to a local economy. For health care providers, many purchases by necessity must be made from distant locations. The complex technology and equipment of modern medicine is subject to large economies of scale and is only produced in a few places in the nation. This equipment might include x-ray machines, MRI equipment and other surgical equipment. Pharmaceutical supplies and drugs are also subject to these same forces. Further, some types of audit, legal and accounting services must be purchased from urban regions due to the complexity of services.

Employees and other professionals are a major source of economic impact in the local economy. These employees, turned consumers, spend large amounts of their income in local retail outlets, housing, automobiles and other services. These consumer expenditures, in turn, support a large number of local resident service jobs such as mechanics, retail clerks, real estate agents and bankers.

### *Economic Impact Multipliers*

The impact of local health care expenditures and health care employee expenditures are called multiplier effects. Multiplier effects are a simplified and compact way of representing these economic effects in a local economy. The multiplier is interpreted as the impact of a one-unit change in sales, employment or income that results in an "x" impact on the local economy. In essence, the multiplier represents the recycling of local dollars and income. This recycling process creates new job opportunities and higher wages for individuals. Leakage of dollars and income out of the community, via taxes or non-local spending, reduces the size of the multiplier effect and reduces the potential size of the local economy.

There are three types of multiplier effects based on the type of economic impact analysis: direct, indirect and induced multipliers (see table 5). The direct multiplier effect is based on an industry's initial economic impact on the community. For example, if a manufacturing plant has revenue of 5 million dollars, then this figure becomes the direct economic impact on the community. The indirect multiplier effect is based on industry-to-industry transactions only. For example, health care purchases local laundry, food, landscaping and floral services. However, the indirect multiplier effect does not include the effect of local employee spending on retail and service sectors in the community such as housing, grocery store

or video store purchases. Alternatively, the induced multiplier effect includes both the industry-to-industry transactions and household purchases, which includes employee spending. In some cases, we may wish to only investigate industry transactions and leave out household purchases. The total economic impact is defined as the direct plus indirect plus induced economic effects.

The direct, indirect and induced multiplier effects can be classified as output or sales, employment and income multipliers (see table 5). Sales or output multipliers represent the change in local sales or revenue due to a change in an industry. Employment multipliers are the impact of a one million dollar change in economic output on the number of jobs in a local economy. Income multipliers represent a one-unit change in economic output on local income. Economic output is measured as a change in total sales for a new or existing business or institution in a region.

**Table 5**  
**Health Care Related Economic Impact Multipliers**

	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>
<b>Employment Multiplier</b>	Health care jobs	Health care supplier jobs	Local retail and service jobs related to health care employee spending
<b>Income Multiplier</b>	Health care employee income	Health care supplier employee income	Local retail and service income related to health care employee spending
<b>Sales or Output Multiplier</b>	Health care revenue	Health care supplier revenue	Local retail and service revenue related to health care employee spending

### *Economic Impact Results*

The Livingston County health care system is an important component of the local economy. This importance can be measured via the linkages the health care sector shares with other local industries. When there is an increase in health care revenue or employees, these changes feed through the rest of the local economic system. For example, more supplies may be purchased through local vendors or new employees may purchase homes and spend money in local stores. The health care expenditures and health care employees are important pieces of the economic puzzle.

The results of this analysis will be presented in the following order: 1) output or sales multiplier 2) employment multiplier 3) income multiplier. The output, employment and income impact analysis is summarized in Tables 6, 7 and 8 below.

The sales or output multiplier represents the amount of local sales or revenue due to the impact of the Livingston County health care system (see Table 6). This revenue represents sales from vendors to the health care providers. The \$23,467,242 dollars in Table 6 represents the direct sales from the health care system and is the direct multiplier effect. Health care vendors are supplied by other vendors, thus creating more employment and income opportunities. Subsequently, the indirect impact is \$1,935,817 million dollars and represents the health care vendors' spending within the county. Finally, health care employees purchase goods and services in the local economy and represent the induced impact on the county. The induced

impact on Livingston County is \$4,569,082 dollars and is associated with health care employees' purchases of goods and services locally. Based on the sales or output multiplier, the Livingston County health care sector has a secondary, or total, economic impact of \$29,972,141 dollars as shown in Table 6.

**Table 6**  
**Livingston County Health Care Sector Impact on County Output (Sales)**

Direct Impact of Health care Sector Output	Indirect Impact of Health Care Sector Output	Induced Impact of Health Care Sector Output	Output (Sales) Multiplier	Total Impact Of Health Care Sector Output (Sales)
\$23,467,242	\$1,935,817	\$4,569,082	1.27	\$29,972,141

Source: 1998 IMPLAN Data Base

The employment multiplier demonstrates the relationship between health care expenditures and employment creation in the community For Livingston County health care sector, the employment multiplier is 1.26 shown in Table 7. This employment multiplier directly creates 414 jobs, indirectly creates 32.4 jobs and health care employee spending creates 78.6 jobs. The employment multiplier indicates that for every health care job an additional .26 jobs are created in the local economy. In total, a 1.26 employment multiplier creates 525 jobs in Livingston County. These jobs are directly or indirectly tied to the local health care system finances.

**Table 7**  
**Livingston County Health Care Sector Impact on County Employment**

Direct Impact of Health care Employment	Indirect Impact of Health Care Employment	Induced Impact of Health Care Employment	Employment Multiplier	Total Impact Of Health Care Employment.
414 Jobs	32.4 Jobs	78.6 Jobs	1.26	525 Jobs

Source: 1998 IMPLAN Data Base

Table 8 indicates the direct, indirect and induced impact on Livingston County labor income due to the health care system. The income multiplier indicates the level of county income that is dependent on the local health care system payroll. Livingston County health care employees are paid a total of \$12,879,874 dollars as shown in Table 8. This income translates into local spending and more jobs and more income in the community. The spillover or the indirect impact from labor income for the health care sector is estimated to be \$895,690 dollars. The induced impact is \$1,666,542 dollars and results in a total income impact of \$15,442,106 dollars for Livingston County. The health care income multiplier in Livingston County is 1.20. This means that for every dollar of income generated in the health care sector, an additional .20 cents of income is generated in the rest of the local economy.

**Table 8**  
**Livingston County Health Care Sector Impact on County Income**

Direct Impact of Health care Sector Income	Indirect Impact of Health Care Sector Income	Induced Impact of Health Care Sector Income	Income Multiplier	Total Impact of Health Care Sector Income.
\$12,879,874	\$895,690	\$1,666,542	1.20	\$15,442,106

Source: 1998 IMPLAN Data Base

## Summary

Overall, the results indicate that the economic activities of the health care and its employees create 525 local jobs and \$15,442,106 dollars in local income. In terms of the local private economy, the local health care system represents 11% of private economic activity. This percentage compares favorably with other industries in the community. Furthermore, the existence of a new health care facility means that this impact is likely to rise faster than many other local industries over the next decade. Health care has been called the “main economic engine” of the next decade. Livingston County is in a position to capture many of the economic and financial benefits of this engine.

This report should be used as a focus for discussion of the economic development of health care in Livingston County. First, a community can identify the current economic and financial roles of county health care providers. Second, supply-demand gaps or potential opportunities for new medical services can be identified in the community. Further research or market demand analysis can determine the feasibility of providing services locally. Seeking out new opportunities for local services will increase the economic impact of the county’s health care system on the local economy. Telemedicine, health care networking and other activities should be examined to enhance the economic role of the local health care system.

## Appendix

### Literature Review

#### *Economic Impact of Health Care on Regional and Local Economies*

There are a wide variety of health care services that include hospitals, physicians and dentists, pharmacies, health clinics and nursing homes. Each of these sectors contributes to the local economies in which they are located, with hospitals generally contributing the largest portion of the impact. Presented is key literature of economic impact of health care services in general and of hospitals in particular on regional and local economies.

The literature on the impact of Health care services to regional and local economies indicate that 1) health care services contribute as export industries for regions in which they are located, 2) and reduce the region's imports by providing services to local residents, who would otherwise seek services outside the region or local area. Both effects of decreasing imports and increasing exports, stimulate and increase local and regional income. The direct impact of the health care sector to local and regional economies is measured through wages paid to employees, through inputs purchased by the health sectors and through the spending generated through the multiplier effect.

Among the recent studies is the impact of health care on a regional economy by Lichty et al. (1986) where a simulation model using input-output was used to assess the health care sector impact on Arrowhead (a seven county area) region in Northeast Minnesota. The model estimated the impact of removing an entire health care sector as well as the impact of closing one hospital. Obviously, the elimination of the entire health sector had a far more dramatic impact on the region, indicating a loss of 42%, from 121,305 to 70,004 of total employment over a period of six years in the baseline if the medical sector was removed. Also, regional gross output declined by 22% from \$ 4,962,141 000 to \$3,866,211,000. A more modest impact was that of a closing hospital with a loss of 1,200 employees and a decline in gross output of 2.1% (from \$4,962,141,100 to \$4,855,977,000) from the baseline, by 1990.

A similar study was done by McConner and Wellever (1989) that examined the impact of a hospital sector on a state economy. An input-output model was used to examine the impact of a Montana hospital on employment, household income, and the level of goods and services produced in the state of Montana. The study revealed a significant hospital impact on total state revenues, salaries and wages and on total employment. Total revenues had a 1.60 multiplier from business spending totaling \$402,131,432 million in 1987. Similarly, salaries for professionals and employment had 1.61 and 1.30 multipliers that totaled indirect impacts of \$196,664,645 and 9,000 respectively.

In terms of a base industry, rural hospitals depend heavily on reimbursements from Medicare and Medicaid and the impact of these federal dollars into the rural communities is very significant. Lee et al. (1988) found that for each state dollar spent on Medicaid there is a federal match of \$3.69 in Mississippi. From the \$4.69 Medicaid expenditure, \$3.05 was spent on income in terms of wages and salaries. He also applied the state income multiplier of 2.172 to generate a total income impact of \$6.62 on the economy concluding that Medicaid dollars from outside the state economy had significant impact of the overall economy of Mississippi.

An earlier study by Moore (1974) measured the impact of the Upstate Medical Center on the community of Syracuse, New York, where he estimated an income multiplier of 2.63 indicated that each dollar of direct expenditure by the medical center produced \$2.63 of total

expenditure. Moore concluded that large public institutions, such as hospitals have the potential to generate millions of dollars in employment and personal income through, in effect, interregional trade.

Extensive studies have indeed indicated the importance of health care to regional and local economies, especially hospitals. More recent studies have measure the impact of hospitals particularly in rural areas. McDermott et al. (1991) measured the impact of four small rural hospitals in Utah on their local economies. He found that these hospitals contributed between 4.0 to 9.0 percent of the average employment in their local, both directly and indirectly.

An earlier study by Christianson and Faulkner (1981) examined single-hospital rural counties from Montana, Nebraska, Nevada, Idaho, North Dakota, South Dakota, Wyoming and Utah to measure the importance of a rural hospital to the community's income in each respective county. They found that income associated with hospital salaries generated, on average a 1.36 percent of direct benefit to the total county income, and had a multiplied income effect from hospital expenditures ranging from 1.54 to 2.37 percent of total county income. The loss from a hospital closer was less significant ranging from 1.53 to 2.29 percent of total county income.

A recent study by Doeksen and Altobelli (1990) also measured the change in local economic activity in three Texas communities of Crowell, Breckenridge and Graham if there was a hospital closure. They found that employment would decrease by 1.1 to 3.0 percent for the baseline for 1994. Similarly, income and retail sales would drop by almost a percent under the same circumstances. This, they concluded, would be detrimental to the local economy.

## **Methodology**

### *Economic Impact Analysis Methodology*

The IMPLAN model was used to generate the economic impact of Livingston County health care. IMPLAN is an input-output model that can be used to examine the economic impact of new industries, loss of an existing industry, fiscal impact analysis and the existence of supply demand gaps. Model version 2.17 was used in this study with the 1998 Kentucky data and structural matrices.

An input-output model is a set of linear equations expressed in matrix form. The so-called Leontief inverse of this matrix reveals "multipliers". Multipliers express in compact form, the relationship between sectors of an economy. In essence, a change in an industry, household, or government expenditure pattern gets reflected through the study economy.

A number of important assumptions underlie input-output analysis. First, prices are fixed in the model. This implies that no relative price changes occur in the economy that would affect resource allocation. Typically, economies assume that a price change affects the relative number of quantities or goods in an economy. Second, supply of factors, such as labor and capital, is always available at the same price. Again, whatever capital or labor is needed by the healthcare sector will be available to a rural community.

IMPLAN industries are based on a relationship called a production function. A production function specifies the dollar value of inputs used by an industry to create its output. The production function is specified as a series of coefficients, called gross absorption coefficients that reflect the percentage of total inputs coming from a particular industry. In essence, these coefficients reflect the recipe for an industry. Industry ingredients, capital and labor, are combined to create a certain dish or output. In this case, lab supplies, surgical

equipment, nursing home beds, nurses and doctors and other factors are combined to create the output called health care.

IMPLAN production functions originally exist based on a national data set. Hospitals and other health care providers from across the nation, both urban and rural, are surveyed by the Census Bureau to determine their expenditure purchasing patterns. These national purchasing patterns are used by IMPLAN to create a regional version of a county's health care production function. However, often this national purchasing pattern is quite different from what actually occurs in a rural health care setting.

This production function is also modified to reflect local versus external purchases of inputs. The distribution of local versus external expenditures is called the regional purchase coefficient. The coefficient is a number between zero and one reflecting the percentage of goods and services bought locally. If an industry purchases an input from outside the community, this purchase is not reflected as an expenditure in other local industries. For example, if a health care provider purchases waste management services from a local provider that industry in turn expands and hires workers. If waste services are purchased outside the community, the expenditure is lost or leaked out of the local economy. Again, these local versus external purchasing patterns are based on aggregate national conditions and may not accurately reflect local purchasing patterns. It is critical to properly account for local production functions and local purchases by the health care sector.

For this study, it was felt important to capture the nature of Livingston County Health care purchasing patterns as opposed to the use of national standard production function. After the initial model for Livingston County was developed, the expenditure records for the health care were reviewed to determine health care spending patterns. Where available, other health care provider records were examined to determine expenditure patterns. These patterns were in some cases significantly different from the original IMPLAN health care expenditure patterns. Also, the regional purchase coefficients were significantly different in some cases between the original IMPLAN model and the revisions based on Livingston county records. The revisions of local spending correspond with findings from other studies that rural health care providers generally affect wholesale and retail trade activities in the county.

Once these revisions are made to the IMPLAN model, the impact of the health care sector is generated. Employment, output and value added multipliers are calculated for the hospital, nursing home, doctor's office and other health care provider sector in the community. These multipliers represent Livingston County health care sector indirect and induced economic impact on the community. Again, this impact is based on a positive change in the health care sector and its impact on other local economic sectors. The economic impact was calculated by removing the newly created health care sector through the Impact screen and determining the loss in employment, labor income and output.

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