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Tools for Understanding Economic Change in Communities: Economic Base Analysis and Shift-Share Analysis

Circular 643A

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INTRODUCTION

This circular (the first in a series) discusses two important economic development analytical tools that can be used by county Extension agents, local officials, planners, and economic development specialists to understand economic changes taking place in their community. They are economic base analysis and shift-share analysis.

There are numerous reasons for local economic changes. Entry of new businesses, expansion of existing businesses, new government policies, national economic trends, and global economic events can greatly affect the economic condition of a locality. These changes can affect all or most of the sectors in an economy even though the transactions of one sector seemingly are unrelated to other sectors. Even in the absence of major changes, local development officials and policy makers may want to know answers to questions such as:

- What are the growing and declining sectors of the economy?

- What is the current employment situation in the local economy?

- How is the local economy doing compared to its neighbors and other communities in the state?

- What are the new opportunities for job growth?

Understanding the current state of the local economy including its relative strengths and weaknesses is necessary in order to formulate answers to existing and/or new economic challenges. This understanding can come from a detailed analysis of current and past performance of the local economy. There are numerous tools that have been developed by economic development scholars to analyze local economies and help economic and community development practitioners understand important economic trends in the local economy. This guide discusses two widely used tools: economic base analysis and shift-share analysis.

ECONOMIC BASE ANALYSIS

Economic base analysis is the preferred method among economic development specialists for understanding a local economy. It is a simple yet valuable tool that can be used to gain an understanding of the economic structure of communities. It can provide comparative information on the economic status of a locality across time periods and other localities with respect to employment conditions and trends.

Economic base analysis assumes that the local economy can be divided into two main sectors: basic and non-basic. The basic sector is made up of those local businesses that produce goods and services sold to consumers outside the community/region. Economic base analysis assumes that the sales of a basic firm are dependent almost entirely on export markets. For example, Intel's facility in New Mexico sells to customers located all over the world. Their sales to consumers in New Mexico are negligible compared to their total sales outside of New Mexico. The non-basic sector, on the other hand, is composed of those firms that produce goods and services that are sold and consumed locally. Almost all local businesses such as hairdressers, dentists, restaurants, and drug stores can be categorized as non-basic because they depend almost entirely on local market sales.

Economic base analysis is grounded on the premise that basic industries form the economic base of a locality, and all other industries flourish by servicing this sector. Through its non-local market sales and resulting injection of new money into the local economy, the basic sector is an important contributor to and driver of local economic growth and progress. Changes in the composition or performance of the basic sector usually impact the non-basic sector and overall trends in the local economy. Economic base analysis has shown that the local economy is strongest when it develops those economic sectors that bring new dollars into the local economy. We next discuss how to determine the basic sectors in a local economy.

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Ideally, economic base analysis should use industry output and trade flows to and from a locality. However, due to data disclosure issues this is not possible for some localities. The alternative is to use employment data. Although there are several ways to estimate the economic base of a locality, the location quotient (LQ) approach is the most popular method. Location quotients measure the relative concentration of a given industry in a given locality compared to a larger area such as the whole nation, the state, or the region.

The location quotient is the ratio of an industry's share of the local employment (locality) divided by its share of the reference area (the nation, the state, or the region). The formula for computing location quotients can be written as:

$LQ = (e_i/\Sigma e)/(E_i/\Sigma E)$
Where:
e_i = Local employment in industry i
Σe = Total employment in the locality
E_i = Reference area employment in industry i
ΣE = Total reference area employment

For example, the locality can be a county and the reference area can be the state in which the county is located, the nation, or a region that consists of several counties or even several states. In Example 1, Donã Ana County is the locality, the State of New Mexico is the reference area, and the health care and social assistance sector is the industry.

Example 1. Employment, 2005

	Donã Ana County	New Mexico
Health care and social assistance employement	11,984	108,336
Total full- and part-time employment	86,856	1,064,351

Location Quotient = (11,984÷86,856)/(108,336÷1,064,351) = 1.35

To calculate the location quotient for the health care and social assistance industry (using Bureau of economic Analysis data for 2005) in Donã Ana County, divide the county's share of employment in that industry (11,984÷86,856) by the State of New Mexico's share of employment in the same industry (108,336÷1,064,351). The location quotient for the health care and social assistance industry in Donã Ana County was 1.35 in 2005. A location quotient of greater than one indicates that this is a "basic" industry—local production can satisfy local consumption and excess may be exported. A location quotient of less than one indicates that the industry cannot satisfy local consumption and the difference must be imported. A location quotient equal to one indicates production can just meet the local consumption demand. Similarly, the location quotient for the healthcare and social assistance industry can be calculated for the State of New Mexico with reference to the nation.

Another concept, related to economic base analysis, used by economic development specialists is the base multiplier. The multiplier is a quantitative expression that estimates the additional effects (e.g., added employment) that results from the initial effect (new employment) working its way through the internal linkages in the local economy. The base multiplier is calculated by determining the ratio between total employment in a particular year and the basic sector employment of that year. It measures how many non-basic-sector jobs are created for each basic-sector job. For example, if the basic sector of Donã Ana County is the health care and social assistance industry, it had 11,984 jobs in 2005. Then the basic multiplier for 2005 would be equal to 7.2 (86,856÷11,984). This multiplier estimates that for every one basic sector job created, six non-basic-sector jobs are created. For every health care and social assistance industry job created, six jobs may be created in other sectors of the economy. The health care and social assistance industry employment plays a major role in other sectors in the area. If the health care and social assistance industry cuts its workforce by several hundred, the local economy will likely lose a greater number of jobs, six for every one job of the health care and social assistance industry.

LIMITATIONS OF THE ECONOMIC BASE ANALYSIS

A location quotient using employment data implies that local productivity (output per worker) is the same as productivity in the reference area. A LQ greater than one suggests the industry is producing in excess of local consumption and is exporting the surplus. However, we can also get a LQ greater than one if the industry requires more workers than average to produce the same level of output. In this case, the greater-than-one LQ is due to labor inefficiency, and the sector will not be as strong in the local economy as it appears. Problems can also arise depending on the level of data aggregation. The data available from the Bureau of Economic Analysis and the Bureau of the Census can be aggregated into different levels. The more the data are aggregated, the more details are hidden, and LQs can vary significantly depending on the level of industry aggregation. Analysts need to be aware of this possibility and adjust the level of aggregation to reflect local conditions and needs. Another issue that LQs do not take into consideration is the possibility that there may be firms importing the same type of goods into a locality as are being exported from it.

SHIFT-SHARE ANALYSIS

Shift-share analysis (SSA) is a technique widely used by regional economists and economic development specialists to examine the changes in employment in a locality. It provides useful information about the characteristics of growth and competitiveness of local industries in a locality compared to a larger reference area. The comparison can also be done with similar industries in other localities. The SSA technique oftentimes is used for decomposing changes in employment in localities, identifying competitive industries in the local economy compared to those of a larger economy (the nation, a state or a region). The SSA helps determine whether a particular local economy has experienced a faster or slower growth rate in employment than the larger economy. Compared with the larger economy, jobs in a local economy may be concentrated in some industries more than in others, based on the industrial structure of the local economy. For this reason, a locality with several fast-growing industries might display a high rate of employment gain. Similarly, a locality with several declining industries might experience a high rate of employment loss. More specifically, the SSA allows us to analyze a change in the number of jobs in a locality in terms of structural changes, not just a general change in total employment in a locality.

SSA decomposes employment change in a region (over a given time period) into three contributing factors:

1. **National growth effect** represents the share of local employment growth that can be attributed to growth of the national economy. This component is based on the assumption that if the larger economy is experiencing employment growth, it is reasonable to expect that this growth will positively influence employment growth in a particular locality. Local businesses are usually aware of how the national economic climates affect them, and this effect is felt most intensely during boom and bust times of the business cycle. To calculate this component, base year (beginning year) employment in each industrial sector of the locality is multiplied by the national average rate of growth for all sectors. The resulting values are summed to obtain the total national growth component.

   National share = (base year [beginning year] employment in each industrial sector of the locality) × (the national average rate of growth for all sectors)

2. **Industrial mix effect** represents the effects that specific industry trends at the national level have had on the change in employment in the locality.

This component captures the fact that nationally some industries grow faster or slower than others and these differences are reflected in local industry structure. This component will highlight the industries in the locality that are increasing nationwide. To calculate the industrial mix component, base year employment in each local industrial sector is multiplied by the difference between the national average rate for that sector and the national average rate for all sectors. A positive industry mix implies that the employment in the locality grew above the overall national average, and a negative industrial mix indicates the opposite.

   Industrial mix effect = (base year employment in local industrial sector X) × (the national average growth rate for sector X – the national average growth rate for all sectors)

3. **Competitive effect** shows how industrial groups in the locality performed relative to those groups at national averages. It is based on the assumption that for the same industry groups, sometimes the locality may not follow the national trends with the same magnitude. This is due to the locality having a comparative advantage in terms of natural resource base, labor resources, and so forth. To calculate this component, base year employment in each local industrial sector is multiplied by the difference between the local sector growth rate and the national average growth rate for that sector. A positive competitive share component suggests that the locality increased its share employment in that industry, and a negative competitive share component means the opposite.

   Competitive effect = (base year employment in local industrial sector X) × (the local growth rate for sector X – the national average growth rate for sector X)

An example of how to calculate the shift-share components for changes in New Mexico employment is provided in Tables 1 through 6. In summary, during the period from 2001 through 2005, New Mexico increased its number of jobs by 8.85% (Table 2) vs. 4.33% for the U.S. (Table 1). Shift-share analysis components of New Mexico's employment gain include: 49% due to the national effect, 8% due to the industry mix effect, and 43% due to New Mexico's competitive effect (Table 6). During the 2001–2005 period, New Mexico had a competitive advantage over the U.S. in several sectors including mining, educational services, health care and social assistance, arts, entertainment, and recreation, and government and government enterprises (Table 6).

Table 1. BEA-REIS Employment Data for the U.S.

Employment category	2001 jobs	2005 jobs	Percent change
Farming	3,056,000	2,913,000	-4.68
Forestry, fishing, related activities, and other	1,022,500	1,012,200	-1.01
Mining	811,400	820,000	1.06
Utilities	618,800	594,100	-3.99
Construction	9,846,700	10,845,700	10.15
Manufacturing	16,994,600	14,860,900	-12.56
Wholesale trade	6,273,400	6,401,300	2.04
Retail trade	18,528,800	18,941,100	2.23
Transportation and warehousing	5,474,000	5,510,100	0.66
Information	4,053,800	3,577,100	-11.76
Finance and insurance	7,839,600	8,186,600	4.43
Real estate and rental and leasing	5,551,400	6,934,300	24.91
Professional and technical services	10,575,800	11,488,700	8.63
Management of companies and enterprises	1,779,300	1,857,000	4.37
Administrative and waste services	9,621,000	10,645,100	10.64
Educational services	3,058,300	3,552,900	16.17
Health care and social assistance	15,611,400	17,267,000	10.61
Arts, entertainment, and recreation	3,243,100	3,517,300	8.45
Accommodation and food services	10,825,200	11,728,300	8.34
Other services, except public administration	9,049,600	9,758,900	7.84
Government and government enterprises	23,180,000	23,837,000	2.83
Total employment	**167,014,700**	**174,249,600**	**4.33**

Table 2. BEA-REIS Employment Data for New Mexico

Employment category	2001 jobs	2005 jobs	Percent change
Farming	24,091	24,550	1.91
Forestry, fishing, related activities, and other	7,019	7,224	2.92
Mining	19,469	21,024	7.99
Utilities	4,272	4,217	-1.29
Construction	63,144	73,164	15.87
Manufacturing	46,001	41,896	-8.92
Wholesale trade	27,970	28,566	2.13
Retail trade	111,250	117,770	5.86
Transportation and warehousing	23,854	24,901	4.39
Information	19,331	17,320	-10.40
Finance and insurance	30,996	32,101	3.56
Real estate and rental and leasing	29,117	37,892	30.14
Professional and technical services	60,386	68,994	14.25
Management of companies and enterprises	6,083	5,921	-2.66
Administrative and waste services	52,659	56,653	7.58
Educational services	11,826	15,551	31.50
Health care and social assistance	89,614	109,575	22.27
Arts, entertainment, and recreation	18,570	21,962	18.27
Accommodation and food services	76,403	81,679	6.91
Other services, except public administration	50,286	53,689	6.77
Government and government enterprises	205,474	219,567	6.86
Total employment	**977,815**	**1,064,351**	**8.85**

Table 3. National Growth Component Calculations

Employment category	2001 jobs		U.S. growth rate		National effect
Farming	24,091	×	4.33%	=	1,043
Forestry, fishing, related activities, and other	7,019	×	4.33%	=	304
Mining	19,469	×	4.33%	=	843
Utilities	4,272	×	4.33%	=	185
Construction	63,144	×	4.33%	=	2,734
Manufacturing	46,001	×	4.33%	=	1,992
Wholesale trade	27,970	×	4.33%	=	1,211
Retail trade	111,250	×	4.33%	=	4,817
Transportation and warehousing	23,854	×	4.33%	=	1,033
Information	19,331	×	4.33%	=	837
Finance and insurance	30,996	×	4.33%	=	1,342
Real estate and rental and leasing	29,117	×	4.33%	=	1,261
Professional and technical services	60,386	×	4.33%	=	2,615
Management of companies and enterprises	6,083	×	4.33%	=	263
Administrative and waste services	52,659	×	4.33%	=	2,280
Educational services	11,826	×	4.33%	=	512
Health care and social assistance	89,614	×	4.33%	=	3,880
Arts, entertainment, and recreation	18,570	×	4.33%	=	804
Accommodation and food services	76,403	×	4.33%	=	3,308
Other services, except public administration	50,286	×	4.33%	=	2,177
Government and government enterprises	205,474	×	4.33%	=	8,897
New Mexico national growth effect					**42,339**

Table 4. Industrial Mix Component Calculations

Employment category	2001 jobs		U.S. industry growth rate		U.S. job growth rate		Industry mix share
Farming	24,091	×	(-4.68%	–	4.33%)	=	-2,171
Forestry, fishing, related activities, and other	7,019	×	(-1.01%	–	4.33%)	=	-375
Mining	19,469	×	(1.06%	–	4.33%)	=	-637
Utilities	4,272	×	(-3.99%	–	4.33%)	=	-355
Construction	63,144	×	(10.15%	–	4.33%)	=	3,672
Manufacturing	46,001	×	(-12.56%	–	4.33%)	=	-7,767
Wholesale trade	27,970	×	(2.04%	–	4.33%)	=	-641
Retail trade	111,250	×	(2.23%	–	4.33%)	=	-2,342
Transportation and warehousing	23,854	×	(0.66%	–	4.33%)	=	-876
Information	19,331	×	(-11.76%	–	4.33%)	=	-3,110
Finance and insurance	30,996	×	(4.43%	–	4.33%)	=	30
Real estate and rental and leasing	29,117	×	(24.91%	–	4.33%)	=	5,993
Professional and technical services	60,386	×	(8.63%	–	4.33%)	=	2,598
Management of companies and enterprises	6,083	×	(4.37%	–	4.33%)	=	2
Administrative and waste services	52,659	×	(10.64%	–	4.33%)	=	3,325
Educational services	11,826	×	(16.17%	–	4.33%)	=	1,400
Health care and social assistance	89,614	×	(10.61%	–	4.33%)	=	5,623
Arts, entertainment, and recreation	18,570	×	(8.45%	–	4.33%)	=	766
Accommodation and food services	76,403	×	(8.34%	–	4.33%)	=	3,066
Other services, except public administration	50,286	×	(7.84%	–	4.33%)	=	1,764
Government and government enterprises	205,474	×	(2.83%	–	4.33%)	=	-3,073
New Mexico industrial mix effect							**6,893**

Table 5. Competitive Component Calculations

Employment category	2001 Jobs		State ind. growth rate		U.S. ind. growth rate		Competitive effect
Farming	24,091	×	(1.91%	–	-4.68%)	=	1,588
Forestry, fishing, related activities, and other	7,019	×	(2.92%	–	-1.01%)	=	276
Mining	19,469	×	(7.99%	–	1.06%)	=	1,349
Utilities	4,272	×	(-1.29%	–	-3.99%)	=	116
Construction	63,144	×	(15.87%	–	10.15%)	=	3,614
Manufacturing	46,001	×	(-8.92%	–	-12.56%)	=	1,671
Wholesale trade	27,970	×	(2.13%	–	2.04%)	=	26
Retail trade	111,250	×	(5.86%	–	2.23%)	=	4,044
Transportation and warehousing	23,854	×	(4.39%	–	0.66%)	=	890
Information	19,331	×	(-10.40%	–	-11.76%)	=	262
Finance and insurance	30,996	×	(3.56%	–	4.43%)	=	-267
Real estate and rental and leasing	29,117	×	(30.14%	–	24.91%)	=	1,522
Professional and technical services	60,386	×	(14.25%	–	8.63%)	=	3,395
Management of companies and enterprises	6,083	×	(-2.66%	–	4.37%)	=	-428
Administrative and waste services	52,659	×	(7.58%	–	10.64%)	=	-1,611
Educational services	11,826	×	(31.50%	–	16.17%)	=	1,812
Health care and social assistance	89,614	×	(22.27%	–	10.61%)	=	10,457
Arts, entertainment, and recreation	18,570	×	(18.27%	–	8.45%)	=	1,822
Accommodation and food services	76,403	×	(6.91%	–	8.34%)	=	-1,098
Other services, except public administration	50,286	×	(6.77%	–	7.84%)	=	-538
Government and government enterprises	205,474	×	(6.86%	–	2.83%)	=	8,269
New Mexico competitive effect							**37,170**

Table 6. Shift-Share Analysis, 2001-2005, New Mexico Versus U.S.

Employment category	National effect	Industry mix effect	Competitive effect	Total
Farming	1,043	-2,171	1,588	460
Forestry, fishing, related activities, and other	304	-375	276	205
Mining	843	-637	1,349	1,555
Utilities	185	-355	116	-55
Construction	2,734	3,672	3,614	10,020
Manufacturing	1,992	-7,767	1,671	-4,105
Wholesale trade	1,211	-641	26	596
Retail trade	4,817	-2,342	4,044	6,520
Transportation and warehousing	1,033	-876	890	1,047
Information	837	-3,110	262	-2,011
Finance and insurance	1,342	30	-267	1,105
Real estate and rental and leasing	1,261	5,993	1,522	8,775
Professional and technical services	2,615	2,598	3,395	8,608
Management of companies and enterprises	263	2	-428	-162
Administrative and waste services	2,280	3,325	-1,611	3,994
Educational services	512	1,400	1,812	3,725
Health care and social assistance	3,880	5,623	10,457	19,961
Arts, entertainment, and recreation	804	766	1,822	3,392
Accommodation and food services	3,308	3,066	-1,098	5,276
Other services, except public administration	2,177	1,764	-538	3,403
Government and government enterprises	8,897	-3,073	8,269	14,093
Total	**42,339 (49%)**	**6,893 (8%)**	**37,170 (43%)**	**86,402 (100%)**

LIMITATIONS OF SHIFT-SHARE ANALYSIS

The shift-share analysis technique is a simple analytical tool, but it has some methodological limitations that require its results be interpreted with caution and used in combination with other regional/local analysis techniques to determine a locality's economic potential. The SSA technique does not fully account for all things that may contribute to or explain changes in local employment, including for example the impact of national and regional business cycles, identification of actual comparative advantages in a locality, and differences due to levels of industrial disaggregation. Nor can SSA identify the determinants of the SSA components. In addition, the results of SSA reflect only the total employment changes over the time period under consideration and do not shed light on the magnitude or cause of employment changes in individual years during the same period. On the other hand, the SSA technique provides a simple, straightforward approach to identifying a locality's employment changes based on local competitive advantage as contrasted to the national growth effect and industrial mix effect. This can be useful information for targeting industries that might offer significant future growth opportunities in a locality.

CONCLUSION

This circular discusses two important analytical tools—economic base analysis and shift-share analysis—that can be used by county Extension agents, local officials, planners, and economic development specialists to understand economic changes taking place in their community. The tools are relatively easy to use. An Excel spreadsheet and data on employment for various categories of industries will do the job. By following the calculations described in the circular, one can determine the economic base of a locality and the competitive industries in a local economy. Employment data by industry may be secured through the U.S. Census Bureau's annual County Business Patterns publication and can be accessed through its website at http://www.census.gov/econ/cbp/index.html. The U.S. Bureau of Economic Analysis (through Regional Economic Accounts) also provides employment data by industry for every state and county; data may be accessed at www.bea.gov/regional/reis/. One shortcoming of both these data sets is that the data are suppressed for some counties due to disclosure rules.

FURTHER READING

Klosterman, Richard E. (1990). *Community and Analysis Planning Techniques*. Rowmand and Littlefield Publishers, Inc. Savage, Maryland. See Chapter 10.

Klosterman, Richard E., Brail, Richard K. and Bossard, Earl G. (1993). *Spreadsheet Models for Urban and Regional Analysis*. See Chapter 20.

Pennsylvania State University. Community Economic Toolbox. Available at http://www.economictoolbox.geog.psu.edu/