

WHAT TO DO WITH ALL THIS DATA?

The Role of Economic Base Analysis in Regional Economic Development

Introduction

It is not uncommon for communities with a desire to focus or direct regional economic growth to seek a better understanding of their local employment structure. Clearly, each region has a unique mix of industries which drive their economy. More than likely the size and diversity of those industries is a function of the region's comparative advantage. In other words, each region has advantages that serve to attract and contribute to growth of particular industries.

Comparative advantage can be natural resource-based such as near metal ores or forests, a function of proximity to a transportation nexus such as a seaport or railway, driven by abundant, skilled labor where a major university is located, or linked to high speed telecommunications systems. Every region has some comparative advantage that is largely responsible for their current industrial make-up.

That group of industries that generates the greatest amount of employment and income in excess of the needs of the local community is referred to as the regional economic base. Economic base analysis is a tool for identifying those industries that are the keys to the local economy. There are many variations on economic base analysis. The techniques have long been used as an easy, yet informative approach for economic development and workforce targeting.

Most these techniques are "share" methods, using ratios from a larger, presumably self-contained region such as the state or nation, to determine local self-sufficiency production and employment levels. One such statistic, the coefficient of specialization, is used to determine in which industries a region appears to be concentrated. The industries with the highest and therefore most significant coefficients of specialization in a given local economy comprise the area's base industries and are the cornerstones of the local economy. On the assumption that every region has both local population-serving industries and export industries, these are sectors that serve as economic drivers of the regional economy. This discussion is written for novice analysts and planners and will explore the basic concepts and calculations behind these techniques of regional analysis.

Regional Economic Base Analysis

In analyzing the area's economic base, the diversity of the local economy and its national business cycle sensitivity can be uncovered. Base analysis serves two main purposes: (1) to identify the major current sources of income and employment in the local area, and (2) to anticipate the changes in the local area economic structure, both those that will tend to occur naturally and those that should be encouraged in the development of a diversified industrial base. Where an area specializes in a certain type of industrial activity, e.g., Austin/Travis County and Computer and Electronic Product Manufacturing, this concentration tends to perpetuate the further economic development of that industry in that particular area. This is known as "agglomeration economies". Also known as "cumulative causation" models, they suggest that if a region is able to exploit an initial comparative advantage, new industry growth and multiplier effects will tend to concentrate in that same region rather than expand elsewhere. Large existing

concentrations of firms in a particular manufacturing industry, for example, assure the creation and maintenance of a skilled and trained labor force from which to draw. The significance of a skilled labor pool especially in an area that comprises a large industrial and household market is well documented in literature relating to industrial relocation.

Aside from the labor pool, existing subsidiary and support services have usually been established which provide new firms with experienced subcontractors and finance, distribution, and marketing firms familiar with the needs and problems related to the particular industry. Thus agglomeration economies includes the support infrastructure that in turn becomes available to support additional capital and employment expansion. It should be noted that although even smaller regions, such as counties, can experience agglomeration economies, the phenomenon is generally restricted to large urban areas which tend to have greater potential for innovation. Expansion, therefore, tends to come in those industries that already exist in an area, increasing the concentration of firms in a particular industry.

Several caveats are in order here because agglomeration economies can change over time. Where a region has a concentrated economic base, such as oil and gas related services in the Permian Basin, the local area can become less diversified and more dependent on a single or a few industrial sectors. Although such concentration or dependence is not inherently bad, the local economy becomes extremely sensitive to the prosperity or decline of the particular key industry(s). Should such a key or basis industry suffer serious declines in demand and production, the local economy loses the employment and income generated by the industry. Where the local economy is not sufficiently diversified to absorb the employment and income losses caused by the demise of a key industry, that economy would suffer severe recessionary effects.

A second caveat is that the regional comparative advantage must be maintained in order for the benefits of agglomeration economies to continue. A region's growth rate is generally dependent on several factors, among which are the demand for, and price elasticity of, the regions products. Output and employment declines can occur if market demand for a regional export product or service diminishes. Similarly, price elasticity, or the price consumers are willing to pay for a product or service, can change over time. The Apparel manufacturing industry in the Upper Rio Grande region is a good example. Consumers found that they could purchase clothing items made in Mexico and the Pacific Rim at prices cheaper than manufacturers, wholesalers and retailers offered on goods made in El Paso. Thus during the 1990s, changing price elasticity led to a demise of the Apparel manufacturing industry, an export industry for that region.

Not only does the local economy lose the income and jobs generated by the key industry, but such a loss triggers a series of losses in those firms and industries which are economically dependent on the key industry. The so-called multiplier or "ripple" effect occurs when the key industry has reduced its production to the point that it must reduce its work force through layoffs, and reduce the amount of related subcontract and service business it previously generated. If the economy is not diverse enough to supply new business opportunities, subcontractors and service firms will also be forced to lay off workers.

This is how the ripple effect plays out. This first wave of decline results in increased unemployment and reduced production of goods or services that can potentially be sold. The second ripple occurs when those individuals who have been laid off do not readily find new jobs and thus no longer have as much money to spend on personal goods and services. Collectively, they buy fewer groceries, stop going to the movies, put off buying new clothes and appliances, and drive the old car that much longer. As the scenario unfolds in the local economy, the second ripple of reduced spending by individuals triggers a new decline in sales and services in other firms and industries. These declines in demand result in more layoffs in the service sector that continue the ripples through the local economy. Although this is a highly simplified explanation of the "reverse multiplier" or ripple effect, it does point out the importance of the key industries in each local area and the need for a diversified economy to avoid or offset the potential debilitating effect from the decline of a key industry.

Logic Behind the Procedure

There is a logical argument behind the division of an area economy into an export sector and a local sector. Consider the early days of the nation when many individuals were engaged as fur trappers. The trappers would stock up with supplies, venture into wilderness areas, capture their game, and skin the hides. The duration of these forays into the wilderness was often gauged by their stock of supplies. The pelts were, upon return to a town or trading post, sold to buyers from other areas or traded for more supplies.

Then some entrepreneurial folks get the idea to establish a trading post closer to the wilderness areas making it easier for the trappers to stock up on supplies. A service has thus been moved into the "local area". Assume that trappers continue to sell their pelts to outside buyers; that is, they export pelts. With their money they purchase their supplies from the trading post. Thus the trading post (local sector) is supported by the selling of pelts (export sector). Soon thereafter another enterprising individual opens a blacksmith shop to shoe the horses of the trappers and construct new traps. This is now a local activity. The trappers, freed from the burdens of shoeing their own horses and pack animals and building new traps, are free to spend more time in their primary activity of trapping. And with a trading post handy, they can make more frequent trips into the wilderness and stock a smaller amount of supplies each trip. Thus their cash outlay for supplies is less for each trip and the excess cash can be used to pay the blacksmith for shoeing horses and building traps. Now the blacksmith and his employees and the owner of the trading post and his employees define the local sector which is supported by the export sector: the trappers.

What essentially is happening is that the goods and services the trappers either imported or performed themselves are now being provided locally rather than imported. We could continue our example ad infinitum and eventually build a replica of a local economy that would be a precursor to some of the modern services of local economies today. This example, though overly simplistic, does explain the basic logic behind the procedure. And if one thinks for a moment, cities that sprang up around basic export industries come to mind--mining towns in the coal regions or the ore regions of the West, towns around oil fields or refineries, steel mills, cotton mills, etc., large industrial cities adjacent to waterways and harbors, etc.

Defining Concepts

Thus far two terms have been used rather loosely--industry and sectors. There should be restrictions on the usage of these terms. Sectors refer to the kinds of markets that industries serve. Industries, therefore, refer to the aggregate of firms producing similar products. When speaking of sectors, the dichotomy of the export sector and the local sector has been used. This dichotomy should be viewed as an initial breakdown. Each of these sectors may be further broken down into other sectors, using the concept of industries as a building block. However, the planner should have some logic behind such a further division. For example, Lockheed Aircraft in Atlanta not only produces commercial jets for sale to national and international firms; but has had contracts with the Federal government, namely the C5-A Transport. All of these activities are exports. Thus it might be advantageous to divide the export sector into a private and public sector since one is dependent on market demand and the other is dependent upon political decisions related to national defense. Availability of data keeps this distinction mostly in theory, however.

The same logic holds for the local economy. A major department store owner's decision to expand his store is a function of the economic well-being of the export sector, the growth of the local population and the rate of interest on the money he must borrow. Consumers, on the other hand, may be guided by a different set of forces when deciding to purchase a house, car or major home appliance. The decision to divide the export sector or the import sector into further subsectors is a decision for the planner once she is sufficiently knowledgeable of the local economy. Just like the cluster concept, there is not a magical number of subsectors. Each area must be analyzed in terms of its uniqueness.

However, it is not enough to delineate an export sector. The planner must identify the exports and the direct and indirect ties to export markets. Perhaps an example will assist in explaining what is meant by direct and indirect exports. Consider the Texas Gulf Coast region of Beaumont--Port Arthur and Orange. The primary industry is petroleum refineries and motor oil is one of the chief products exported. Although some motor oil is consumed locally, the amount is insignificant in relation to total production. However, motor oil has to be packaged in some type of container, usually a metal can. Assume that the cans are purchased from a local manufacturer. The sales of the cans are local in nature; but shouldn't they be classified as exports since the can must go where the motor oil is shipped? This is an example of direct and indirect ties to the export market. The direct tie is the motor oil; the indirect tie is the metal can. Further indirect ties to the export market would be purchases of metal for making tin cans, electric power, etc. Essentially, what the planner must do is to track the linkages in the production process. The same concept holds true for the local sector. Consider a bakery, the sales of which are primarily local in nature. The bakery must have flour, electricity, wrappers, etc. Again the linkages in the production process must be traced.

Identifying the Economic Base

As mentioned earlier, economic base analysis describes all productive activity in terms of two categories. There are basic or export activities which sell in export markets and bring additional employment and revenue into the local area. And there are non-basic or service activities whose

output is consumed totally within the local area. The importance of economic base analysis is in its ability to identify those basic or export sectors of a local economy that will bring growth, in terms of revenues and employment, into the local area. This exogenous expansion will in turn cause local service sectors to expand and prosper in accordance with the multiplier concept of regenerative expansion.

It is the export industries that hold the key to local expansion, and therefore identifying those sectors of the local economy that are basic and monitoring their change provides a predictive tool for general regional changes. One technique that can be applied to analysis of the local economic base is called the **location quotient** approach, and identifies basic sectors by comparing the local area's consumption patterns with those of the nation. The term "location quotient" is used generically, and often interchangeably, to represent many different variations of the same basic technique. Thus, there are several acceptable ways to calculate LQs, each based on a different set of assumptions.

For example, the *Assumptions Approach* is a method whereby all employment in agriculture, mining (natural resource-based industries) and manufacturing is automatically assumed to be export-oriented and everything else is assumed to be service or population serving. This approach usually holds true for small, predominantly rural communities.

A second approach is referred to as the *Minimum Requirements* technique, which assumes that any industry (or some number of jobs within any industry) can be either Basic or Service depending on its relative concentration in a region--as compared against a larger, presumably self-contained area (such as the U.S.). The assumption is that a self-contained economy at equilibrium tends to have a fixed percentage of its workforce scattered among all industry sectors necessary to meet it's needs. Thus, if you compare the local area's employment percentage against that of the self-contained region, any industry that has a higher percentage of its jobs in the local area than the self-contained area is classified as export.

One twist to this technique allows an analyst to calculate the number of jobs needed to meet the self-sufficiency needs of the area and then assigns all employment greater than that level to the export sector. It is important to note that as trade volume increases between the U.S. and the rest of the world, the U.S. becomes less a "self-contained" economy. This diminishes the explanatory power of the techniques where the U.S. is presumed as the self-contained region for calculation purposes.

A third technique is a hybrid of the *Assumptions* and *Minimum Requirements* techniques that assigns all employment in natural resource-based industries as export-oriented but allows detailed manufacturing industries to be either service or export depending on their relative concentrations.

Within the generic framework of the location quotient technique are many different labels. Terms such as *coefficient of localization* or *coefficient of specialization* are two commonly used terms. For our purposes, the term *coefficient of specialization* will apply to the index number created by the formula expressed below. The term *location quotient* will be reserved to identify

the number of jobs needed to meet local self-sufficiency. This calculation will also be explained later.

The **coefficient of specialization** can be computed in accordance with the location quotient approach to determine a region's basic industrial sector(s). The equation for a coefficient of specialization can be written:

$$\frac{\text{Local employment in industry } i / \text{Total local employment}}{\text{National employment in industry } i / \text{Total national employment}} = \text{Coefficient of Specialization}$$

To do the calculations for a given geographical area defined by the planner or analyst, employment by industry data must be obtained for both the local area and the nation for some given time period. This technique requires the assumption that local residents have the same demand patterns for goods and services as those at the national level. In other words, a planner must treat the national economy as an aggregate of all local regions against which to compare local industry employment. Thus if the local area is completely self-sufficient in one industrial group (that is, it neither exports nor imports products in that industrial group), we would expect that local employment in that industry as a percent of total local employment would be the same as national employment in that industry as a percent of total national employment.

An index number can be calculated for each industrial group (the same methodology can be used for occupational groupings). If, as in the example above, the percent employment in an industry (or occupation) at the local level relative to total regional employment is exactly the same as the percent employment of the industry (or occupation) at the national level, relative to total national employment, the index would be 1.00. If the regional percentage is greater, the index will be greater than 1.00; if it is less, the index number will be less than 1.00. Employment in those industries with coefficients greater than 1.00 is designated as basic or export employment. Jobs in those industries with coefficients of less than 1.00 are designated as non-basic, import or service employment.

Understanding Export-Related Employment and Location Quotients

The concept of the coefficient of specialization is to quickly identify those sectors of the economy which are critical to the structure and prosperity of a local area. The more pervasive location quotient approach to analyzing the economic base of a local area takes into consideration the fact that even in an export or base industry, some of the output is consumed locally. Similarly, even in a non-basic or service industry some of the output may be exported (note previous examples under Defining Concepts).

The following formula can be used to identify the level of local employment necessary to produce meet local consumption needs:

$$\text{Location Quotient} = \frac{(\text{National employment in industry I} * \text{Total local employment})}{\text{Total national employment}}$$

Solving for X (the location quotient) gives you the level of local employment necessary to meet local consumption needs. If the actual local employment in the industry is greater than the value of X, the excess employment can be allocated to the export sector. In other words, some local industries have employment levels necessary to meet local consumption needs (this would be X) and some employment greater than X which would be classified as export employment or additional jobs which exist to produce an excess of goods or services to be sold in outside or export markets. If actual local employment in an industry is less than X, the local area is probably not producing enough of that particular good or service to meet its own needs and must import it from other areas. It can be said that an area with an industry coefficient of specialization of less than 1.00 (or local industry employment less than X), probably represents a market for that good or service to be produced outside the area and brought in for local consumption.

An example here should make this concept more clear. Data requirements include employment by industry for both the local area and the nation. This example will use the West Central Texas LWDB, and private non-agricultural employment data. The time period for analysis is the first quarter 2002.

Total local employment:.....113,595
 Total national employment:.....127,309,200

West Central Texas 1stQTR 2002

Industry	NAICS	Local Employ	National Employ	Needed for Self-Sufficiency	Export Employ	Service Employ
Educational Services	611	14,288	12,031,300	10,735	3,553	10,735
Oil & Gas Extraction	211	897	122,200	109	788	109
Pipeline Transportation	486	188	42,500	38	150	38
Publishing Industries	511	468	968,000	864	0	468

For example, inserting the appropriate data for the Oil & Gas Extraction industry (NAICS 211) into the formula results in the following equation:

$$X = (122,200 * 113,595) \text{ divided by } 127,309,200 = 109.04$$

Solving for X results in a location quotient of 109.4. This is the level of employment necessary to meet local consumption or self-sufficiency needs for oil & gas extraction products and services. Actual local employment however, was 897. The difference, or 788 persons, owe their jobs to the export of oil & gas extraction products and services. Clearly, if national or international demand for oil & gas extraction products decreases, it will likely have a negative impact on the numbers of jobs in the local economy which rely on export markets for their

existence. In the case of publishing industries (NAICS 511), solving for X results in a quotient of 864. Actual local employment in NAICS 511 is only 468 which indicates that there is not even sufficient levels of publishing industries to meet local demand, much less to export. Although it is possible that goods from local publishing industries are sold outside the local area, these data indicate that West Central Texas area is likely a net importer of publishing services or in a net import position in terms of local industry employment and self-sufficiency.

Estimating the Multiplier

The next analytical step is to compute the basic to non-basic or “export-service ratio”. This figure provides the ratio of basic to non-basic employment in the local economy. This ratio presumes that every job created in the export sector creates or supports some additional jobs in the service sector. The basic to non-basic ratio or multiplier is then found by dividing total service employment by total export employment. Consider the following example for West Central Texas hypothetical data:

	<u>1990</u>	<u>2002</u>	<u>Change</u>
Total employment	110,727	113,595	2,868
Total service (non-basic)	75,976	88,000	12,024
Total export (basic)	34,751	25,595	-9,156

As the data are presented here, it is assumed that the location quotients (solving for X) have been computed to assign employment to basic and non-basic sectors. Totals have been calculated by summing both columns of data. What will be shown is the development of the basic:non-basic ratio and the export base multiplier.

Basic to Non-basic Ratio

1. Based on 1990 total employment $\frac{75,976}{34,751} = \frac{2.18}{1} = \mathbf{2.18:1}$
2. Based on 2002 total employment $\frac{88,000}{25,595} = \frac{3.43}{1} = \mathbf{3.43:1}$

In each instance we can see that the ratio of non-basic to basic employment is greater than 1.00. This is essentially what is meant by the concept of the multiplier--that each job in the basic or export sector supports some multiple of jobs in the non-basic sector. As documented below, that ratio depends upon the databases utilized by the planner. The multiplier can be computed directly in the following manner:

$$\frac{\text{Total Local Employment}}{\text{Total Basic Employment}} = \text{Export Multiplier}$$

1. Based on 1990 total employment $\frac{110,727}{34,751} = \frac{3.19}{1} = \mathbf{3.19:1}$
2. Based on 2002 total employment $\frac{113,595}{25,595} = \frac{4.44}{1} = \mathbf{4.44:1}$

The distinction between the basic to non-basic ratio and the export multiplier is that the former is used only to calculate the number of service jobs that would be created by each new job in the export sector. The export multiplier includes jobs that would be created in both the service and the export sectors for each new job created in the export sector. Based on total 2002 employment, this means that 3.43 service jobs would be created for each new export sector job created in West Central Texas, based on the basic to non-basic ratio. However, the actual multiplier for 2002 would be 4.44 which reflects the number of additional service and export jobs that would be created with the addition of a new export sector job.

If an area gains new jobs in the export sector, one would anticipate the creation of other jobs in the local sector. On the other hand, if an area loses jobs in the export sector, one would anticipate a decline in employment in the local sector. Two examples will help demonstrate the importance of national demand on a region's export sector.

The state of Michigan relies heavily on the export of automobiles. When the national demand for new automobiles fell in 1974 and 1975, not only did employment in the automobile industry fall, but layoffs of workers in the automotive industry adversely affected the local sector. The city of Houston is one of the major regional exporters of oil field tools, pipe and supplies. The demand for increased production of oil and gas led to a net increase of exports in this sector causing more income to flow into the region and supporting more local employment.

Assuming a constant state of consumer preferences, one can estimate the expansion or contraction of the local or non-basic sector as a function of the export or basic sector. Of course the planner should revise the multiplier as new data become available.

Before we leave the technical explanation of the location quotient technique a word of caution is in order. The location quotient is a simple calculation that often yields valuable insights into regional employment dynamics. For this reason it is often used for multiple purposes. **Without discussing all the details of the limitations of location quotient analysis, suffice to say that one must always remember that the location quotient technique is merely a rough, descriptive indicator of relative concentration as compared to a larger, presumed self-contained area.** Unknown factors such as employment or dollar leakages due to inter-regional or global trade and varied consumer tastes, preferences or consumption patterns in the local area can, in some cases, significantly affect the usefulness of the calculations.

Practical Applications

Coefficients of specialization can be computed for employment by industry and employment by occupation. By computing the coefficients for different time periods, a planner may obtain an

idea of whether the area is becoming more or less specialized economically. In this manner a planner can be aware of the impact of economic policies on the employment status of individuals in various industries.

One major advantage to calculating basic to non-basic ratios and export multipliers lies in their predictive powers. The local area multiplier allows the planner to do much the same thing as a localized econometric input-output model, albeit with considerable less sophistication, cost and accuracy. If a firm that is in a local basic/export industry moves into the area or expands, the planner can make a rough estimate of the number of additional service jobs that will be created due to the multiplier effect. Identifying local economic linkages upstream and downstream from a particular industry can be largely intuitive and reasoned judgment can and should be used in its application. The specific related industries that are likely to expand, and the measurable significance of the economic connection, however, can only be "guesstimated" without identifying the economic linkages that a regional input-output model would show.

From an economic development standpoint, these coefficients indicate the nature, diversity and concentration of economic activity in a local area. Where diversification of the economic base is a desired goal, the coefficients indicate which sectors of local economy have greater concentrations of employment and which sectors might be targeted for indigenous expansion or firm relocation recruitment efforts. For example, where an area is viewed as under-represented or over-specialized in a particular industry, coefficients of specialization can be used as a monitoring tool to assess the impact of economic development efforts over time. More in-depth analysis of the structure and nature of change in the local economy can be done using shift-share analysis. The SOCRATES or Texas Industry Profiles software systems provide on-line tools for generating shift-share reports at the Texas LWDB level and can be accessed at <http://socrates.cdr.state.tx.us> or www.texasindustryprofiles.com respectively. The ability to pick any number of different time periods for which to conduct a shift-share analysis makes these on-line tools valuable additions to any economic developer's repertoire.

The Role of Local Wisdom

While a good amount of energy has been committed in this discussion to concepts of regional economic analysis and the methodology behind the location quotient technique, the numbers can take one only so far. Like a finicky hunting dog willing to point at a fallen prey but refusing to retrieve it, the location quotients can point to industry sectors where a comparative advantage exists but they cannot answer the most fundamental questions that make such knowledge actionable. In other words, it is one thing to know that a region has a comparative advantage in an industry. But in order to provide useful guidance and shape policy initiatives an analyst must know what is the nature of that comparative advantage. Based on the knowledge that a comparative advantage exists, some questions the analyst or planner should begin formulating for direct employer contact are:

1. Who are the primary businesses that comprise this industry in the region? Is the industry dominated by one or two large employers or a number of smaller firms?
2. What do these employers consider to be the primary benefits or advantages to being located in this region, in comparison with other regions?

3. Have these advantages increased or lessened over the past two years? Five years? Ten years?
4. Can these advantages be enhanced or otherwise positively influenced by changes in public policy or public investments, i.e. to add floor space, capacity or employment?
5. Are there any disadvantages, current or forecasted, that might make the continued location of employers in the industry, in this region, less desirable?
6. Which of these disadvantages or disincentives can be lessened, ameliorated or eliminated through public intervention, policy or investment? What might those policy actions entail?

Depending on the type of industry, the planner or analyst can develop more specific questions for each employer directly related to special workforce requirements, supply chain issues or any unique interface with the public infrastructure, i.e. transportation, education, broadband or other telecommunications. It is this next level of locally gleaned information, often referred to as “local wisdom,” that can finally yield actionable results for regional community development. Of course, it was the macro level regional economic analysis that allowed the planner to target a direct employer contact strategy with enhanced likelihood that the employer could become engaged.

Moreover, where such inquiries lead to action on the part of the community, employers are indeed more likely to follow through with hypothetical expansion scenarios. If the employer believes such inquiry can yield actionable results they may even agree to participate as a local workforce board member, join regional economic development forums or otherwise become part of the community of change.