Chapter 4 Understanding Your Regional Economy —The Economic Base Theory

4.1 Introduction to Economic Models

Imagine that a car manufacturer is planning to build a car distribution center in the greater Cincinnati metropolitan region. Strategically, this would be a good choice for the car manufacturer, given that Interstate Highway 75 (I-75) is the main artery of the national car industry and Ohio lies in the midst of it. Economically, this would be great for the region, in that it would provide jobs and income for its workforce and new activities for regional businesses to supply the car manufacturer with goods and services.

Envision another scenario in which a national fast-food chain considers building a manufacturing plant in the greater Cincinnati region to produce the buns and patties for our well-loved "Juicy Burgers". The fast-food chain talks about creating 800 new jobs but expects a tax incentive package in return from the local government to smooth out their initial investment.

What do both scenarios have in common? Obviously, they would be highly welcome by

(1) the regional workforce, particularly those seeking employment with these businesses;

(2) the construction industry, which could gain additional contracts for building the distribution center and the plant;

(3) regional businesses and firms, which might expect an increase in demand for their goods boosting their overall level of business activities;

(4) the city and county governments, who may, in the long-run, benefit from additional tax revenues (e.g., corporate income tax).

Planners throughout the region busily consider the implications of these scenarios. Land use planners, working for the local and regional governments, would think about where to locate these two new industries. At the same time, their colleagues in the transportation department would examine the proposed locations for these new industries to ensure that they are strategically located so as not to add to traffic congestion. Economic development (ED) planners would use the opportunity to predict how industry output, employment, and income for residents and the government might be affected by this increase in **economic activities**. More specifically, ED planners might develop an impact analysis using **multipliers** to estimate changes in the regional economy (e.g., output, employment,

and income) resulting from the proposed car distribution center or the fast-food chain's manufacturing plant. Clearly, in the case of the fast-food chain the **direct effect** on the labor market would be the creation of 800 new jobs. But what would be the **indirect effects** of this new plant on other businesses in the region? The 800 new jobs will create new income that will be spent, at least partly, within the region on housing, clothes, food, entertainment, and other items. In return, this will create more jobs in other regional businesses. Multipliers are one way to estimate the **total effects** on employment, for example, as a result of the new fast-food chain's manufacturing plant.

In this chapter, we will explore how the **economic base theory** can increase our understanding of how a regional economy works and how economic development processes shape regional economies. Although economic base theory—like other theories—is a simplified abstraction of reality, it can nevertheless be a useful platform for understanding how data can be used to analyze economic development processes and evaluate competing development strategies. We will start with a brief introduction of the origins of the economic base theory. A description of the structure of macroeconomic models in general will be followed by presentation of the economic base model. We will then focus on how you can evaluate the state of a regional economy based on readily available economic indicators and the application of the economic base theory. In particular, we will focus on location quotients, calculate the economic base multiplier, and use shift-share analysis for explaining observed patterns of economic growth or decline. Boone County, Kentucky, will once again serve as the study region.

4.2 The Economic Base Theory

The economic base theory has a longstanding tradition in planning and geography. The first appearance of the idea of an economic base can be traced back to 1659 when Pieter De la Court (1618 – 1685), a Dutch cloth merchant, published his manuscript on the prosperity of his home city of Leiden entitled: "t Welvaren der Stadt Leiden (the prosperity of the city of Leiden)".[①] In his manuscript, De la Court saw the wealth of Leiden as the direct result of the city's export-oriented industries: the University of Leiden and the manufacturing industries. De la

① Earlier publications by De la Court were initialed "V.D.H." which stands for Van den Hove, the Dutch translation for De la Court. De la Court's main publication Interest van Holland ofte Gronden van Hollands welvaert [The true interest and political maxims of the Republic of Holland and West-Friesland] was published in 1662 and has since been regarded as a milestone in the promotion of free market competition and the republic state. De la Court's ideas have translated into several languages and they even influenced the constitutional conventions of the United States of America in 1780. De la Court's homepage can be found at: http://www.childandfamilystudies.leidenuniv.nl/index.php3?c=268.

Court recognized that the inflow of foreign financial resources into a city will ultimately increase the city's overall economic activities.

De la Court's idea was later picked up and made popular by, among others, the German political scientist Werner Sombart (1863 – 1941).[①] In his work, Sombart shaped the concepts of "Städtegründer and Städtefüller", which were translated by the American economic historian Frederick Nussbaum's (1933) as "town builders" and "town fillers".[②] Town builders leverage a town's prosperity by the means of trade; whereas town fillers provide the goods and services that are locally demanded. Sombart's 1916 first published volume of "Der Moderne Kapitalismus (modern capitalism)" presented a limited qualitative concept of the basic (export) v. non-basic (local) economic sectors. However, in the third volume with the same title, Sombart (1927) provided the first known, quantitative approach for identifying export employment shares.

The first appearance of the economic base theory in a textbook most likely occurred in 1939. In their textbook, *Principles of Urban Real Estate*, Homer Hoyt and Arthur Weimer presented the economic base theory as a methodical approach to determining basic employment and calculating the ratio between basic and service employment.[③] The authors substituted the words basic and service employment for Sombart's town-building and town-filling activities. As we will see later, Hoyt and Weimer's approach is still widely used in economic base analysis.

While Hoyt and Weimer are rightfully given much credit for the advancement of the economic base model, many other scholars contributed to its current popularity. Richard Andrews, Walter Isard, and Stan Czamanski, for instance, wrote several papers on the topic in the 1950s and 1960s.[④] We would not want to conclude this section without mentioning the work of Charles Tiebout (1924 – 1968). In his 1962 publication, Charles Tiebout added much to the credibility of the economic base theory by providing a mathematical proof that the economic base multiplier is equivalent to the Keynesian multiplier used by

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① Günter Krumme, Werner Sombart and the Economic Base Concept, *Land Economics*, 44(1), February 1968, pp.112 – 116.

② Günter Krumme gives Werner Sombart the credit for phrasing the expressions "Städtegründer and Städtefüller". Frederick Nussbaum used among others Sombart's three volumes "Der Moderne Kapitalismus" for bringing main ideas of the economic history of Europe to a larger American audience in his book "*A History of the Economic Institutions of Modern Europe*", published in 1933. He literally translated the expressions Städtegründer and Städtefüller as town builder and town filler.

③ Andrew M. Isserman. Economic Base Studies for Urban and Regional Planning, In: Lloyd Rodwin and Bishwapriya Sanyal, eds. *The Profession of City Planning: Changes, Images, and Challenges, 1950 – 2000*. Center for Urban Policy Research, New Brunswick, NJ. Copyright © 2000 by Rutgers, The State University of New Jersey, Center for Urban Policy Research.

④ For more on this topic, please see Isserman's, "*The Profession of City Planning*", which is an excellent source of early references on the economic base theory.

economists. This is an association we will come back to when explaining the underlying principles of the economic base theory.[①]

4.3 Understanding Your Regional Economy

Charles Tiebout showed us how the theoretical construct of the export base model, rooted in Keynesian macroeconomic theory, is related to the economic base theory; and therefore, the Keynesian multiplier is similar, in concept, to the economic base multiplier. Based on original work by Richard F. Kahn (1931), Maynard Keynes developed a multiplier framework, which allows assessment of total changes in economic activity that result from changes in exogenous spending, such as government expenditure and business investment. Following the rationale that initial exogenous spending leads to additional economic transactions within the region, Keynes reasoned that this expected increase in demand for regional goods and services has to be a "multiple" of the initial change in exogenous demand (Keynes, 1936).

Starting with Tiebout's conclusion, this section presents a version of a Keynesian macroeconomic model as a way to visualize a regional economy. In particular, we will recognize in this simplified framework **who** are the actors in a regional economy and **how** they relate to each other. We will then show how the macroeconomic model leads to the economic base model.

The most widely used approach for creating a visual image of a regional economy is based on the **circular flow of income and expenditure** as shown in Fig. 4.1. In this snapshot of an economy, we can identify three economic agents or decision makers: (1) firms and businesses, (2) households, and (3) the government. The selling and buying activities of decision makers takes place in three markets. In the **commodity market** they exchange goods and services for money. Trade of financial assets occurs in the **financial market** where people might, for example, buy assets to earn interest. And, the **factor market** provides firms and businesses with the necessary factors of production, such as capital and labor.

The lower left part of the loop represents the **flow of income**: households receive income from firms and businesses for providing the factors necessary for production. In particular, firms and businesses pay wages and salaries for labor, interest for capital, rent for land, and profit for entrepreneurial activities. Households own the factors of production, and therefore the combined outlays of the firms constitute aggregated household income.

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① Charles Tiebout (1962), *The Community Economic Base Study*, Supplementary Paper #16, Published by the Committee for Economic Development (CED).

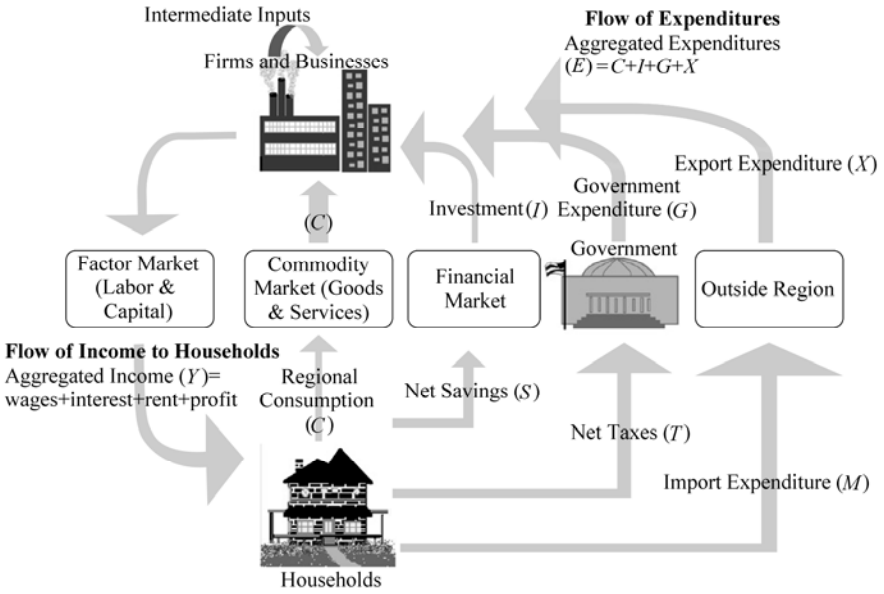


Figure 4.1 The circular flow of income and expenditure

The upper right side of the loop indicates a matched **flow of expenditures**: household consumption, investment spending, government purchases, and exports create **final demand** for locally produced goods and services. **Regional consumption** (C) represents spending by households for goods and services, such as food, clothing, and education. The purchase of a house is excluded from household consumption and listed under investment spending. **Investment spending** (I) refers to the creation of capital stock. It contains three subcategories: (1) fixed investment such as when a firm replaces worn-out machinery or a university builds a multipurpose field hall; (2) residential investment, the purchase of a house by households; and (3) inventory investment, businesses' inventory of unsold goods, for example, unsold automobiles at a car dealership. Investment is financed by **net household savings** (S). **Government expenditures** (G) consist of all the goods and services bought by various levels of governments, including highways, military equipment, and government investment. Government expenditure is financed by **net tax revenues** (T). This is called net tax revenues because it is the revenues that remain after transfer payments (e.g., social security benefits) and interest payments (e.g., government bonds) have been made. The final category on the expenditure side of the economy accounts for trade—both domestic (trade with other regions within the country) and foreign (trade with other countries). Households spend some of their income on **imports** (M)—the purchase of foreign-made goods and services. Similarly, people, institutions, and firms located outside of a region demand regionally produced

goods and services—**export expenditures** (X). The **net export** (NX) is obtained by subtracting the value of imports from the value of exports.

The **flow of income** considers total income in the economy as the combined outlays of firms and businesses to factors of production owned by households. On the other side, the **flow of expenditures** measures aggregated spending on the economy's output of goods and services by all economic agents; within and outside of the region. Both sides form the national income accounting. Following the rules of national income accounting, both the flow of income and expenditures must ultimately lead to the same result; **the gross regional product** (GRP) or the monetary value of all regional economic activities. In both cases, the goal is to calculate a single summary measure that captures the level of regional economic activities. Real gross regional product—real GRP—measures the total regional economic activity on the final demand side, or

$$\text{real GRP} = C + I + G + \text{NX} \tag{4.1}$$

where,

C — the level of household consumption of regionally produced commodities;

I — the level of regional investment in physical capital;

G — the level of total government spending;

NX— represents total net exports (i.e., exports minus imports).

Using net exports implies that regional spending on imports is subtracted from real GDP as dollars leaving the region because imports do not add to the level of regional economic activities—called a **leakage**. Exports, on the other side, add to regional economic activities as inflowing dollars positively stimulate regional output—called an **injection**.

Similarly, the level of regional economic activities can also be calculated using the value added approach, indicated on the left-hand side of Fig. 4.1, or

$$\text{value added GRP} = \text{wages} + \text{interest} + \text{rent} + \text{profit} \tag{4.2}$$

Both approaches, if done correctly, must ultimately lead to the same level of total regional economic activities. Both measure the flow of dollars in the regional economy.

Using the information from this illustration we now can calculate the most fundamental form of the Keynesian multiplier (KM). For simplicity, we assume an economy with no government, no exports, and no imports. Under this situation, the economy is in equilibrium, where expenditures (E) equal income (Y):

$$E = Y \tag{4.3}$$

This equilibrium follows from the simple fact that every dollar of expenditure must have been earned. The next step is to define aggregate expenditure (E) as

the sum of consumption (C) and investment (I), or:

$$E = C + I \tag{4.4}$$

and aggregate income (Y) as the sum of consumption (C) and savings (S), or:

$$Y = C + S \tag{4.5}$$

where, income (Y) is now measured in terms of household spending. With the absence of government and imports, savings represents a leakage in the system because income going to savings is the money not spent on regionally produced goods and services, and therefore, does not foster regional economic growth. In this simplified economy, an increase in aggregated savings (as opposed to consumption) would lead to a decline of economic activities. Investment (I) is determined exogenously. It is the policy variable that will be used later to determine changes in the equilibrium level of aggregate output.

The equilibrium condition of the commodity market implies:

$$Y = C + I \tag{4.6}$$

which is the result of substituting Eq. (4.4) into Eq. (4.3). The level of household consumption (C) depends upon various factors such as household income, household wealth, the interest rate, and expectations households have about the future. One way of representing consumption (C) is as a function of income (Y), or:

$$C = f(Y) = a + \text{mpc} \cdot Y \tag{4.7}$$

where,

a — the level of autonomous spending independent of income (e.g., housing and food);

mpc — the marginal propensity to consume. It is the fraction of each additional dollar earned that households will spend on consumption.

Substituting Eq. (4.7) into Eq. (4.6) we get:

$$Y = a + \text{mpc} \cdot Y + I \tag{4.8}$$

Solving this equation in terms of Y we get:

$$Y - \text{mpc} \cdot Y = a + I \tag{4.9}$$

$$Y \cdot (1 - \text{mpc}) = a + I \tag{4.10}$$

$$Y = \left(\frac{1}{1 - \text{mpc}} \right)(a + I) \tag{4.11}$$

where, $\left(\frac{1}{1 - \text{mpc}} \right)$ is called the Keynesian investment multiplier. Because a

(independent autonomous spending) is assumed to be predetermined and fixed—called a parameter—the expected change in income (output) results solely from a change in investment, independent of regional income, or:

$$\Delta Y = \left(\frac{1}{1 - \text{mpc}} \right) \cdot \Delta I \tag{4.12}$$

where,

ΔY — the expected change in income (output);

ΔI — the exogenous change in investment—the injection into the economy.

In this rather simplistic framework, households either spend a proportion of their income, according to the marginal propensity to consume (mpc), or save their income, corresponding to the marginal propensity to save (mps). Given that households can either spend their income or save it, we can conclude that:

$$\text{mpc} + \text{mps} = 1 \tag{4.13}$$

where, mps or (1 – mpc) refers to the leakage of regional income—the savings. Rewriting Eq. (4.12) as:

$$\left(\frac{1}{1 - \text{mpc}} \right) = \frac{\Delta Y}{\Delta I} = \frac{\text{change in income (ouput)}}{\text{chang in investment}} \tag{4.14}$$

We can define the Keynesian multiplier as the ratio of a change in income (output) to some exogenous change in investment.

For students familiar with calculus, the Keynesian multiplier can alternatively be derived by taking the partial derivative with respect to investment, or

$$Y = \left(\frac{1}{1 - \text{mpc}} \right)(a + I) \tag{4.11}$$

$$\frac{\partial Y}{\partial I} = \left(\frac{1}{1 - \text{mpc}} \right) \tag{4.15}$$

leading to the same result as in Eq. (4.14).

The **economic base theory** explains regional economic growth through the level of a region's export activities. The larger the external demand for a region's goods and services, the larger the economic stimulus. These non-regional expenditures lead to a multiplying effect of regional output, expressed through the economic base multiplier. Regional firms and businesses welcome exogenous increases in demand for their products and, assuming an absence of supply or capacity constraints, attempt to meet this increase in demand. In return, the

regional firms and businesses increase their own demand for inputs from other regional suppliers, called intermediate inputs, and, for labor and capital, the factors of production.

The next round of economic impacts leads the regional suppliers to increase their own demand for intermediate inputs, labor, and capital and so on. The result is a chain reaction set in place through an injection of exogenous demand.

The chain reaction is additionally amplified through increases in aggregate household spending. This is made possible because an increase in regional output leads to an increase in demand for labor, which in turn leads to an increase in household income. In return, households will spend a fraction of this additional income on regionally produced goods and services, that alone increases demand. The round-by-round effect that follows an increase in exogenous demand is captured by a single summary measure— the economic base multiplier.

The economic base model is illustrated in Fig. 4.2. The economic base model divides total economic activities for a region—the right-hand side of the illustration—into either basic activities or non-basic activities. **Basic activities** include all regionally produced goods and services sold to people and businesses outside the region. This includes, of course, all goods and services leaving the region. But, it also includes all goods and services that are purchased by people out of town within the region where they are produced. The hotel industry is an example. A tourist from San Francisco staying in a hotel in Cincinnati, Ohio, increases regional exports (X). The important distinction is in the case of the tourist, payments made by the tourist come from outside Cincinnati. While for

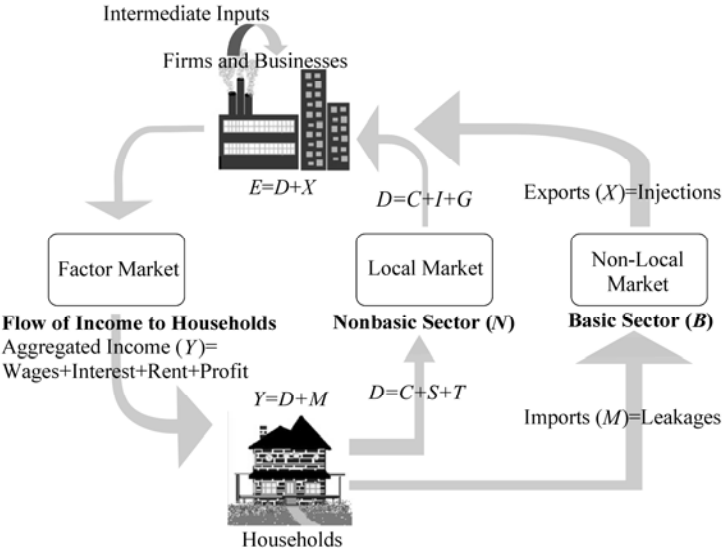


Figure 4.2 Economic base model

Cincinnati this inflow—injection—increases regional economic activities, for San Francisco on the other hand it is an outflow—leakage—of income.

Non-basic activities by definition include all purchases of regionally produced goods and services by local residents. As Fig. 4.2 indicates, these regional expenditures (D) are household driven and refer to goods and services used by the region itself. Grocery stores, real estate brokers, automobile repair shops, and banks provide goods and services usually referred to as non-basic activities. In the case of large corporations, for instance a national food or restaurant chain, the distinction between basic and non-basic activity is much fuzzier as some of the regional expenditures leave the region for some headquarters outside the regions. In this context, the food industry and restaurants, usually a typical regional or non-basic activity, takes on the character of a basic activity. Today's food and banking have become increasingly non-local.

In the economic base model, imports (M) play the same role as savings play in the Keynesian macroeconomic model. Imports represent the leakage of the economy, in that regional income leaves without further contributing to regional economic activities. Contrarily, export activities bring new dollars into the regional economy, increase regional production of goods and services, and fuel regional economic growth—it is the economic base for regional economic growth. In the context of regional economic development and following the principles of economic base theory, politicians and ED planners can encourage regional economic growth by: (1) promoting exports (i.e., increasing injections), and (2) encouraging import substitution (i.e., decreasing leakages).

An easy approach to deriving the economic base multiplier (BM) uses the dichotomy of basic and non-basic activities. In an economy where all activities are classified as non-basic (N) and basic (B), total regional activities (T) can be defined as:

$$T = N + B \tag{4.16}$$

While basic activities (B) are determined by exogenous sources (outside the region), non-basic activities (N) can be written as a function of total regional activities (T), or

$$N = f(T) = c + (\text{mpp} \cdot T) \tag{4.17}$$

where,

c— the level of autonomous domestic spending independent of total regional activities;

mpp — the marginal propensity to purchase regional products. It defines the fraction households will assign to domestic/local expenditures (D) of each additional dollar they earn.

Substituting Eq. (4.17) into Eq. (4.16) and solving this equation in terms of T for B gives us the simplest form of the economic base multiplier (BM) as:

$$T = c + (\text{mpp} \cdot T) + B \tag{4.18}$$

$$T - (\text{mpp} \cdot T) = c + B \tag{4.19}$$

$$T \cdot (1 - \text{mpp}) = c + B \tag{4.20}$$

$$T = \left(\frac{1}{1 - \text{mpp}} \right)(c + B) \tag{4.21}$$

where $\left(\frac{1}{1 - \text{mpp}} \right)$ is the economic base multiplier. We see immediately that the economic base multiplier is very similar to the Keynesian multiplier Eq. (4.11). Analogously, the economic base multiplier measures the change in total regional activities (ΔT) that results from an exogenous change in basic activities (ΔB) — the initial export stimulus as:

$$\Delta T = \left(\frac{1}{1 - \text{mpp}} \right) \cdot \Delta B \tag{4.22}$$

The alternative way of deriving the economic base multiplier using calculus is:

$$T = \left(\frac{1}{1 - \text{mpp}} \right)(c + B) \tag{4.21}$$

$$\frac{\partial T}{\partial B} = \left(\frac{1}{1 - \text{mpp}} \right) \tag{4.23}$$

Charles Tiebout was the first to recognize the close relationship between the economic base and the Keynesian multiplier. Following the economic dichotomy of the economic base theory, households either spend an additional dollar of income on imports (M) or on regional/local products (D). Expenditure on imports is expressed as the marginal propensity to import, mpm. Expenditure on domestic/local products is expressed as the marginal propensity to purchase regional products, mpp. Given that each additional dollar must be spent on either imports or regional products, we can specify that:

$$\text{mpp} + \text{mpm} = 1 \tag{4.24}$$

We may also express the marginal propensity to purchase regional products, mpp, as the ratio of non-basic activities to total regional activities, or:

$$\text{mpp} = \frac{\text{non-basic activities}}{\text{total regional activities}} = \frac{N}{T} \tag{4.25}$$

This allows us to rewrite the multiplier as:

$$\text{BM} = \left(\frac{1}{1 - N/T} \right) \tag{4.26}$$

We will now write the BM in a form that is well-recognized in the planning literature. From Eq. (4.16) we recognize that:

$$T = N + B \tag{4.27a}$$

Dividing Eq. (4.27a) through T, we can rewrite the equation as:

$$1 = \frac{N}{T} + \frac{B}{T} \tag{4.27b}$$

Next we rearrange Eq. (4.27b):

$$\begin{cases} 1 = \dfrac{N}{T} + \dfrac{B}{T} \\ \left(\dfrac{1}{1 - N/T} \right) = \left(\dfrac{1}{B/T} \right) \end{cases} \tag{4.27c}$$

We recognize from Eq. (4.26) that the left-hand side of Eq. (4.27c) defines the economic base multiplier. Throughout planning-relevant literature, the economic base multiplier, BM is expressed as the ratio of total regional activities over basic economic activities, or:

$$\text{BM} = \frac{1}{B/T} = \frac{T}{B} \tag{4.28}$$

Alternatively the economic base multiplier can be derived following the step-by-step procedure outlined for the Keynesian multiplier.[①] The starting point, again, is the initial equilibrium condition of aggregate expenditures (E) equals aggregate income (Y), or

$$E = Y \tag{4.29}$$

① Follows Schaffer, Chapter 2, p. 6, Illustration 2.2, "The pure export-base model."

Aggregate expenditure (E) is defined as the sum of domestic production (D) and exports (X), or:

$$E = D + X \tag{4.30}$$

Note that exports (X) replaced investment (I) as exogenous source for economic growth. Aggregate income (Y) is the sum of domestic expenditure (D) and imports (M), or:

$$Y = D + M \tag{4.31}$$

Imports in the economic base model represent the leakage. In an economic dichotomy with only a regional and a non-regional market, domestic production and domestic expenditure are identical. D refers both to the regional purchases of regionally produced goods and services and the non-basic (N) or regional market activities.
Combining Eqs. (4.28), (4.29), and (4.30), we can write:

$$Y = Y - M + X \tag{4.32}$$

where, exports (X) as the exogenous driving-force for economic growth, imports (M) as the endogenous leakages, and aggregate income (Y) as a measure for regional economic performance. Expressing imports in terms of aggregate income, or

$$M = f(Y) = \text{mpm} \cdot Y \tag{4.33}$$

We can derive the economic base multiplier as:

$$Y = Y - (\text{mpm} \cdot Y) + X \tag{4.34}$$

$$Y - Y + \text{mpm} \cdot Y = X \tag{4.35}$$

$$Y = (1/\text{mpm}) \cdot X \tag{4.36}$$

And, the economic base multiplier is:

$$\frac{\partial Y}{\partial X} = \left(\frac{1}{\text{mpm}} \right) \tag{4.37}$$

The similarity between Eqs. (4.21) and (4.35) is obvious when replacing aggregate income (Y) by total regional activities (T), exports (X) by base activities (B), and the marginal propensity to import (mpm) by (1 – mpp).

4.4 Assessing the State of a Regional Economy

4.4.1 Compiling a Regional Economic Profile

Performing a local or regional economic profile is a first and essential step towards an up-to-date description of the state of the economy. There are several ways of doing this, all of which will give you a brief introduction to the indicators of local/regional economic and social conditions. Indicators included in the regional economic profile can include, but are not limited to:

Population statistics: population size, growth, and population composition (sex, age, and race); components of population change, median age, educational attainments, marital status, etc.

Household, family, and individual statistics: average household size, average family size, family structures, poverty rates, individuals below poverty level, families below poverty level, poverty rates, etc.

Housing statistics: total housing units, owner-occupancy rate, renter-occupancy rate, vacancies, median housing values, median of selected monthly owner costs, etc.

Economic statistics: median household income, median family income, population in labor force, employed and unemployed population, population not in labor force, personal income (e.g., net earnings, transfer payments, and dividends) by place of residence, per capita income by place of residence, means of transportation to work, mean travel time to work, etc.

Industry characteristics: employment by industry or by occupation, average earnings per job, earnings by place of work/industry (e.g., wages and salaries, other labor income, proprietors' income).

Natural physical resources: climate, environmental amenities, primary resources, such as water, forests, minerals, etc.

Built physical resources: communication, and transportation, and utility infrastructures.

A methodical and in-depth analysis of the region's economic and social conditions to identify the region's strengths, weaknesses, and opportunities for future economic development should not be limited to economic and industry characteristics. Information on the region's geographic, demographic, housing, or quality of life indicators will supplement each economic profile with valuable information. It is widely perceived that firms and businesses make their location decisions based upon more than purely economic factors, such as labor and energy cost, access to input and output markets, availability, price, and quality of local inputs. Location factors such as regional amenity features, climate, availability of built and natural physical resources (e.g., communication and transportation infrastructure, proximity to ocean, mountain, or state parks), and educational

attainments of the population also may influence the region's competitiveness for attracting new businesses. To fully understand a region's comparative advantage and competitive position, it is, therefore, essential to include factors describing the larger physical and natural resources of your region.

Additionally, it is very helpful to compare your region's selected economic and social key indicators to that of a larger **benchmark** economy of which the region is a part. The benchmark region, for instance, may be a metropolitan statistical area (MSA), a state, or even the nation. Looking at key indicators for two geographic regions at a time allows you to immediately evaluate the comparative attractiveness of your region as an industrial and residential location. For example, Table 4.1 presents a variety of key variables included in an economic profile for Boone County. Comparing Boone County with Kentucky, we see instantly that the population in Boone County is on average younger and better educated than the overall population in Kentucky. Fewer families and individuals fall below the poverty level in Boone County (e.g., 4.4% in Boone County versus 12.7% in Kentucky). The cost of buying and owning a house is higher in Boone County; however, this is accompanied by correspondingly higher median household income levels in Boone County. Of the population 25 years and over, a larger share is in the labor force for Boone County than for Kentucky (e.g., 73.1% versus 60.9%), and Boone County registers lower unemployed labor force figures (2.3% versus 3.5%). Overall, we can conclude that Boone County is a prospering county in Kentucky, which performs above the state level in most selected key indicators.

Table 4.1 Highlights from the 2000 economic and social profiles, Boone County, KY[1]

	Boone County		Kentucky	
	Number	Percent (%)	Number	Percent (%)
Population Characteristics[2],[3]				
Total population	85,991	100.0	4,041,769	100.0
Male	42,499	49.4	1,975,368	48.9
Female	43,492	50.6	2,066,401	51.1
Median age (years)	33.4	(×)	35.9	(×)
Under 5 years	6,849	8.0	265,901	6.6
18 years and over	61,347	71.3	3,046,951	75.4
25 years and over	54,050	62.9	2,645,093	65.4
65 years and over	6,941	8.1	504,793	12.5
High school graduate or higher (25 years and older)	46,094	85.1	1,961,397	74.1

Continued

	Boone County		Kentucky	
	Number	Percent (%)	Number	Percent (%)
Bachelor's degree or higher (25 years and older)	8,564	22.8	271,418	17.1
Disability Status (population 21 to 64 years)	8,442	16.5	557,971	24.0
Household, Family, and Individual Characteristics[(2),(4)]				
Average household size	2.73	(×)	2.47	(×)
Average family size	3.17	(×)	2.97	(×)
Families below poverty level	1,042	4.4	140,519	12.7
Individuals below poverty level	4,785	5.6	621,096	15.8
Housing Characteristics[(2),(5)]				
Total housing units	33,351	100.0	1,750,927	100.0
Occupied housing units	31,258	93.7	1,590,647	90.8
Owner-occupied housing units	23,212	74.3	1,125,397	70.8
Renter-occupied housing units	8,046	25.7	465,250	29.2
Vacant housing units	2,093	6.3	160,280	9.2
Median value (dollars)	131,800	(×)	86,700	(×)
Median of selected monthly owner costs	(×)	(×)	(×)	(×)
With a mortgage	1,103	(×)	816	(×)
Not mortgaged	243	(×)	214	(×)
Economic Characteristics[(2),(4),(6)]				
Median household income (dollars)	53,593	(×)	33,672	(×)
Median family income (dollars)	61,114	(×)	40,939	(×)
Per capita income (dollars)	23,535	(×)	18,093	(×)
Population 16 years and older	64,033	100.0	3,161,542	100.0
In Labor Force (civilian and armed forces)	46,791	73.1	1,926,731	60.9
Employed	45,338	70.8	1,817,381	57.5
Unemployed	1,453	2.3	109,350	3.5
Not in labor force	17,242	26.9	1,234,811	39.1
Mean travel time to work in minutes (16 years and older)	24.4	(×)	23.5	(×)
Personal income by place of residence (dollars)	2,548,401	100.0	98,214,681	100.0
Net earnings (dollars)	2,000,735	78.5	63,927,483	65.1
Transfer payments (dollars)	217,453	8.5	16,583,202	16.9
Dividends (dollars)	330,213	13.0	17,703,996	18.0
Unemployment rate 2002	3.6		5.6	

Continued

	Boone County		Kentucky	
	Number	Percent (%)	Number	Percent (%)
Industry Characteristics[7],[8]				
Employment by industry	70,007	(×)	1,717,978	(×)
Average earnings per job (dollars)	35,912	(×)	29,407	(×)
Earnings by place of work (dollars)	2,876,699	100.0	68,851,883	100.0
Wages and salaries (dollars)	2,429,653	84.5	54,349,107	78.9
Other labor income (dollars)	277,420	9.6	7,150,156	10.4
Proprietors' income (dollars)	169,626	5.9	7,352,620	10.7
Five Largest Employers in the County:				
Delta Air Lines – Air Carrier	5,500			
COMAIR – Air Carrier	5,000			
Board of Education – Public School System	2,000			
DHL Airways – Air Freight Center	1,800			
GAP/Babnana Republic	1,722			
Geography Characteristics[9]	Boone County		Kentucky	
Land area, 2000 (square miles)	246		39,728	
Persons per square mile, 2000	349.2		101.7	
Metropolitan Statistical Area	Cincinnati-Middletown,OH-KY-IN MSA			

(1) Sources: all data were accessed in April 2004.

(2) U.S. Census Bureau, State and County Quickfacts, DP-1. *Profile of General Demographic Characteristics*: 2000. Census Summary File 1 (SF1);

(3) U.S. Census Bureau, State and County Quickfacts, DP-2. *Profile of Selected Social Characteristics*: 2000. Census Summary File 3 (SF3);

(4) U.S. Census Bureau, State and County Quickfacts, DP-3. *Profile of Selected Economic Characteristics*: 2000. Census Summary File 3 (SF3);

(5) U.S. Census Bureau, State and County Quickfacts, DP-4. *Profile of Selected Housing Characteristics*: 2000. Census Summary File 3 (SF3);

(6) U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Regional Economic Accounts, *CA 05 Regional Economic Profile*, 2000;

(7) U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Regional Economic Accounts, *CA 30 Regional Economic Profile*, 2000;

(8) U.S. Department of Labor, Bureau of Labor Statistics (BLS), *Quarterly Census of Employment and Wages* (QCEW), 2002;

(9) U.S. Census Bureau, *State and County QuickFacts*, 2000.

A next step to shed more light on the regional economic profile is to study the industry mix of a region. Identifying **major industries** helps to answer the question of whether your region's economic prosperity is driven largely by one or two main industries or the result of a wide variety of different industries. The breakdown of regional employment by industry (Table 4.2) helps to identify strengths and weaknesses of the regional economy.

Table 4.2 Boone County and Kentucky employment by industry, 2002

2002 NAICS Code	2002 NAICS Title	Boone County Employment	Employment Boone Co. (%)	Kentucky Employment	Employment Kentucky (%)
11	Agriculture, Forestry, Fishing and Hunting	79	0.11	7,558	0.44
21	Mining	35	0.05	19,501	1.14
22	Utilities	481	0.69	6,706	0.39
23	Construction	2,230	3.19	83,289	4.85
31 – 33	Manufacturing	10,360	14.80	275,466	16.03
42	Wholesale Trade	5,166	7.38	71,507	4.16
44 – 45	Retail Trade	8,724	12.46	212,458	12.37
48 – 49	Transportation and Warehousing	12,855	18.36	76,588	4.46
51	Information	1,657	2.37	31,745	1.85
52	Finance and Insurance	4,506	6.44	63,321	3.69
53	Real Estate and Rental and Leasing	934	1.33	19,688	1.15
54	Professional, Scientific, and Technical Services	1,341	1.92	56,712	3.30
55	Management of Companies and Enterprises	995	1.42	13,451	0.78
56	Administrative and Support and Waste Mgmt.	4,233	6.05	84,912	4.94
61	Educational Services	267	0.38	12,901	0.75
62	Health Care and Social Assistance	2,897	4.14	189,627	11.04
71	Arts, Entertainment, and Recreation	489	0.70	17,747	1.03
72	Accommodation and Food Services	5,821	8.31	135,372	7.88
81	Other Services (except Public Administration)	1,733	2.48	45,768	2.66
92	Public Administration	5,107	7.29	292,125	17.00
99	Unclassified	97	0.14	1,536	0.09
Total		70,007	100.00	1,717,978	100.00

Source: Bureau of Labor Statistics (BLS), *Quarterly Census of Employment and Wages* (QCEW), 2002.

Boone County appears to be highly specialized in transportation and warehousing. Not surprising given that Boone County houses the Cincinnati/ Northern Kentucky International Airport. Again, data on employment by industry can be compared to a larger benchmark region. For example, manufacturing

makes up 14.8% of the county's employment compared to 16.0% in Kentucky statewide. Although manufacturing is the second largest industry sector in the county, the Boone County data do not necessarily indicate that it is particularly specialized in manufacturing. But note that this conclusion only holds when comparing Boone County with Kentucky at the two-digit level of establishment aggregation using the North American Industry Classification System (NAICS) code. Using a different benchmark region and a different level of industry aggregation might alter the finding. Graphically, this can be emphasized in a chart as shown in Fig. 4.3.

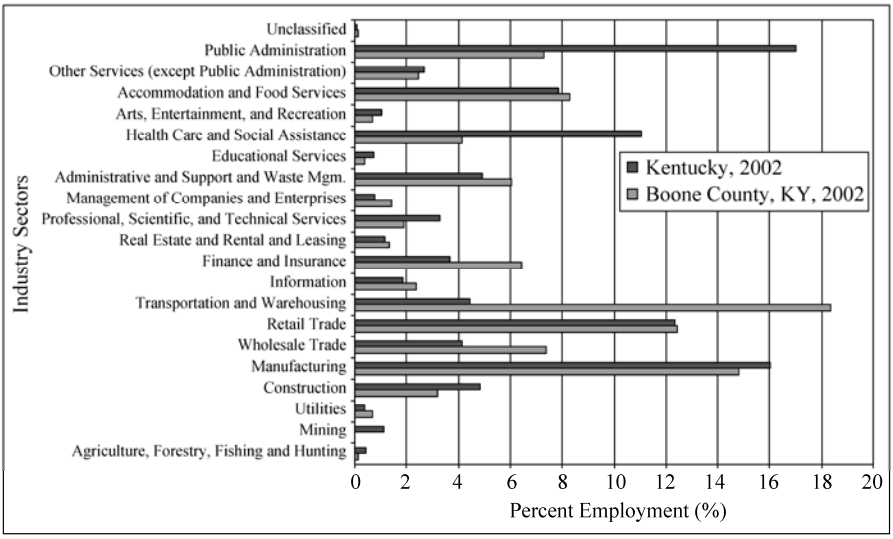
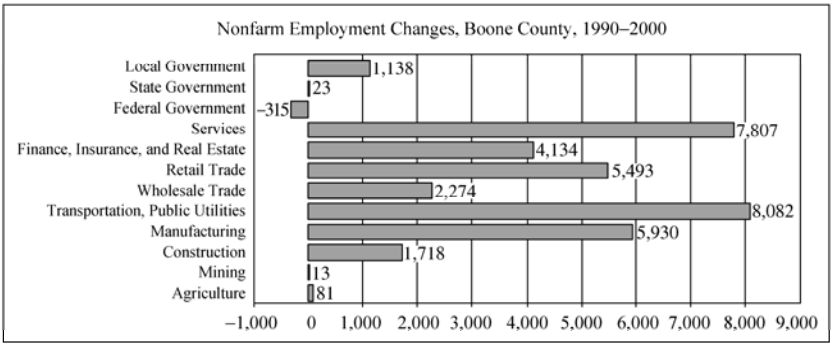


Figure 4.3 Boone County and Kentucky employment by industry, 2002

Another common practice in compiling a regional economic profile is to evaluate selected key indicators over time. For example, what were the industry sectors that experienced the largest growth for a particular time period? Observing past trends in selected variables might allow us to draw some preliminary conclusions about what to expect in the near future.

Trend data can be reported in tables or graphically, as demonstrated in the bar charts. In particular for Boone County, Figure 4.4 shows that all sectors exhibited a growth in absolute employment except the Federal Government. Transportation and public utilities show the largest increase in employment of 8,082 employers, demonstrating once again its importance for the regional economy.

It is arguable whether recently observed trend patterns will continue without changes in the future. At least for short-term predictions, historical growth patterns may give some guidance to identifying upcoming needs and opportunities for regional economic development. An economic profile containing economic and social indicators, a comparison of the region with an



Source: Bureau of Economic Analysis (BEA), Local Area Personal Income Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2000.

Figure 4.4 Industry employment changes for Boone County, 1990 – 2000

appropriate benchmark region, and an evaluation of historic growth patterns highlights what challenges and opportunities a region may face in encouraging and sustaining business development. It helps and supports the decision process in regional economic development planning while helping firms and residents in their location decisions.

4.4.2 Preliminary Consideration

The usefulness and appropriateness of the results of an economic base analysis and its analytical tools and techniques depend heavily on such factors as the choice of size of the study region, the selected benchmark region for comparison, the chosen measurement units or the economic indicators, and the level of detail used in the classification system of establishments.

4.4.2.1 The Study and Benchmark Region

While the definition of **study region** comes straight from the research question, the choice of a study region plays a crucial role in terms of availability of useful data and interpretation of the results of the economic base analysis. Usually, government agencies provide economic and social data at different geographic levels. Most commonly in the United States, data are provided at the national, state, and county level. The U.S. Census Bureau provides data on population and housing characteristics (e.g., Census 2000 summary file 3, SF 3) by census tract and block group. Economic data published by the U.S. Census Bureau's Economic Census are available at the larger ZIP code level. The Bureau of Labor Statistics reports employment and wages in the Quarterly Census of Employment and Wages program at the county, metropolitan statistical area, state, and national levels. Annual income and employment data, published by the Bureau of Economic Analysis (BEA), are also available for counties, MSAs, states, and

the nation or specific BEA-defined economic areas, which usually are larger multi-county areas. By identifying the study region, attention should be paid to data availability, particularly, when applying the economic base concept at the community level. Tiebout[①] mentioned in his paper on community economic base analysis that practically any size area is appropriate for an economic base study. Further, he recommends study of the larger economic area, which contains the community of interest as part of the community economic base analysis. Results at the community level are more viable when accompanied by additional knowledge of the larger economic area.

Besides the problem of data availability, the size of the study region must be considered in interpreting results from an economic base study. Smaller study regions generally have smaller economies and tend to be more specialized in fewer products compared with larger regions. For example, Boone County's economy is smaller than the economy of the Cincinnati-Middletown Metropolitan Statistical Area[②] of which Boone County is a part. Further, the location of the Cincinnati/ Northern Kentucky International Airport in the county explains its specialization in transportation. This has two immediate implications for Boone County.

First, **the more a regional economy is specialized in the production of particular products, the more the region tends to import from the outside the region.** Boone County is highly specialized in transportation and warehousing (e.g., NAICS sector 48 – 49 in Fig. 4.3). With a large share of the labor force employed in these industries, Boone County might not be self-sufficient in other sectors. It must import other non-transportation and warehousing goods and services as needed. Money leaving the region for imports reduces the level of intra-regional or non-basic economic activities resulting in a smaller multiplier. At the same time, this high degree of specialization in transportation and warehousing leads to large exports of these sectors' services, boosting basic activities also leading to smaller multipliers (see also Fig. 4.2).

Secondly, **smaller regions usually have smaller multipliers.** In this context, size can refer to the region, population, employment, and other indicators. Comparing Boone County with the nation, one would expect the nation to be self-sufficient in most aspects. A higher level of self-sufficiency means fewer imports and more non-basic activities—most of the money is captured by the nation. This higher intensity of intra-national activities leads to higher multipliers. Conversely, smaller regions, like Boone County, depend to a larger extent on imports, which decrease the amount of intra-regional activities and results in smaller multipliers.

As we have already seen earlier, a common practice in economic base

① Charles Tiebout (1962), *The Community Economic Base Study*.

② The Cincinnati-Middletown Metropolitan Statistical Area includes fifteen counties in Ohio, Kentucky, and Indiana. Boone County is one of the seven Kentucky counties included in the Cincinnati-Middletown MSA.

analysis is using a **benchmark region** for comparison. A benchmark region is also widely used for determining the level of basic activities. Therefore, the choice and the size of the benchmark regions play crucial roles in the magnitude of the economic base multiplier and other outcomes of economic base analyses. Before deciding on a benchmark region, one should pay close attention to the purpose of the study. Does it make sense to compare Boone County with the nation? Or, would Kentucky or the Cincinnati MSA be the better benchmark region? In practice, smaller regions like counties are often compared with larger regions like MSAs or states. Usually, the smaller region is always an integral part of a larger benchmark region. It just would not make as much sense to compare Boone County with the state of California as it would to compare it to the state of Kentucky of which it is a part. Alternatively, one might call on the Cincinnati MSA or the Midwest as the benchmark region. It is important to recognize that each benchmark region has its own structural industry composition and its own strengths and weaknesses. By comparing Boone County with the Cincinnati MSA (a suburban-urban metropolitan area), one might draw different conclusions than from a comparison of Boone County to the state of Kentucky (which includes other metropolitan areas as well as rural areas).

4.4.2.2 Economic Indicator or Units of Measurement

There is no general rule as to which unit of measurement is the best for a particular situation. Each indicator has its strengths and weaknesses and is, by itself, insufficient to fully describe the state of a regional economy. In practice the choice of selecting the appropriate economic variable to use for the analysis is influenced by the availability of data. Often, the range of data on indicators available for smaller areas is limited.

Employment is probably the most commonly used economic indicator in any regional economic analysis. This is partly because it is easy to conceptualize that 12,855 people were employed in the transportation and warehousing sector in Boone County in 2002. Whereas, it is more difficult to interpret a county's economic activities when saying that its annual wage payments totaled 652.6 million dollars for 2002. Its status as the most widely available economic data series also influences the choice of employment as an indicator.

Although employment data are readily available through the Bureau of Labor Statistics, the Bureau of Economic Analysis, and the Census Bureau, as Table 4.3 indicates, the definition of **employment** is not necessarily the same among different agencies providing the data.

Generally, employment data can be provided by place of residence or place of work. **Employment by place of residence data** takes into account where members of the work force live. It divides the region's resident population into those in the labor force (those working or searching for work) and those not

Table 4.3 Total employment, Boone County, KY, 2001

	Total Employment, Boone County, KY 2001
Bureau of Labor Statistics (BLS)	
Quarterly Census of Employment and Wages	68,684
Bureau of Economic Analysis (BEA)	
Local Area Personal Income	81,919
Census Bureau	
County Business Patterns	55,444

in the labor force. The population in the labor force is further subdivided into employed and unemployed. To be considered unemployed and in the labor force, one must be without a job and actively looking for one. Those outside the labor force are both without a job and not seeking employment. Referring back to Table 4.1, of the 64,033 persons sixteen years and older in Boone County, 46,791 persons are in the labor force and 17,242 are not in labor force. Note that employment by place of residence does not necessarily match employment by place of work. Some people hold more than one job, particularly when counting part-time jobs. Others commute to work outside their region of residence. Some common and widely used sources for employment by place of residence data in the U.S. are:

(1) The Census Bureau, Decennial Census, Summary File 3 (SF3) (http: //www.census.gov/Press-Release/www/2002/sumfile3.html);

(2) Bureau of Labor Statistics (BLS), Local Area Unemployment Statistics (LAUS) Program (http://www.bls.gov/lau/home.htm).

Employment by place of work refers to the actual number of jobs in a geographic area. Employment is commonly categorized by establishment according to their primary type of activity. Unfortunately, the definitions of employment by place of work published by the Census Bureau, the Bureau of Labor Statistics, and the Bureau of Economic Analysis differ substantially among agencies as already indicated in Table 4.3.

The **Bureau of Labor Statistics** and the State Employment Security Agencies (SESAs) cooperatively offer the Quarterly Census of Employment and Wages program.[①] Employment and wage data are available at the national, state, and county levels classified by establishment (disclosure restrictions may apply for confidentiality reasons). It includes workers covered by State Unemployment Insurance (UI) laws or federal employees covered by the Unemployment Compensation for Federal Employees (UCFE) program. Monthly employment counts every worker who received pay for the period that includes the 12th of each month. Quarterly wages include the complete compensation paid for the

① Source: http://www.bls.gov/cew/cewover.htm.

corresponding period. The statistics are incomplete in that they do not include the self-employed, proprietors, domestic workers, unpaid family workers, railroad workers covered by the railroad unemployment insurance system, and members of the armed forces. The BLS data do account for civilian government employees.

Quarterly employment and wage data are available on the BLS website. To access these data, go to the **Employment and Unemployment** menu and select **State and Local Employment**. From this page you can access the **Quarterly Census of Employment and Wages** (QCEW). Detailed QCEW statistics on employment and wage series are available for 1975 – 2000 on the Standard Industrial Classification (SIC) basis and from 2001 forward on the NAICS basis. In addition, 1990 – 2000 data are available on reconstructed NAICS basis. To access **Current Employment and Wages** (CEW) from the BLS website, go to the **Geography** menu and select **State and Local Employment**. From this page, you will have access to the CEW data.

The BEA makes employment and wage data available at the national, state, and county levels as part of its local area personal income estimates. The data are also available on the Regional Economic Information System (REIS) CD-ROM.[①] The BEA uses BLS data for its estimates and makes adjustments to account for employment and wages not covered, or only partially covered, by the State UI and UCFE programs. Among others, the BEA corrects employment and wages for the following establishments: farms, farm labor contractors, private households, private elementary and secondary schools, religious membership organizations, railroads, military, U.S. residents who are employed by international organizations and by foreign embassies, nonprofit organizations, students and their spouses employed by colleges or universities, elected officials of the judiciary, interns employed by hospitals and by social service agencies, and insurance agents classified as statutory employees.[②]

To access BEA data on Local Area Personal Income, Select **State and Local Personal Income**. From this page, access the **Interactive Table** and select **Local Area Annual Estimates**. Local Area Personal Income data include among others: (1) detailed county tables by NAICS industry for total full-time and part-time employment (series CA25) for 2001 forward, (2) detailed county employment by SIC industry (series CA25) for 1969 – 2000, and (3) wage and salary summary estimates from 1969 onwards (CA34).

The Census Bureau publishes employment and payroll data in its County Business Patterns (CBP).[③] The economic censuses collect economic data every five years from Federal administrative records and from survey information of

① For more information: http://www.bea.gov/bea/regional/articles.cfm.

② Source: http://www.bea.gov/bea/regional/articles/lapi2001/alternative_measures.cfm#N_4_.

③ Source: http://www.census.gov/epcd/cbp/view/cbpview.html.

business establishments. Employment data reported in the CBP are usually lower in magnitude (see Table 4.3) when compared with BLS data because the CBP data do not include most government employees who are part of the BLS data. They only include government employees working in government hospitals, depository institutions, federal and federally sponsored credit agencies, liquor stores, and wholesale liquor establishments. The CBP data further exclude some agricultural production employees and household employees. Nevertheless, the CBP data are more complete with respect to educational and membership organizations and of small nonprofit organizations in other industries. One last difference is that the CBP data report employment for the month of March whereas BLS employment is the average of monthly data.

To get U.S. Census Bureau county business patterns data, select **Business**, select **County Business Patterns**. Employment and payroll data are available: ① at the county, state, national, ZIP, or MSA level on a NAICS basis for 1998 forward and ② at the county, state, national, or ZIP level on a SIC basis for 1994 – 1997.

While employment is the most popular economic indicator, in terms of giving a complete picture of the economy of a region, it has some significant shortcomings:

(1) Employment by place of work counts the number of jobs by establishment regardless if they are full- or time-part. Such figures may mask under-employment levels, skewing the real level of regional economic activity as some persons hold two part-time jobs or some persons only work seasonally.

(2) Technological progress and human development lead to substantial productivity increases. As such, employment figures may not correspond to output levels. The introduction of computers in the production process, —for example, the computerization of a car manufacturing assembly line—may increased the amount of goods and services produced, while, at the same time, the labor force in that particular sector stagnates or decreases.

(3) Measuring regional economic activity based on employment figures also does not account for government transfer payments and other non-job related income. Using only employment data, the level of economic activities in regions with higher levels of poverty, and therefore, higher levels of social security payments, is underestimated.

Income and earnings data indicate the amount of money circulating in the regional economy rather than the number of persons employed. The data addresses some of the shortcomings of employment statistics described earlier by: (1) accounting for full-time, part-time, and seasonal employment, (2) recognizing the fact that different jobs are paid differently, and (3) including non-job related income sources. However, the interpretation of this data is less straight forward than that of jobs. The use of dollar values rather than job numbers means that one must pay particular attention to exactly what the dollar values represent.

Income is a good measure to use when a study concerns the region's standard of living. It serves as the basis for calculating the per capita income, per family income, and per household income indicators. While the numerator—the aggregated personal income—remains the same in all three measures, the denominator changes accordingly to population, number of families, and households respectively. There are two major sources for U.S. personal income data: the Bureau of Economic Analysis (BEA) and the U.S. Census Bureau.

The **BEA** lists personal income by place of residence. The BEA defines personal income as:①

	earnings by place of work
−	personal contributions for social insurance
+	adjustments for residence②
=	net earnings by place of residence
+	investment (dividends, interest , and rent)
+	transfer payments (social security payments, pensions, welfare)
=	**personal income by place of residence**

It includes all sources of income—monetary and non-monetary (e.g., food stamps), but excludes individual social security contributions. Personal income as reported by the BEA converts earnings by place of work data into earnings by place of residence. As such it qualifies as an appropriate measure— together with local area cost of living—for a region's quality of life. The personal income data by the BEA are available at the national, state, county and metropolitan statistical area level. Personal income by place of residence data (CA05) from 1969 – 2000 are available under the 1987 SIC; from 2001 forwards, data are available under the NAICS.

For median household income, household, family, and per capita income indicators, and poverty rates, the U.S. Census Bureau might be the right gateway. In contrast to the BEA definition of personal income, the Census Bureau's money income definition excludes nonmonetary income sources and includes personal contributions for social insurance.

Earnings data are available by place of work and indicate an industry sector's contribution to regional income. Earnings by place of work are the largest contributor to personal income. Alternatively, earnings data are published by government agencies as wages, payroll, or earnings by industry. As we have already seen in the case of employment, there is no unique definition of earnings across government agencies. Although wages and payroll are similar concepts, the definitions as applied to compilation of data do not necessarily

① http://www.bea.gov/bea/regional/articles/lapi2001/intro.cfm.

② Adjusts regional earnings for the net inflow of earnings of inter-area commuters. For example, a person living in Boone County and working in Hamilton County, Ohio brings her earnings back home to Boone County. In contrast, persons that commute to Boone County for work leave the region with their earnings.

match. Usually, payroll is the more comprehensive definition for money compensation than wages. Ways and payroll are discussed below.

The Bureau of Labor Statistics (BLS) publishes total and average wages under its Quarterly Census of Employment and Wages program.[①] The BLS defines wages according to when the compensation was paid, regardless of when services were performed. Included in total compensation payments are bonuses, stock options, severance pay, the cash value of meals and lodging, tips and other gratuities, and, if applicable, employer contributions to deferred compensation plans (e.g. 401(k) plans).[②] Average wages are defined as the ratio of total annual wages over annual average employment. Depending on annual average employment, the ratio of full-time to part-time employment plays a crucial role in the level of average annual wages.

The BLS Current Employment Statistics (CES) program makes **earnings of workers** on non-farm payrolls available to the public.[③] Earnings data are derived from reports of gross payrolls based on the pay before deductions—such as Social Security, unemployment insurance, withholding tax, bonds, and union dues—are taken.[④] They include overtime pay, shift premiums, and payments for holidays, vacations, and sick leave. Excluded are bonuses, commissions, tips, and payments in kind (the value of free rent, fuel, or meals).

The BEA reports **earnings by place of work** and **earnings by industry** together with personal income in its **personal income by major source and earnings by industry** series (CN05). The BEA defines earnings by place of work as the sum of:[⑤]

	wages and salary disbursements
+	other labor income
+	proprietors' income
=	**earnings by place of work**

Wage and salary disbursements are the actual employers' compensation, including bonuses, commissions, pay-in-kind, incentive payments, and tips. It is a measure of gross disbursements, measured before deductions, such as social security contributions and union dues. Other labor income mainly consists of employer contributions to employee retirement plans, private group health and life insurance plans, privately administered workers' compensation plans, and supplemental unemployment benefit plans. Proprietors' income includes the return for business owners from sole proprietorships, partnerships, and tax-exempt cooperatives. This includes profit or other compensation paid to proprietors or

① Source: http://www.bls.gov/cew/home.htm.

② Source: http://www.bls.gov/cew/cewbultn02.htm.

③ Source: http://www.bls.gov/sae/home.htm.

④ Source: http://www.bls.gov/opub/hom/homch2_b.htm.

⑤ Source: http://www.bea.gov/bea/regional/definitions/.

partners. Earnings by place of work are reported as an aggregate for each region. Earnings by industry, on the other hand, identify each industry sector's contribution to regional income and as such give us more detailed information on a region's strengths, weaknesses, and opportunities for future economic growth.

The U.S. Census Bureau lists **payroll** statistics, together with employment, in its County Business Patterns (CBP). The Census Bureau defines payroll as the sum of salaries, wages, tips, commissions, bonuses, vacation allowances, sick-leave pay, employee contributions to qualified pension plans, and the value of taxable fringe benefits. It is measured before deductions, such as Social Security, income tax, or insurance, are made. Proprietors' income is excluded. The CBP report the first quarter and annual payroll at the county, state, and national level.[①]

There are many more units of measurement that can be used in an economic profile. For example, data measuring industry output—e.g., **sales** data—might be of particular interest for local governments in projecting tax revenues. Although sales data are conceptually straight forward and constitute an appropriate measure of regional economic transactions, they are used infrequently, as they raise the concern of double-counting. Industries sell goods and services to households, governments, and outside the region and receive payments in return. Industries also sell goods and services to other industry sectors in the region, called intermediate inputs. In order to avoid double counting, these inter-industry transactions within the region must be subtracted from the total reported sales; otherwise, they will inflate the level of regional economic activities. For instance, in the sale of motherboards and soundcards from a computer parts manufacturer to an establishment that assembles computers, the sales of the motherboards and soundcards to the assembly establishment do not count towards total regional sales as they do when measuring the gross state product (GSP). Otherwise, the value of these same computer components would be listed twice: once by the computer part manufacturer and once by the computer assembly plant. Only final sales to consumers are listed under this rubric to avoid double counting. Sales data will become of major importance when discussing the input-output framework in Chapter 5.

4.4.2.3 The Level of Detail—the Economic Aggregation

Since the 1930's, economic data, such as employment and earnings by place of work have been collected, aggregated, and categorized in the U.S. following the SIC. Under the demand-oriented SIC, establishments are categorized according to their predominant type of economic activity. An establishment is a single economic unit engaged in the production process of goods and services. It can be a farm, a factory, or a grocery store. A company or an enterprise can consist of

① Source: http://censtats.census.gov/cbpnaic/cbpnaic.shtml.

more than one establishment. Industrial classification groups all establishments together based upon their major economic activity.

The original SIC was developed in the United States during a time when the nation's economic activities were dominated by manufacturing. To keep up with the economy's changing industrial composition—the appearance of new industries and diminishing of others—the SIC has been revised frequently, most recently in 1987. In 1997, due to major changes in the structure of the economy, for instance, the emergence of advanced technology industries (e.g., wireless telecommunication, internet publishing, fiber optic cable manufacturing, and reproduction of computer software), the NAICS was introduced. Not only does the NAICS expand the number of individual industries from 1,004 in the SIC system to 1,170 in the NAICS, in contrast to the demand-oriented SIC system, the NAICS is based on an economic production-oriented conceptual framework. In this sense, the NAICS, groups establishments together that have similar processes producing goods and services regarding their use of material inputs, capital equipments, and labor rather than their similarity in output as in the SIC.

The 1987 SIC is a hierarchical system. At the highest level of aggregation, it arrays the economy into eleven divisions, A through K (see Table 4.4). Divisions are divided into 83 two- digit major groups that are further subdivided into

Table 4.4 The 1987 U.S. Standard Industrial Classification System(1)

Major Division	1987 SIC Code	Industrial Sector
A	01 – 09	Agriculture, Forestry, and Fishing
B	10 – 14	Mining
C	15 – 17	Construction
D	20 – 39	Manufacturing
E	40 – 49	Transportation, Communication, and Utilities
	45	Transportation by Air
	451	Air Transportation, Scheduled, and Air Courier
	4512	Air Transportation, Scheduled
	4513	Air Courier Services
F	50 – 51	Wholesale Trade
G	52 – 59	Retail Trade
H	60 – 67	Finance, Insurance, and Real Estate (FIRE)
I	70 – 88	Services
J	90 – 97	Public Administration
K	99	Nonclassifiable Establishments

(1) Source: http://www.osha.gov/cgi-bin/sic/sicser5 and http://www.census.gov/epcd/naics/issues2.

416 three-digit industry groups. At the largest level of detail, the SIC systems covers 1,004 four-digit industries.

For example, division E covers "Transportation, Communication, and Utilities" (SIC code 40 – 49). "Transportation by Air" (SIC code 45) is one major group within division E. Among others, it includes, at the three-digit level the industry group "Air Transportation, Scheduled, and Air Courier" (SIC code 451). At the four-digit or highest level of detail, this particular industry group 451 covers industries "Air Transportation, Scheduled" (SIC code 4512) and "Air Courier Services" (SIC code 4513).

Classification of an economy into eleven divisions does not reveal much detail about individual industry activities. Breaking down divisions into major industry groups allows one to draw a more detailed picture of the regional economy. For smaller geographical areas, a more detailed break down which identifies industry groups or individual industries known to be located in the area may provide interesting insight into the local economy. For example, one would expect that Boone County, site of the Cincinnati/Northern Kentucky International Airport, would be highly specialized in air transportation. At the division-level, this specialization is not available, as air transportation is aggregated into the Transportation, Communication, and Utilities division. The two-digit level identifies Air Transportation as an individual industry group. More detailed information could then be included in an analysis at the three- and four-digit level. However, for reasons of confidentiality, this detailed level of information is not always readily available.

Introduced in 1997, the NAICS shown in Table 4.5 has already seen a revision in 2002. As its name says, NAICS is the standard classification system in Canada, Mexico, and the United States. Like its predecessor, the SIC, the NAICS is of hierarchical structure. The total number of industries covered under the NAICS is 1,179. The NAICS manual of the Bureau of Labor Statistics identifies 20 sectors, 100 sub sectors, 317 four-digit industry groups, 725 five-digit NAICS industries, and 1,170 six-digit industries.[①] Structural differences between the NAICS and SIC systems are summarized in Table 4.6.

The reorganization of the industries under the production-oriented NAICS gives the data greater economic meaning. Data produced under NAICS are more suitable than SIC data for calculating economic indicators that combine input and output measures, such as productivity, unit labor costs, and employment-output ratios.[②] Under the NAICS, the SIC divisions of Manufacturing and Services have been completely restructured. Additional sectors have been introduced to reflect the modern economy. For example, an information sector has been created covering Publishing Industries (formerly Manufacturing in the SIC), Broadcasting

① Source: www.bls.gov/cew/cewbultn02.htm.

② Source: Development of the NAICS, http://www.census.gov/epcd/www/naicsdev.htm.

Table 4.5 The 2002 North American Industry Classification System

2002 NAICS Code	2002 NAICS Title
11	Agriculture, Forestry, Fishing and Hunting
21	Mining
22	Utilities
23	Construction
31 – 33	Manufacturing
42	Wholesale Trade
44 – 45	Retail Trade
48 – 49	Transportation and Warehousing
481	Air Transportation
4811	Scheduled Air Transportation
51	Information
517	Telecommunication
5172	Wireless Telecommunications Carriers (except Satellite)
51721	Wireless Telecommunications Carriers (except Satellite)
517211	Paging
517212	Cellular and Other Wireless Telecommunications
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support and Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)
92	Public Administration
99	Unclassified

Table 4.6 NAICS and SIC structural differences

Level of Detail	NAICS	SIC
Letter	–	Division
Two-digit	Sector	Major Group
Three-digit	Sub-sector	Industry Group
Four-digit	Industry Group	Industry
Five-digit	NAICS Industry	–
Six-digit	U.S. Industry	–

and Telecommunications (formerly Transportation, Communication, and Utilities), Motion Picture and Sound Recording industries, Information Services and Data Processing, and Libraries (all formerly classified as Services). Hotels and Other Lodging, Eating and Drinking Places form the new Accommodation and Food Services industrial category. Wholesale and retail industries have also been redefined. Updates on the NAICS are scheduled on a five-year basis.

Meanwhile, government agencies have completely converted the publication of economic data from the SIC code to the NAICS code. However, data prior to 1997 are still listed under the SIC system. This means that economic time series analysis confronts the difficult task of matching data from two different classification systems. In order to allow users to compare the two systems, the U.S. Census Bureau publishes a 1997 NAICS and 1987 SIC correspondence table (http://www.census.gov/epcd/www/naicstab.htm). In 2002, the 1997 NAICS underwent its first major revision, in which six of the twenty sectors were substantially revised. Tables matching the 2002 NAICS to the 1997 NAICS, as well as the 2002 NAICS to the 1987 SIC system, are available at the Census website (http://www.census.gov/epcd/naics02/).

4.5 Economic Base Analysis Techniques

So far we have examined a region's economy by evaluating readily available economic indicators. We have evaluated the most recently available economic and socioeconomic indicators, observed them over time, and compared a region's performance indicators to that of a benchmark region. We have discussed the economic base model as a way of conceptualizing the economic activity of a region. In this section, we will begin to apply analytical tools and techniques that fall under the category of economic base analysis. We will learn to analyze and describe the strengths and weaknesses of an economy, its specialization, and its level of diversity. Particularly where data availability constrains the use of more complex economic models, e.g., input-output or regional econometric models, economic base analysis techniques can become powerful decision making tools.

In order to begin, we need to divide the economy into basic and non-basic sectors. Recall that the basic sector is the engine of economic growth and depends on economic conditions outside the region, and the non-basic sector supports the basic sector and depends largely on local economic conditions.

4.5.1 The Survey Method

Conceptually, the most straightforward approach of dividing an economy into a non-basic and basic sector would be to conduct an extensive business survey.

Surveying local establishments, for example through mail questionnaires or telephone interviews, on whether produced goods and services are sold locally or exported outside the region would be the most direct way to either classify their activities as basic or non-basic and should provide the most accurate method of categorization.

Despite its conceptual simplicity, the survey method is rarely used, for good reasons. First, a widespread business survey requires time, money, and trained stuff. Depending on the number of regional businesses, the effort of conducting the survey may not be justified when compared with the usefulness of the survey results. Second, the accuracy of the outcome might be questionable considering the sensitivity of businesses to the questions asked regarding employment and sales. Businesses may not be willing to participate, and a lowered participation rate may decrease the accuracy of the data.

Instead of a full survey, sampling provides a means of classifying businesses with less effort. For larger areas with a vast number of businesses (the population), it is faster and more efficient to study a sample (subset of the population) instead of conducting a full census. When evaluating and studying the sample, we make inferences about the overall population while considering potential sampling errors. Stratified sampling, for instance, is one way to achieve an even representation of all regional businesses. Stratified sampling divides the population (e.g., all firms and businesses) into categories, or strata. For instance, we easily can divide businesses according to the North American Industry Classification System. Then, we draw a random sample from each stratum (e.g., agriculture, mining, utilities, and so on). The survey approach can further be simplified by taking into account that some businesses serve mostly the local market (e.g., local government), while others are purely export oriented (e.g., hotel and lodging). Pre-classification of some industry sectors will reduce the number of strata to those sectors that obviously serve entirely local or non-local markets.

4.5.2 The Assumption Method

The assumption approach is simple, quick, and inexpensive. The assumption approach simply assumes economic activities—industry sectors— as either being completely basic or completely non-basic. It is widely perceived that the Agriculture, Mining, Manufacturing, State and Federal Governments sectors are entirely basic activities and as such depend solely on factors outside the region. All remaining activities, basically the Utilities, Construction, Local Government, and service industries sectors, are assumed to be non-basic, depending only on local economic conditions. For Boone County, Table 4.7 demonstrates the use of the assumption method.

Unfortunately, one can never clearly divide economic activities into completely basic or non-basic activities. Referring to Table 4.7, Transportation Equipment

Table 4.7 Assumption method, Boone County, KY, 2002[1]

NAICS Code	2002 NAICS Title	Total Employment	Basic Employment	Non-basic Employment
11	Agriculture, Forestry, Fishing and Hunting	79	79	–
21	Mining	35	35	–
22	Utilities	481	–	481
23	Construction	2,230	–	2,230
238	Specialty Trade Contractors	1,569	–	1,569
31 – 33	Manufacturing	10,360	10,360	–
311	Food Manufacturing	1,498	1,498	–
323	Printing and Related Support Activities	935	935	–
326	Plastics and Rubber Products Manufacturing	1,770	1,770	–
333	Machinery Manufacturing	1,545	1,545	–
336	Transportation Equipment Manufacturing	1,317	1,317	–
42	Wholesale Trade	5,166	–	5,166
423	Merchant Wholesalers, Durable Goods	2,935	–	2,935
424	Merchant Wholesalers, Nondurable Goods	1,965	–	1,965
44 – 45	Retail Trade	8,724	–	8,724
445	Food and Beverage Stores	1,114	–	1,114
452	General Merchandise Stores	2,312	–	2,312
48 – 49	Transportation and Warehousing	12,855	12,855	–
481	Air Transportation	7,710	7,710	–
4811	Scheduled Air Transportation	7,652	7,652	–
492	Couriers and Messengers	2,236	2,236	–
493	Warehousing and Storage	1,183	1,183	–
51	Information	1,657	–	1,657
511	Publishing Industries (except Internet)	1,156	–	1,156
52	Finance and Insurance	4,506	–	4,506
522	Credit Intermediation and Related Activities	2,249	–	2,249
53	Real Estate and Rental and Leasing	934	–	934
54	Professional, Scientific, and Technical Services	1,341	–	1,341
55	Management of Companies and Enterprises	995	–	995
56	Administrative and Support and Waste Mgmt.	4,233	–	4,233
561	Administrative and Support Services	4,078	–	4,078
61	Educational Services	267	–	267
62	Health Care and Social Assistance	2,897	–	2,897
621	Ambulatory Health Care Services	1,055	–	1,055
71	Arts, Entertainment, and Recreation	489	–	489
72	Accommodation and Food Services	5,821	–	5,821
722	Food Services and Drinking Places	5,186	–	5,186
81	Other Services (except Public Administration)	1,733	–	1,733
811	Repair and Maintenance	943	–	943
92	Public Administration	5,107	1,434	3,673
92	Federal Government	1,161	1,161	–
92	State Government	273	273	–
92	Local Government	3,673	–	3,673
99	Unclassified	97	–	97
	Total	70,007	24,763	45,244

(1) Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2002

Manufacturing is classified as basic. In particular, the 1,317 persons employed by establishments categorized under NAICS code 336 produce transportation equipment that is entirely exported outside the county. This assumption also means that all transportation equipment purchased by the larger Cincinnati / Northern Kentucky International Airport is imported from outside the county. This case clearly demonstrates that assuming all manufacturing industries are entirely basic will create substantial errors and ultimately lead to biased conclusions. Deciding on whether transportation equipment manufacturing should be classified as either basic or non-basic depends solely on the judgment of the researcher. In the case of Boone County, we will use the common practice of assuming that all manufacturing activities are basic sector activities. However, we must also acknowledge that in reality, the presence of the Cincinnati / Northern Kentucky International Airport, a consumer of transportation equipment, indicates that the assumption may ignore some locally consumed manufactured goods.

In another example, we assumed Transportation and Warehousing (a service activity) to be a basic activity. Our assumption revises the common approach of assuming all service-related industries perform non-basic activities. We make this adaptation in recognition that the majority of travelers using the Cincinnati / Northern Kentucky International Airport are not from Boone County. Additionally, most of the incoming and outgoing freight does not stay or originate in the Boone County.

These two examples show that the common practice of assigning all Agriculture, Mining, Manufacturing, State and Federal Government activity to the basic sector raises the question of accuracy in the results. Although commonly assigned to the non-basic sector, many service sector can be mainly basic activities under certain cirtumstances. This shows that only very few industry sectors can be clearly categorized as either basic or non-basic and that the assumption method by itself is of limited use dividing an area's economy into basic and non-basic activities. However, one useful application of the assumption method is to combine it with the survey method or as we will see later with the location quotient method. Identifying strata that are clear cut basic activities (such as Tourism, Hotel and Lodging) or non-basic activities (such as Local Government and Motion Picture Theaters) can substantially reduce the amount of survey work. Further, in-depth knowledge of the area's firms and businesses can improve the accuracy of the assumption method.

4.5.3 The Location Quotient Method

The **location quotient** (LQ) method is probably the most popular and widely used economic base analysis technique. Location quotients are applicable when identifying an area's industrial specialization relative to a benchmark region,

often the nation. In this section, we use Boone County, Kentucky, as the study region and compare its economy to the National economy. We will refer to Boone County's economy as **regional economy**. Alternatively and as you will see in many other publications, the study region's economy may often be referred to as *local economy*.

Tiebout[①] also named LQs **coefficients of specialization**. For instance, we already know that Boone County is specialized in Transportation and Warehousing. We will later confirm this preliminary conclusion by evaluating the location quotient of transportation and warehousing. Observing location quotients over time will give us some insight into whether a regional industry is losing ground or gaining in strength. For example, a vast shopping mall, developed in the late 1970s in Florence, Boone County, attracts people from all over the Cincinnati area. By observing location quotients of the retail industry over time, we can look at whether the retail industry has developed into one of the economic driving forces (or specializations) of Boone County.

In contrast to the previously described assumption method, where an industry sector is assumed to be either basic or non-basic, the location quotient allows industry sectors to be divided into basic and non-basic activities. The location quotient method compares an industry's share of regional economic activity to the nation's share of economic activity for that industry. Although employment is the most common measure of economic activity, income and earnings data are also frequently used. Using employment as an example, the location quotient compares the share of regional employment in industry *i* with the share of national employment in industry *i*.

4.5.3.1 Calculation of Location Quotients

Location quotients are calculated at one point in time using the following formula:

$$\mathrm{LQ}_i = \left(\frac{e_i}{e}\right) \Big/ \left(\frac{E_i}{E}\right) = \frac{\text{share of regional employment in industry } i}{\text{share of national employment in industry } i} \tag{4.38}$$

where, in the case of employment,

e_i — regional employment in industry *i*;

e — total regional employment (all sectors);

E_i — employment in industry *i* of the benchmark region (i.e., the nation);

E — total employment of the benchmark region.

More specifically, the location quotient can be described as the ratio of an industry's share of regional employment over its share of national employment.

① Tiebout, 1962: 47.

It must be noted that the results of the location quotient method are highly influenced by the choice of the benchmark region. Generally, a more self-sufficient benchmark region is a better reference region. Meaning that, for calculating location quotients, larger geographic areas such as states and the nation are preferred.

The resulting location quotient may be interpreted in the following manner:

(1) **Location Quotients > 1.0**: $(e_i / e) > (E_i / E)$. The region has a greater share of employment (or earnings, etc) in industry *i* than the benchmark region. At least part of a region's employment in industrial sector *i* is engaged in basic activities. It is also assumed that for the region, industry *i* produces more goods and services than can be consumed locally, and therefore exports this excess production. The higher the LQ is, the greater the region's specialization in this industrial sector. In this case, the regional industry *i* is comprised of a basic and non-basic employment. While we generally assume that all excess production is exported, we must be aware of special cases where the entire production can be considered being a basic activity. For example, an establishment producing windshields for an automobile manufacturer will deliver all the windshields to where the automobile manufacturer assembles the cars. This activity should be considered entirely basic, if the windshield manufacturer and car manufacturer are not located next to each other (i.e., within the same economic region).

(2) **Location Quotients = 1.0**: $(e_i / e) = (E_i / E)$. The region's share of employment in industry *i* is equal to that of the benchmark region. It is assumed that the region is completely self-sufficient and neither exports nor imports the goods or services of this industry. All employment is considered non-basic.

(3) **Location Quotients < 1.0**: $(e_i / e) < (E_i / E)$. If industry *i* has a smaller share of employment than the benchmark region—the region falls below the level of self-sufficiency and needs to import to meet local demand for that particular industry sector's goods and services. All employment is considered non-basic.

Location quotients for Boone County are summarized in Table 4.8. Before going into greater detail about what location quotients can reveal or tell us, some remarks about the assumptions and development of the data in summary Table 4.8 are necessary. Our goal is to divide a region's economy into basic and non-basic activities, at a level of detail sufficient to identify the region's economic specializations. First, we use the assumption approach and assign clear-cut industries to either the basic or the non-basic sector. In particular, we assign all employment in Agriculture (11), Mining (21), Accommodation (721), Federal Government (92) and State Government (92) to the basic sector, while Local Government (92) employment is considered to be entirely non-basic. Second, to capture more detailed information on basic activities we decide to use the three-digit classification level for all sectors that indicate basic activities. For

Table 4.8 Location quotients and basic employment for Boone County, KY, 2002[1]

NAICS Code	2002 NAICS Title	Area Employment (e_i)	US Employment (E_i)	Location Quotient (LQ_i)	Basic Employment (b_i)	Nonbasic Employment (n_i)
	Total Employment	70,007	128,233,919		24,478	45,529
11	Agriculture, Forestry, Fishing and Hunting[2]	79	1,155,890	0.125	79	0
21	Mining[2]	35	505,979	0.127	35	0
22	Utilities	481	592,152	1.488	158	323
23	Construction	2,230	6,683,553	0.611	0	2,230
31 – 33	Manufacturing	10,360	15,209,192			
311	Food Manufacturing	1,498	1,532,478	1.791	661	837
314	Textile Product Mills	365	194,385	3.439	259	106
322	Paper Manufacturing	708	543,379	2.387	411	297
323	Printing and Related Support Activities	935	707,566	2.421	549	386
325	Chemical Manufacturing	686	924,737	1.359	181	505
326	Plastics and Rubber Products Manufacturing	1,770	846,766	3.829	1,308	462
333	Machinery Manufacturing	1,545	1,221,816	2.316	878	667
336	Transportation Equipment Manufacturing	1,317	1,820,170	1.325	323	994
N/A	Other Manufacturing	1,536	7,417,895	0.379	0	1,536
42	Wholesale Trade	5,166	5,617,456			
423	Merchant Wholesalers, Durable Goods	2,935	2,981,513	1.803	1,307	1,628
424	Merchant Wholesalers, Nondurable Goods	1,965	2,006,466	1.794	870	1,095
425	Wholesale Electronic Markets, etc.	266	629,478	0.774	0	266
44 – 45	Retail Trade	8,724	15,018,588			

Continued

NAICS Code	2002 NAICS Title	Area Employment (e_i)	US Employment (E_i)	Location Quotient (LQ_i)	Basic Employment (b_i)	Nonbasic Employment (n_i)
442	Furniture and Home Furnishings Stores	376	539,759	1.276	81	295
443	Electronics and Appliance Stores	472	527,907	1.638	184	288
447	Gasoline Stations	510	895,547	1.043	21	489
451	Sporting Goods, Hobby, Book, and Music Stores	525	667,119	1.442	161	364
452	General Merchandise Stores	2,312	2,814,249	1.505	776	1,536
453	Miscellaneous Store Retailers	603	963,711	1.146	77	526
N/A	Other Retail Trade	3,926	8,610,296	0.835	0	3,926
48 – 49	Transportation and Warehousing	12,855	3,989,116			
481	Air Transportation	7,710	561,291	25.161	7,404	306
488	Support Activities for Transportation	831	514,560	2.958	550	281
492	Couriers and Messengers	2,236	567,288	7.220	1,926	310
493	Warehousing and Storage	1,183	510,539	4.244	904	279
N/A	Other Transportation and Warehousing	895	1,835,438	0.893	0	895
51	Information	1,657	3,364,485			
511	Publishing Industries (except Internet)	1,156	958,746	2.209	633	523
518	Internet Service Providers	245	436,750	1.028	7	238
N/A	Other Information Services	256	1,968,989	0.238	0	256
52	Finance and Insurance	4,506	5,678,156			
522	Credit Intermediation and Related Activities	2,249	2,668,892	1.544	792	1,457
N/A	Other Finance and Insurance (D)	2,257	3,009,264	1.374	614	1,643
53	Real Estate and Rental and Leasing	934	2,028,109			
531	Real Estate	352	1,382,381	0.466	0	352

Continued

NAICS Code	2002 NAICS Title	Area Employment (e_i)	US Employment (E_i)	Location Quotient (LQ_i)	Basic Employment (b_i)	Nonbasic Employment (n_i)
532	Rental and Leasing Services	582	645,728	1.651	229	353
54	Professional, Scientific, and Technical Services	1,341	6,654,743	0.369	0	1,341
55	Management of Companies and Enterprises	995	1,695,554	1.075	69	926
56	Administrative and Support and Waste Mgm.	4,233	7,589,300			
561	Administrative and Support Services	4,078	7,271,717	1.027	108	3,970
562	Waste Management and Remediation Services	155	317,583	0.894	0	155
61	Educational Services	267	1,951,003	0.251	0	267
62	Health Care and Social Assistance	2,897	13,395,715	0.396	0	2,897
71	Arts, Entertainment, and Recreation	489	1,798,621	0.498	0	489
72	Accommodation and Food Services	5,821	10,197,329			
721	Accommodation[(2)]	636	1,772,296	0.657	636	0
722	Food Services and Drinking Places	5,185	8,425,033	1.127	586	4,599
81	Other Services (except Public Administration)	1,733	4,246,011			
811	Repair and Maintenance	943	1,238,075	1.395	267	676
N/A	All Other Services	790	3,007,936	0.481	0	790
92	Federal Government[(2)]	1,161	2,758,627	0.771	1,161	0
92	State Government[(2)]	273	4,485,071	0.111	273	0
92	Local Government[(2)]	3,673	13,412,941	0.502	0	3,673
99	Unclassified	97	206,330	0.861	0	97

(1) Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2002

(2) assigned to either basic or nonbasice sector using the assumption approach.

instance, manufacturing sub-sectors (e.g., three-digit level) that are basic activities or specializations of Boone County are listed individually. The remaining sub-sectors and sectors where data restrictions applied for reasons of confidentiality are all lumped together. In the case of manufacturing, they are labeled "Other Manufacturing". Lumping all manufacturing sub-sectors into one higher manufacturing sector (e.g., two-digit level) not only leads to a loss of sectoral information, but in the case of Boone County would result in a lower estimate of basic employment in manufacturing.

Now let us turn our attention to some specific location quotients and how to interpret them. For example, the Utility sector in Boone County has a location quotient of 1.488. The location quotient for utilities is calculated as

$$\mathrm{LQ}_{\text{utilities}} = \frac{481/70,007}{592,152/128,233,921} = 1.488$$

This implies that Boone County's utility industry also supplies neighboring counties with utilities. On the other hand, the county is far away from being self-sufficient in the provision of health care and social assistance as indicated by this industry's location quotient of 0.396.

For the vast shopping mall in Boone County with approximately 130 specialty stores on over 924,000 square feet of retail space[①], we further break down the retail sector into its sub-sectors. Using the three-digit NAICS, it becomes apparent that Boone County is indeed specialized in retail activities commonly located in shopping malls, such as furniture and home furnishing stores (442), electronic and appliance stores (443), sporting goods, hobby, and music stores (451), and general merchandise stores (452). All of these sectors have location quotients of greater than one indicating that people from outside the country frequent these stores.

This example further emphasizes the importance of going beyond the two-digit level of industrial classification. It is at the more detailed three-digit level of aggregation that we can immediately see Boone County's strength in several retail sub-sectors and its shortfalls in some other retail sub-sectors. By considering only the more aggregated two-digit level of industrial aggregation, this particular piece of information is lost. Comparing Table 4.9 below, location quotients for Boone County using the two-digit industry classification, with Table 4.8, location quotients for Boone County using the three-digit industry classification— indicates the loss of detail by using only the two-digit classification. Particularly for smaller areas with a relative small number of firms and businesses, the more detailed level of industrial classification reveals important information on the

① Source: http://www.tripsouth.com/shopping/ky-shopping.shtml.

Table 4.9 Location quotients using two-digit industry classification, Boone County, 2002

NAICS Code	2002 NAICS Title	Area Employment (e_i)	US Employment (E_i)	Location Quotient (LQ_i)	Basic Employment (b_i)	Nonbasic Employment (n_i)
	Total Employment	70,007	128,233,919		18,883	51,124
11	Agriculture, Forestry, Fishing and Hunting(1)	79	1,155,890	0.125	79	0
21	Mining(1)	35	505,979	0.127	35	0
22	Utilities	481	592,152	1.488	158	323
23	Construction	2,230	6,683,553	0.611	0	2,230
31 – 33	Manufacturing	10,360	15,209,192	1.248	2,057	8,303
42	Wholesale Trade	5,166	5,617,456	1.685	2,099	3,067
44 – 45	Retail Trade	8,724	15,018,588	1.064	525	8,199
48 – 49	Transportation and Warehousing	12,855	3,989,116	5.903	10,677	2,178
51	Information	1,657	3,364,485	0.902	0	1,657
52	Finance and Insurance	4,506	5,678,156	1.454	1,406	3,100
53	Real Estate and Rental and Leasing	934	2,028,109	0.844	0	934
54	Professional, Scientific, and Technical Services	1,341	6,654,743	0.369	0	1,341
55	Management of Companies and Enterprises	995	1,695,554	1.075	69	926
56	Administrative and Support and Waste Mgm.	4,233	7,589,300	1.022	90	4,143
61	Educational Services	267	1,951,003	0.251	0	267
62	Health Care and Social Assistance	2,897	13,395,715	0.396	0	2,897
71	Arts, Entertainment, and Recreation	489	1,798,621	0.498	0	489
72	Accommodation and Food Services	5,821	10,197,329	1.046	254	5,567
81	Other Services (except Public Administration)	1,733	4,246,011	0.748	0	1,733
92	Federal Government(1)	1,161	2,758,627	0.771	1,161	0
92	State Government(1)	273	4,485,071	0.111	273	0
92	Local Government(1)	3,673	13,412,941	0.502	0	3,673
99	Unclassified	97	206,330	0.861	0	97

(1) assigned to either basic or nonbasice sector using the assumption approach

area's economic strengths, weaknesses, and opportunities for economic growth. Sometimes for small areas, however, data availability at the more detailed level (because of business confidentiality) becomes a limitation that hinders a more detailed economic analysis.

The presence of the larger Cincinnati / Northern Kentucky International Airport is reflected by a location quotient of 25.161 for the air transportation sub-sector (NAICS 481). Again, this highlights the significance of a more detailed analysis at the three-digit level of industrial classification. Such information is not available using the two-digit level of industrial classification where we cannot distinguish between transportation and warehousing (NAICS 48 – 49). The detailed classification helps explaining the presence of firms and businesses that clearly have a major contribution to the regional economy, such as the shopping mall in Florence and the Cincinnati / Northern Kentucky International Airport.

In the next step, the location quotient can then be used to calculate basic or excess employment for an industry *i* as:

$$b_i = \left(1 - \frac{1}{\mathrm{LQ}_i}\right) \cdot e_i \tag{4.39}$$

where,

b_i — area basic employment in industry *i*.

For instance, Boone County's basic employment in machinery manufacturing (NAICS 333) is calculated as

$$b_{\text{mach.mfg.}} = \left(1 - \frac{1}{2.316}\right) \times 1{,}545 = 878$$

Out of a total of 1,545 employed in machinery manufacturing, 878 persons work to produce exports. Using the location quotient to derive export employment for location quotients smaller than 1.0 results in negative employment figures. This can easily be shown by evaluating the term $1/\mathrm{LQ}_i$, which is larger than 1.0 for LQ's < 1.0. For example, the construction industry has a location quotient of less than 1.0. Using the basic employment calculation results in:

$$b_{\text{construction}} = \left(1 - \frac{1}{0.611}\right) \times 2{,}230 = -1{,}420$$

Negative employment does not really mean anything in this context, but one could interpret the negative employment figure as the number of workers needed in industry *i* (e.g., the example construction) to become self-sufficient; or to have a location quotient of exactly 1.0. In the example of Boone County, we have left out all basic employment calculations for industries with location quotients of less than 1.0.

Estimation of basic employment

Regional employment in industry *i* is the sum of basic and non-basic employment, or:

$$e_i = b_i + n_i \tag{4.40}$$

Defining self-sufficiency by comparing a region's economy with that of the nation, we can describe non-basic employment in industry *i* as:

$$n_i = \left(\frac{E_i}{E}\right) \cdot e \tag{4.41}$$

Where (E_i / E) is the share of industry *i* in national employment; a measure to define self-sufficiency in industry *i*. Substituting Eq. (4.41) into Eq. (4.40) then results in an expression that allows us to calculate basic employment without using location quotients:

$$b_i = e_i - \left(\frac{E_i}{E} \cdot e\right) \tag{4.42}$$

Dividing both sides of the equation by E_i and rearranging the equation allows us to calculate export employment without using location quotients:

$$\frac{b_i}{E_i} = \frac{e_i}{E_i} - \left(\frac{E_i}{E} \cdot \frac{e}{E_i}\right) \tag{4.43}$$

$$b_i = \left(\frac{e_i}{E_i} - \frac{e}{E}\right) \cdot E_i \tag{4.44}$$

This term can be rearranged further:

$$b_i = \left(\frac{e_i \cdot E_i}{E_i} - \frac{e \cdot E_i}{E}\right) = \left(1 - \frac{e \cdot E_i}{e_i \cdot E}\right) \cdot e_i = \left(1 - \frac{1}{\mathrm{LQ}_i}\right) \cdot e_i \tag{4.45}$$

Bringing it all together in one step, we thus can write:

$$n_i = \left(\frac{E_i}{E}\right) \cdot e \;\Rightarrow\; for\ n_i = e_i \;\Rightarrow\; \mathrm{LQ}_i = 1.0 \;\Rightarrow\; \left(\frac{e_i}{e}\right) = \left(\frac{E_i}{E}\right) \tag{4.46}$$

Dividing both sides of the equation again gives us the expression of the location quotient:

$$\left[\left(\frac{e_i}{e}\right) \Big/ \left(\frac{E_i}{E}\right)\right] = 1.0 = \mathrm{LQ}_i \tag{4.47}$$

Once we understand how the location quotient is derived and how it can be used to calculate basic employment in industry *i*, the assumptions and shortcomings of the economic base techniques are easy to understand.①

But before we discuss the assumptions of the location quotient approach, let us rewrite the location quotient formula as:

$$\mathrm{LQ}_i = \left(\frac{e_i}{e}\right) \Big/ \left(\frac{E_i}{E}\right) = \left(\frac{e_i}{E_i}\right) \Big/ \left(\frac{e}{E}\right) \tag{4.48}$$

Rearranging the location quotient formula allows us to define the region's consumption and production shares. The consumption share (e/E) is expressed as the region's proportion of total national employment; the production share (e_i/E_i) is determined as the region's proportion of national employment in industry *i*. We now can conclude that the region is exporting its excess production if the production share exceeds the consumption share, or $(e_i/E_i) > (e/E)$. Analogously, the region must import if its production share falls short relative to the consumption share, or $(e_i/E_i) < (e/E)$. Identifying consumption and production shares will help us understand the assumptions and shortcomings of the location quotient approach and modification suggestions. In the remainder of this section, we will focus on the assumptions imbedded in the location quotient method and we will see how these assumptions affect the magnitude of the LQ and, thus, the calculated level of regional basic employment. The necessary information needed to modify the locations quotients in the examples is listed in Table 4.10.

Table 4.10 Additional information of Modification of the Location Quotient Method, Boone County, KY(1)

	Boone County	The Nation
Employment in 2002		
Employment in Information Sector	1,657	3,364,485
Total Employment	70,007	128,233,921
Personal Income in 2001 (thousands of dollar)	2,702,447	8,677,490,000
Wages in 2002 (thousands of dollar)		
Wages in Information Sector	59,580	188,758,526
Total Wages	2,514,100	4,714,374,741

(1) Sources: Bureau of Economic Analysis, CA05N data series; Bureau of Labor Statistics, quarterly census of employment and wages.

① Tiebout (1962) criticized the shortcomings already in much detail in his *The Community Economic Base Study*, p.48.

4.5.3.2 Assumptions and Limitations of Location Quotients

Assumption 1: Constant consumption pattern assumption

Defining the regional consumption share as e/E—the region's proportion of total national employment—implies that employees (used as a surrogate for consumers) in both the region and the nation exhibit equal consumption behavior. It simply means that the demand for health care services, going to movies, buying CDs, or going out for dinner is identical in the study region (Boone County) and the benchmark region (the nation).

This is intuitively flawed; for example, as we would expect a region in Florida, with a large percentage of retirees to have a higher demand for health care services than the nation as a whole. On the other hand, we might expect the same Florida region to exhibit a lower demand for primary education than that of the nation. Regional differences in consumption patterns become even more obvious by considering where people go scuba diving, sailing, or winter skiing. There are more cross-county skiers in Vail, Colorado (a mountain resort area) than on the Keys in Florida (an area of island beach resorts). We would, therefore, assume that the demand for winter sport accessories would be higher in Colorado than in Florida. Alternatively, the number of persons owning a yacht is larger in Florida than in Colorado. Furthermore, wealth is not distributed evenly across the nation. Richer counties, such as suburban Westchester, New York outside of New York, City, probably have a higher demand for luxury items, such as jewelry or 42 inch plasma TVs, than the rest of the nation.

These examples clearly show that the demand for goods and services is area-specific and assuming an equal consumption pattern between a study region and its benchmark region is a potential source for errors. While there is no clear-cut solution for this issue, the literature[①] recommends replacing employment data with income data to estimate the consumption share in the location quotient formula:

$$e/E \Rightarrow y/Y \tag{4.49}$$

where, y and Y are regional and national income by industry respectively. The rationale is that consumption is better reflected through income than through employment data. Rewriting the initial location quotient definition by using personal income, we can recalculate Boone County's information location quotient (LQ_{inf}) as:

$$LQ_{inf} = \left(\frac{e_{inf}}{y}\right) \Big/ \left(\frac{E_{inf}}{Y}\right) = \left(\frac{1,657}{2,702,447}\right) \Big/ \left(\frac{3,364,485}{8,677,490,000}\right) = 1.581 \tag{4.50}$$

① Klosterman, 1990, *Community Analysis and Planning Techniques*, p. 138.

which clearly differs from the purely employment-based location quotient of 0.902 (see Table 4.8), which is below the level of self-sufficiency. However, using income-based location quotient, Boone County now appears to be specialized in providing information services and exporting excess capacities.

Assumption 2: Constant labor productivity assumption

The production share term e_i / E_i in the rearranged location quotient formula implies equal labor productivity—defined as the ratio of total output over the number of workers or the number of hours worked—across regions. For example, we can read this as one food service industry worker in Boone County generates the same amount of output as a worker does in any part of the nation. This is just never the case as. The output of the food service industry depends largely on the region's wealth, the attractiveness of the region as a tourist destination, and the level of automation. Restaurants, for example, may wash their dishes by hand or use largely automated dish washers. Output is the same, namely clean dishes. But, the labor productivity (output per worker) is different for labor intensive versus capital intensive production. Again, the location quotient approach can be refined. Here, we are substituting earnings data (w) for employment data:①

$$e_i / E_i \Rightarrow w_i / W_i \tag{4.51}$$

By doing so, we are taking for granted that the level of regional earnings is a better reflector of regional labor productivity than employment. Remember that wages and salaries are a large component of regional earnings. In the following example of Boone County, we substitute the industry-specific employment through the industry's total annual wages implying that regional labor productivity is reflected in regional wage rates:

$$\mathrm{LQ}_{\inf} = \left(\frac{w_{\inf}}{y}\right) \Big/ \left(\frac{W_{\inf}}{Y}\right) = \left(\frac{59,580}{2,702,447}\right) \Big/ \left(\frac{188,758,526}{8,677,490,000}\right) = 1.014 \tag{4.52}$$

It turns out that the location quotient for information in Boone County changes again significantly. The location quotient is now 1.014, indicating that the county is self-sufficient with respect to information services.

Another approach of addressing the labor productivity assumption listed in the literature② is by using an industry-specific value added③ parameter (v_i):

① Schaffer, 1999, *Regional Impact Models*, p. 10.

② Issermann (1977), *The Location Quotient Approach to Estimating Regional Economic Impacts*, p. 38.

③ Value added is defined as the value of a firm's output minus all the intermediate inputs purchased from other firms. It contains wages, interest, rent, profits, and indirect taxes.

$$e_i / E_i \Rightarrow v_i(e_i / E_i) \tag{4.53}$$

where v_i is calculated as the sector's regional value added over its national value added. The idea is the same as before where we have replaced employment with earnings (e.g., using annual wages). Wages and salaries, which at least for labor-intensive industries is the largest contributor to value added, are a better way of accounting for regional labor productivity than employment.

For both adjustments, the presumption is that regional wage rates reflect regional labor productivity. However, this is arguable as regional wage rates are also determined by regional differences in the cost-of-living. For instance, corresponding wage rates will reflect the higher cost of living in New York City as compared to Flagstaff, Arizona. Therefore, a university professor in New York City is likely to earn more than her colleague in Flagstaff so that she may afford the same standard of living. Now decide for yourself, is it appropriate to conclude that the professor in New York City is much more productive than her colleague in Flagstaff based on the difference in salaries?

Assumption 3: No cross-hauling

Cross-hauling describes the fact that a region simultaneously exports and imports the same goods and services. Obviously, some people in Detroit, home to General Motors, Chrysler and Ford headquarters, are driving Japanese, and German and other imported cars. Thus, we can conclude that, while Detroit exports its excess production of cars, it imports cars to meet local consumer preferences at the same time.

The location quotient approach assumes that local demand is met first through local production. The region is assumed to import only if the region falls short of meeting all regional demand. Excess capacities are exported after all regional demand is satisfied through regional production. While conceptually straight forward, there is little that can be done to offset the cross-hauling effects. In every industry sector where cross-hauling is common—basically all sectors that are not solely focusing on local demand—exports are underestimated and so is the level of regional basic activities. A common alternative is to do the economic base analysis using a more detailed level of industrial classification. The idea is that a higher level of disaggregation (e.g., four-, five-, or six-digit NAICS code) partly counterbalances for the possibility that exports and imports cancel at a highly aggregated level of (e.g., two- digit NAICS code). A good example to demonstrate this "offsetting effect" is the retail industry in Boone County (Table 4.11).

At the two-digit level, retail trade in Boone County has a location quotient of 1.064. The region seems to be self-sufficient in that its residents purchase all goods and services offered by retailers locally. Additionally, basic employment

Table 4.11 Retail Trade, Boone County, KY

NAICS Code	2002 NAICS Title	Area Employment (e_i)	US Employment (E_i)	Location Quotient (LQ_i)	Basic Employment (b_i)	Non-basic Employment (n_i)
44 – 45	Retail Trade	8,724	15,018,588	1.064	525	8,199
445	Food and Beverage Stores	1,114	2,869,978	0.711	0	1,114
452	General Merchandise Stores	2,312	2,814,249	1.505	776	1,536

of 525 persons is possible as nonresidents, e.g., people out-of-town, shop Boone County's retail stores as well.

At the three-digit level, it is a completely different story. Boone County is specialized in General Merchandise Stores (NAICS 452). The majority of employees fall into the non-basic employment category with a total of 1,536 workers. The remaining 776 employees are counted under basic employment serving non-residents who like to shop in Boone County. At the same time, Boone County falls short of meeting the local demand for food and beverage stores, as the LQ of 0.711 indicates. This example illustrates the method's dependency on the degree of aggregation of the data.

At the two-digit level of industry classification, Boone County has a basic employment of 525; while at the three-digit level, basic employment in the General Merchandise Store sub-sector augments basic employment to 776. This is an increase of 47.8% by only considering these two selected sub-sectors. Accounting for all seven sub-sectors of Retail Trade listed in Table 4.8 would further increase basic employment. By doing this across all industry sectors for the county, you would find that basic employment figures are highly underestimated, which in return inflates the economic base multiplier.

Assumption 4: Self-sufficiency of the benchmark region

So far we have assumed that the benchmark region, e.g., the nation, is self-sufficient. This implies that the benchmark region consumes all of what is being produced and neither exports nor imports. Therefore, net national exports—determined as exports minus imports—for any industry sector is assumed to be zero. But we all know that this is rarely the case, particularly for manufacturing industries. Consider, for example, that there are few places on this planet where we are not able to get a McDonald's Hamburger and a can of Coca Cola. There are many other industry sectors that simultaneously export and import internationally, e.g., cross-hauling. A good example is automobile manufacturing. People all over the world drive American cars as well as domestically produced

autos. Many Americans also prefer imported cars, such as Mercedes and Porsche over Chevrolet and Lincoln. This leads to both an underestimation of basic employment in the nation and an overestimation of national non-basic employment.

But what does this imply for the location quotient approach? The Printing Industry in the nation (NAICS 323) is a net exporter of its product, which is indicated by the fact that its exports exceed its imports.① With part of the industry's output being sold overseas, many workers in printing are engaged in international export production, which in return overestimates the denominator E_{pr} / E in the location quotient formula:

$$\text{LQ}_{\text{pr}} = \left(\frac{e_{\text{pr}}}{e} \right) \Big/ \left(\frac{E_{\text{pr}}}{E} \right) \tag{4.54}$$

Note that for the purposes of calculating regional industry's location quotient, we assume that the benchmark region is self-sufficient in that sector and that we count only employment for national domestic consumption. But because national employment in printing (E_{pr}) includes both, non-basic and basic (international employment) employee, this overstates national employment in printing (E_{pr}). As a result, the denominator (E_{pr} / E) increases, causing the location quotient (LQ_{pr}) to decrease. The bottom line here is that in the case of the printing industry, its national employment share is overestimated leading to an underestimation of regional basic employment in the industry.

To demonstrate the impacts of exporting and importing, we have selected two manufacturing industries from Boone County, namely printing and related support activities (NAICS 323) and plastic and rubber products manufacturing (NAICS 326). For simplicity in remainder of this subsection, we will call these two sectors printing and rubber/plastic. Data on these sectors' net export values and values of shipments are available through the International Trade Administration (ITA) of the U.S. Department of Commerce (www.ita.doc.gov). These trade data are compatible with the employment data as they were tabulated following the NAICS concordance and are available down to the six-digit level. Value of shipments② covers the received net selling values free of board (f.o.b.) of all products shipped. The data and the adjusted employment figures are listed in Table 4.12.

① Source: International Trade Administration (ITA).

② Source: http://quickfacts.census.gov/qfd/meta/long_58619.htm.

Table 4.12 National employment export adjustments(1)

NAICS Code	2002 NAICS Title	US Employment (E_i)	US Net Exports (million $)	Value of Shipments (million $)	US Non-basic Employment (Non-basic $-E_i$)	US Basic Employment (Basic $-E_i$)
323	Printing and Related Support Activities	707,566	724	100,792	702,483	5,083
326	Plastics and Rubber Products Manufacturing	846,766	− 1,142	170,717	852,430	− 5,664

(1) Source: http://www.ita.doc.gov/td/industry/otea/industry_sector/tables_naics.htm.

One possible approach of addressing the self-sufficiency assumption of the benchmark region is to break down national employment in industry *i* into its basic and non-basic components:①

$$E_i = E_i^{\text{basic}} + E_i^{\text{non-basic}} \tag{4.55}$$

Knowing the export volume of an industry sector will allow us at least to estimate the sector's basic and non-basic activities (e.g., employment). In return we can adjust the national employment in industry *i* (E_i) by replacing it through the estimated non-basic national employment in this industry *i*.

$$E_i \Rightarrow E_i^{\text{non-basic}} \tag{4.56}$$

Using the example of printing activities, we adjust national employment in printing (E_{pr}) as follows:

$$\begin{aligned} E_{\text{pr}}^{\text{basic}} &= \left(E_{\text{pr}} \cdot \frac{\text{net export in printing}}{\text{value of shipments in printing}} \right) \\ &= \left(707,566 \times \frac{724}{100,792} \right) \\ &= 5,083 \end{aligned} \tag{4.57}$$

$$\begin{aligned} E_{\text{pr}}^{\text{non-basic}} &= E_{\text{pr}} - E_{\text{pr}}^{\text{basic}} \\ &= 707,566 - 5,083 \\ &= 702,483 \end{aligned} \tag{4.58}$$

In this context, net export's share of total industry shipments gives us an approximation of how many persons are employed in the basic sector for the nation. Therefore, basic national employment in printing is estimated as total national employment in printing times the ratio of net export over value of shipments. The result indicates that 5,083 persons employed by the printing industry work for

① Klosterman, *Community Analysis and Planning Techniques*, p. 140.

export markets. We then subtract basic employment form national employment in printing (E_{pr}) and get the non-basic employment of 702,483.

Finally, we can adjust the location quotient for printing in Boone County (LQ_{pr}) by replacing national employment in printing (E_{pr}) with national non-basic employment in printing $(E_{pr}^{\text{non-basic}})$:

$$\mathrm{LQ}_{pr} = \left(\frac{e_{pr}}{e}\right) \Big/ \left(\frac{E_{pr}^{\text{non-basic}}}{E}\right) = \left(\frac{935}{70,007}\right) \Big/ \left(\frac{702,483}{128,233,921}\right) = 2.438 \qquad (4.59)$$

As a result, the location quotient in Boone County increases from 2.421 (see Table 4.8) to 2.438, which in return will increase the printing sector's basic employment. The absolute change of 0.017 (0.7%) comes from the fact that a small portion of the value of shipments is exported (i.e., net export). The larger the share of net exports of the value of shipments, the larger the expected change in the location quotient and vice versa.

We conclude this section with three more remarks. First, net export data, as used in the example, are available for manufacturing-related activities only. The reason is that most service-related activities are predominantly oriented towards the national market. For instance, Americans buy computers, clothing, and food items from China, but Americans will have a hard time buying health care or warehousing in China. Some exceptions to this more general rule are that communication, utilities, finance, and insurance services are traded to some extent between the United States and Canada. Some services in the United States are increasingly provided offshore by places like India, for instance, costumer services by phone.

Second, in the case of a negative net export value—where imports exceed exports for an industry sector—the change in location quotient is the opposite of the above example. Conceptually, this means that nationwide there is not enough employment in industry *i* (E_i) to satisfy all demand, which understates national employment in industry *i* (E_i). In return this overestimates regional basic employment and inflates the location quotient in industry *i*. The plastic/rubber industry included in Table 4.12 is an example of an industry with a negative net export (e.g., − 1,142). The location quotient (LQ_{pl}) adjustment for plastic/rubber can be recalculated as:

$$\mathrm{LQ}_{pl} = \left(\frac{e_{pl}}{e}\right) \Big/ \left(\frac{E_{pl}^{\text{non-basic}}}{E}\right) = \left(\frac{1,770}{70,007}\right) \Big/ \left(\frac{852,430}{128,233,921}\right) = 3.803$$

resulting in a decrease in the LQ_{pl} from 3.829 to 3.803. As you can see, the direction of change for values of negative net exports is just the opposite of the

change for values of positive net exports.

Finally, the four adjustment procedures we have discussed can be applied individually or cumulatively. For instance, using a more detailed level of industrial classification already increases the accuracy of the basic employment estimation. However, probably due to the tremendous increase in data requirements and computational complexity; in practice, few adjustments are actually applied to basic employment estimation.

The benchmark region caveat

An additional issue of which to be aware is the importance of the choice of benchmark region on the outcome of any economic base analysis. This choice defines the denominator in the location quotient formula, and, therefore, has a large impact on the magnitude of the location quotient and on the level of basic employment. To demonstrate this, we calculated the LQs for manufacturing in Boone County using (1) the Nation and (2) Kentucky as benchmark regions. The results are summarized in Table 4.13.

Table 4.13 Location quotient comparison by using alternative benchmark regions

	Boone County	Kentucky	The Nation
Manufacturing Employment	10,360	275,466	15,209,192
Total Employment	70,007	1,717,978	128,233,921
Location Quotients	–	0.923	1.248

Using the nation as benchmark region, the location quotient for manufacturing (LQ_{mfg}) is calculates as:

$$LQ_{mfg} = \frac{10,360/70,007}{15,209,192/128,233,921} = 1.248$$

The alternative use of Kentucky as the benchmark region significantly alters the location quotient as the example below shows:

$$LQ_{mfg} = \frac{10,360/70,007}{275,466/1,717,978} = 0.923$$

As this particular case demonstrates, the choice of the benchmark region has a significant impact on the outcome for the location quotient. In particular, using the nation as the reference region, Boone County appears to be specialized in manufacturing with excess production assumed to be exported. Choosing Kentucky as reference region alters the outcome. In this case, Boone County appears not to be self-sufficient in manufacturing products and we would conclude that the county needs to import manufacturing products in order to meet local demand.

Despite the shortcomings of location quotients, they are still widely used simply because they are conceptually easy to understand, simple to apply, and require a minimum of time and effort to find the appropriate data. However, their ease in use can lead to tremendous misinterpretations and one must critically evaluate all calculated location quotients. In order to avoid the embarrassment of presenting erroneous location quotients, combining the assumption and the location quotient method can help identifying conceptual errors. Some industry sectors are more easily and accurately assessed using the assumption method as they clearly serve either the regional or nonregional markets. Regardless of the outcome of the location quotient method, adjustments should be made based on your specific knowledge of the local industry. Among others, sectors that are often pre-specified as either purely basic or non-basic are:

local government = non-basic.

state and federal governments = basic.

hotel and lodging = basic; but local conventions, weddings, flower shows, and other local events may be partly considered non-basic activities.

real estate = non-basic; but high growth areas may have location quotients greater than one.

construction = non-basic; but area's with a larger population growth than observed nationwide can have location quotients greater than one.

food services and drinking places = non-basic; but predominantly tourist areas (e.g., Orlando, Florida) can be more basic than non-basic activities.

tourist industry = basic; but tourist locations also attract local visitors.

The exact assignment of employment to either basic or non-basic activites depends much on your common sense. In the case of local governments it is probably not difficult to imagine that they serve only their local residents. On the other hand, you will not stay in a hotel in your hometown while your apartment is next door. Thus, hotel and lodging are usually entirely basic activities. More difficult is the task for food services and drinking places. Generally, we would assume that they serve primarily local customers. You most certainly will not open a restaurant targeting people out of town. However, there are some clear cases where the food services and drinking places can have a large basic component. Orlando, Florida, is one of the cities that mainly lives off of tourism. Assigning all food services and drinking places to the non-basic sector would lead to underestimate basic activities in Orlando. Another example would be Ithaca, New York, a small town with a large out of town student body attending Cornell University. There are a large number of restaurants and bars in the college town next to campus. Although the students live in Ithaca, many of them receive supported from their parents, with the money coming from outside of the town. Thus, some of the restaurants and bars may be classified as basic activities.

We conclude this section with the understanding that location quotients are still very popular among planners as they allow a quick and inexpensive assessment

of an area's economic strengths and weaknesses and opportunities for further economic growth. A solid knowledge of a region's economy and on-site interviews can help to improve the location quotient method and avoid drawing incorrect conclusions.

4.5.4 Minimum Requirement Method

The minimum requirement (MR) method, first introduced by Ullman and Dacey in 1960[①], is very similar conceptually to the location quotient method. Rather than comparing a study region to the national or state economy, the minimum requirement method compares the study region to **a set of similar comparison regions**. Using employment as an example, the minimum requirement method compares a study region's employment shares for industry i (e_i / e) to the employment shares for the same industry i of a whole set of similar regions, based on a variety of selection criteria. Using selection criteria guarantees that these selected regions are suitable for serving as comparison regions.

In the example, we have selected comparison counties using the following criteria:

(1) They must be comparable in population size to the study region, Boone County;

(2) They must be part of a larger metropolitan statistical area and, therefore, exhibit some urban characteristics;

(3) They must be located in the Midwest.

Following the selection criteria, we have identified six counties that we will use for comparison with Boone County to demonstrate the minimum requirement method. There is no specification for the number of areas needed for an adequate comparison. The general rule is: the more the better. Tiebout[②] lists this number as 100, but also mentions that this increases the possibility of including some mavericks—counties that exhibit some unusual economic patterns because of peculiar regional circumstances.

The minimum requirement method works as follows:

(1) select several similar regions for comparison using a set of selection criteria (e.g., population size, location, part of a metropolitan statistical area, etc.).

(2) calculate all industry sector's employment shares for the study region (e_i / e) and all comparison regions (E_i / E).

(3) identify the smallest industry employment share for each industry

① Edward Ullman and Michael Dacey. 1960. The minimum requirements approach to the urban economic base. In: *Papers and Proceedings, Regional Science Association* 6, pp. 175 – 194.

② Tiebout, 1962, *The community economic base study*, p. 50.

i ($E_i^{\min} / E^{\min}$) among all regions, including the study region. The smallest industry employment share for each industry i ($E_i^{\min} / E^{\min}$) determines the level of non-basic employment (n_i) required to satisfy local demand for any of these regions.

(4) compute basic sector employment (b_i) for the study region by using each industry's minimum share ($E_i^{\min} / E^{\min}$) in the formula:

$$b_i = \left[\left(\frac{e_i}{e} \right) - \left(\frac{E_i^{\min}}{E^{\min}} \right) \right] \cdot e \tag{4.60}$$

The similarity of the minimum requirement and the location quotient methods can be seen by writing the location quotient (LQ_i) using minimum employment shares ($E_i^{\min} / E^{\min}$) rather than national employment:

$$\mathrm{LQ}_i^{\mathrm{MR}} = \left(\frac{e_i}{e} \right) \Big/ \left(\frac{E_i^{\min}}{E^{\min}} \right) \tag{4.61}$$

It is important to note that the employment ratio in the denominator ($E_i^{\min} / E^{\min}$) now refers to the region with the smallest employment share for that particular industry i and not to the nation or state as usually done in the location quotient approach. The identified "minimum shares" region produces just enough goods and services to meet local demand and as such does not export. In general, there are two possible outcomes:

(1) The study region is the "minimum employment shares region", such that:

$$\left(\frac{e_i}{e} \right) = \left(\frac{E_i^{\min}}{E^{\min}} \right)$$

Therefore, there is no basic employment (b_i) in industry sector i in the study region. Under these circumstances, the location quotient equals one ($\mathrm{LQ}_i^{\mathrm{MR}} = 1$), indicating that the study region is self-sufficient but has no excess production of i for export.

(2) The minimum employment shares region for industry i is identified as one of the selected comparison regions, or $\left(\frac{e_i}{e} \right) > \left(\frac{E_i^{\min}}{E^{\min}} \right)$.

Our study region will have some basic employment (b_i), and the location quotient ($\mathrm{LQ}_i^{\mathrm{MR}}$) will be greater than one.

Computationally, the minimum requirement method is easy to perform.

However, studies with large numbers of comparison regions create additional challenges. Imagine identifying dozens of comparison regions and collecting all the necessary employment data for each. For the purpose of demonstrating the minimum requirement approach, we compare Boone County with six selected counties in Kentucky, Indiana, and West Virginia. The selected counties are:

Campbell County, KY Hardin County, KY
Daviess, County, KY Clark County, IN
Warren, County, KY Cabell County, WV

As indicated in Table 4.14, all comparison region counties meet the above selection criteria—they are of similar population size, are part of a metropolitan statistical area, and are located in the Midwest United States. Table 4.14 further contains all employment data used for calculating the minimum employment shares. Unfortunately, in some counties employment figures are not disclosed for reasons of confidentiality (indicated as "D"), but are included in total county employment numbers.

Having identified counties for comparison, in the next step, we calculate the employment shares for all industries: for Boone County (e_i / e) and for all comparison counties (E_i / E). Employment shares are simply the ratio of industry employment (e_i and E_i) over total employment (e and E) in a county. All employment shares are listed in Table 4.15. For instance, Clark County's information sector's (NAICS 51) employment share is calculated as:

$$\frac{E_i}{E} = \frac{85}{15{,}190} = 0.0056$$

Next, for each industry *i*, we identify the smallest industry employment share ($E_i^{\min} / E^{\min}$), or the smallest number in a row. All minimum employment shares are highlighted in Table 4.15. For instance, the minimum employment share for retail trade belongs to Clark County at 0.1223 (1,857/15,190). We can interpret this minimum employment share as follows: for any of the counties listed in Table 4.15, a minimum of 12.23 percent of all employees are required to work in retail trade to meet local demand in any of these counties. Employees beyond this minimum employment share are assumed to serve non-regional customers and are therefore classified as basic employment. For Boone County, where 12.46 percent of the workforce is employed by retail trade, 12.23 percent are therefore assumed to be required for regional (non-basic) customers, while the remaining 0.23 percent serve non-regional (basic) customers.

The minimum employment shares for each industry *i* ($E_i^{\min} / E^{\min}$) are listed in Table 4.16. They allow us to calculate the level of basic employment (b_i) for the study region. For the calculation of basic employment in Boone County we

Table 4.14 Employment by major industries—Boone County and comparison regions, 2002[1]

County		Boone	Campbell	Hardin	Daviess	Warren	Clark	Cabell
MSA,state		Cincinnati, OH-KY-IN	Cincinnati, OH-KY-IN	Elizabeth-town, KY	Owensboro, KY	Bowling Greene, KY	Louisville, KY-IN	Huntington-Ashland, WV-KY-OH
July 1, 2002 Pop Estimate		93,290	88,604	95,724	91,694	94,730	98,198	95,266
NAICS Code	Industry Sector							
11	Agriculture, Forestry, Fishing and Hunting	79	(D)	(D)	114	64	(D)	22
21	Mining	35	(D)	(D)	131	171	(D)	48
22	Utilities	481	(D)	(D)	(D)	(D)	41	305
23	Construction	2,230	1,376	1,557	2,743	2,559	1,817	2,099
31 – 33	Manufacturing	10,360	2,975	6,258	6,159	8,619	2,007	5,046
42	Wholesale Trade	5,166	888	910	1,812	1,749	769	2,163
44 – 45	Retail Trade	8,724	3,727	5,399	5,639	6,829	1,857	6,975
48 – 49	Transportation and Warehousing	12,855	(D)	(D)	(D)	(D)	911	636
51	Information	1,657	261	749	552	619	85	910
52	Finance and Insurance	4,506	458	1,229	1,574	1,446	328	2,214
53	Real Estate and Rental and Leasing	934	507	440	430	540	154	667
54	Professional, Scientific, and Technical Services	1,341	955	983	(D)	1,191	409	1,931
55	Management of Companies and Enterprises	995	249	121	(D)	1,320	18	154
56	Administrative and Support and Waste Mgm.	4,233	988	1,557	1,743	2,301	889	3,491
61	Educational Services	267	94	98	401	130	22	196
62	Health Care and Social Assistance	2,897	3,380	3,311	3,771	5,812	1,208	9,540
71	Arts, Entertainment, and Recreation	489	365	160	316	300	238	281
72	Accommodation and Food Services	5,821	3,485	3,247	3,379	4,653	1,294	4,918
81	Other Services (except Public Administration)	1,733	906	1,116	1,292	1,099	411	1,722
92	Public Administration Total	5,107	5,166	10,620	7,999	8,122	2,476	7,083
92	Federal Government	1,161	308	4,534	301	789	102	1,118
92	State Government	273	2,017	1,123	1,062	3,537	70	2,629
92	Local Government	3,673	2,841	4,963	6,636	3,796	2,304	3,336
99	Unclassified	97	27	19	12	16	5	10
Total Employment		70,007	26,371	38,814	40,937	49,166	15,190	50,411

(1) Data: Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW).

Table 4.15 Employment shares by major industries – Boone County and comparison regions, 2002

County		Boone	Campbell	Hardin	Daviess	Warren	Clark	Cabell
MSA, State		Cincinnati, OH-KY-IN	Cincinnati, OH-KY-IN	Elizabeth-town, KY	Owensboro, KY	Bowling Greene, KY	Louisville, KY-IN	Huntington-Ashland, WV-KY-OH
NAICS Code	Industry Sector							
11	Agriculture, Forestry, Fishing and Hunting	0.0011	(D)	(D)	0.0028	0.0013	(D)	0.0004
21	Mining	0.0005	(D)	(D)	0.0032	0.0035	(D)	0.0010
22	Utilities	0.0069	(D)	(D)	(D)	(D)	0.0027	0.0061
23	Construction	0.0319	0.0522	0.0401	0.0670	0.0520	0.1196	0.0416
31 – 33	Manufacturing	0.1480	0.1128	0.1612	0.1505	0.1753	0.1321	0.1001
42	Wholesale Trade	0.0738	0.0337	0.0234	0.0443	0.0356	0.0506	0.0429
44 – 45	Retail Trade	0.1246	0.1413	0.1391	0.1377	0.1389	0.1223	0.1384
48 – 49	Transportation and Warehousing	0.1836	(D)	(D)	(D)	(D)	0.0600	0.0126
51	Information	0.0237	0.0099	0.0193	0.0135	0.0126	0.0056	0.0181
52	Finance and Insurance	0.0644	0.0174	0.0317	0.0384	0.0294	0.0216	0.0439
53	Real Estate and Rental and Leasing	0.0133	0.0192	0.0113	0.0105	0.0110	0.0101	0.0132
54	Professional, Scientific, and Technical Services	0.0192	0.0362	0.0253	(D)	0.0242	0.0269	0.0383
55	Management of Companies and Enterprises	0.0142	0.0094	0.0031	(D)	0.0268	0.0012	0.0031
56	Administrative and Support and Waste Mgm.	0.0605	0.0375	0.0401	0.0426	0.0468	0.0585	0.0693
61	Educational Services	0.0038	0.0036	0.0025	0.0098	0.0026	0.0014	0.0039
62	Health Care and Social Assistance	0.0414	0.1282	0.0853	0.0921	0.1182	0.0795	0.1892
71	Arts, Entertainment, and Recreation	0.0070	0.0138	0.0041	0.0077	0.0061	0.0157	0.0056
72	Accommodation and Food Services	0.0831	0.1322	0.0837	0.0825	0.0946	0.0852	0.0976
81	Other Services (except Public Administration)	0.0248	0.0344	0.0288	0.0316	0.0224	0.0271	0.0342
92	Public Administration Total	0.0729	0.1959	0.2736	0.1954	0.1652	0.1630	0.1405
92	Federal Government	0.0166	0.0117	0.1168	0.0074	0.0160	0.0067	0.0222
92	State Government	0.0039	0.0765	0.0289	0.0259	0.0719	0.0046	0.0522
92	Local Government	0.0525	0.1077	0.1279	0.1621	0.0772	0.1517	0.0662
99	Unclassified	0.0014	0.0010	0.0005	0.0003	0.0003	0.0003	0.0002
Total		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 4.16 Basic employment calculation—Boone County, KY, 2002

Boone County, KY, 2002		Regional Employment Share (e_i/e)	Minimum Employment Share (E_i^{min}/E^{min})	Total Employment (e_i)	Basic Employment (b_i)	Nonbasic Employment (n_i)
NAICS Code	Industry Sector					
11	Agriculture, Forestry, Fishing and Hunting	0.0011	0.0004	79	49	30
21	Mining	0.0005	0.0005	35	0	35
22	Utilities	0.0069	0.0027	481	294	187
23	Construction	0.0319	0.0319	2,230	0	2,230
31 – 33	Manufacturing	0.1480	0.1001	10,360	3,353	7,007
42	Wholesale Trade	0.0738	0.0234	5,166	3,528	1,638
44 – 45	Retail Trade	0.1246	0.1223	8,724	161	8,563
48 – 49	Transportation and Warehousing	0.1836	0.0126	12,855	11,971	884
51	Information	0.0237	0.0056	1,657	1,267	390
52	Finance and Insurance	0.0644	0.0174	4,506	3,290	1,216
53	Real Estate and Rental and Leasing	0.0133	0.0101	934	224	710
54	Professional, Scientific, and Technical Services	0.0192	0.0192	1,341	0	1,341
55	Management of Companies and Enterprises	0.0142	0.0012	995	910	85
56	Administrative and Support and Waste Mgm.	0.0605	0.0375	4,233	1,610	2,623
61	Educational Services	0.0038	0.0014	267	168	99
62	Health Care and Social Assistance	0.0414	0.0414	2,897	0	2,897
71	Arts, Entertainment, and Recreation	0.0070	0.0041	489	203	286
72	Accommodation and Food Services	0.0831	0.0825	5,821	42	5,779
81	Other Services (except Public Administration)	0.0248	0.0224	1,733	168	1,565
92	Public Administration Total	0.0729	0.0729	5,107	1,434	3,673
92	Federal Government	0.0166	0.0067	1,161	1,161	0
92	State Government	0.0039	0.0039	273	273	0
92	Local Government	0.0525	0.0525	3,673	0	3,673
99	Unclassified	0.0014	0.0002	97	84	13
Total				70,007	28,758	41,249

apply the formula:

$$b_i = \left[\left(\frac{e_i}{e} \right) - \left(\frac{E_i^{\min}}{E^{\min}} \right) \right] \cdot e \tag{4.60}$$

For example, basic employment in manufacturing (b_{mfg}—NAICS 31 – 33) for Boone County is calculated as:

$$b_{\text{mfg}} = (0.1480 - 0.1001) \times 70{,}007 = 3{,}353$$

All calculations can easily be carried out using spreadsheet software. However, attention must be paid to those sectors that are clearly (intuitively) either basic or non-basic. For Boone County, we classify federal and state governments as entirely basic, while local government is deemed an entirely non-basic activity. Understanding the region's economy prior to classifying what industry sectors might be either completely basic or non-basic helps to avoid incorrect assumptions. Altogether, based on the minimum requirement method, 28,758 employees of the total workforce of 70,007 employees in Boone County are classified as basic, while the remaining 41,249 employees serve in non-basic activites.

Like other methods described under the economic base analysis umbrella, the minimum requirement method has its shortcomings. The first and probably most significant criticism of the minimum requirement method is the absence of imports. Calculating basic employment (b_i) for industry *i* as:

$$b_i = \left[\left(\frac{e_i}{e} \right) - \left(\frac{E_i^{\min}}{E^{\min}} \right) \right] \cdot e \tag{4.60}$$

assumes that the study region never falls short of meeting local demand. In other words, the study region must never import goods and services. The minimum requirement approach allows only for two possible scenarios:

(1) $\left(\frac{e_i}{e} \right) = \left(\frac{E_i^{\min}}{E^{\min}} \right)$, which implies a location quotient (LQ_i) of exactly 1.0. The study region is just self-sufficient and neither exports nor imports.

(2) $\left(\frac{e_i}{e} \right) > \left(\frac{E_i^{\min}}{E^{\min}} \right)$, which results in a location quotient greater than 1.0. The study region therefore exports its excess production.

Technically, the minimum requirement method does not account for the possibility of a location quotient (LQ_i) of less than 1.0, the only scenario under which the study region must import to meet local demand.

Second, increasing the number of comparison regions and/or choosing a higher level of sector disaggregation inevitably decreases the magnitude of the

minimum shares, thereby increasing the level of exports or basic activities. The more regions are included among the comparison regions, the greater the possibility of including regions with almost no needs in certain industries. Without excluding the aberrant region's minimum shares from the analysis, we basically reduce local needs for that industry to almost zero and overemphasize other regions' export activities in that sector. Tiebout (1962), for instance, recommended excluding the lowest minimum share values from the analysis to avoid the fallacy resulting from regions with unusually low local demand for certain products.

Third, the minimum requirement method should not be done in isolation from other economic base methods. Combining it with the assumption method helps to avoid calculating basic employment for sectors that are clearly oriented towards local markets only (e.g., local government) and vice versa.

4.6 Evaluating Regional Economies Using the Economic Base Multiplier and Shift-Share Analysis

The last section of this chapter on economic base theory deals with its applicability for evaluating economic impacts and decomposition of economic changes. **Economic impact studies** usually assess regional economy changes in selected key variable, such as employment, income, or output, following an initial exogenous change. An example of an initial exogenous change, also referred to as an injection, exogenous inflow, or increase in basic activities, can be a local manufacturer receiving a lucrative contract that will significantly increase its export sales. The question in which economic developers are interested is how to estimate the total impact on, for instance, regional employment following a change in basic employment. The total impact on a region's employment exceeds the original impact—the change in basic employment. This effect—also referred to as **ripple-effect**—can be explained by the fact that an increase in export demand for a region's goods and services will create additional economic activities beyond the initial exogenous inflow of spending. For instance, for an industry *i* to increase its output it also requires an increase of its own inputs. And part of these new inputs will come from non-basic sectors, which support basic activities. Technically, the economic base multiplier is a ratio measuring the stimulus and the cumulative multiplier effect following the initial stimulus. In the case of employment, the employment multiplier measures the expected total employment change in the region following a change in basic employment. The multiplier thus accounts for two effects: the initial stimulus, or direct effect, and the multiplier, or indirect effect.[①]

① For the time being we use a more simplistic approach by dividing the total effect into direct and indirect effects. In the following chapter on input-output analyses we will revise this statement and account for as many as three effects, namely the direct, indirect, and induced effect.

4.6.1 The Economic Base Multiplier

The economic base model builds on the notion of an economic dichotomy. Every economy can be divided into two sectors: a basic sector which depends largely on conditions external to a study region and a non-basic sector which depends widely on conditions within the region. In a hypothetical framework consisting only of a basic sector and a non-basic sector, we assume that the basic sector is the driving force of the regional economy. Thus, increases in export activities will lead to economic development. From that, we can directly infer that the increases in basic activities ultimately lead to increases in non-basic activities and, therefore, to an overall increase of the region's economic activities.

For instance, an increase in export sales generates additional income—inflow of money—for the region. In return, part of this additional income is spent on regionally produced goods and services while the other part is spent on imports (e.g., leakages). The part of additional income spent locally, therefore, increases the level of regional economic activities, which in return generates new additional income, of which a part is again spent on regional goods and services and a part is spent on imports, and so on. This chain reaction of economic activities, the ripple-effect, following an exogenous injection is captured in its entity by the economic base multiplier. In this sense, the economic base multiplier is a measure of the entire level of economic activities following a stimulus in the regional basic sector. Whereby the magnitude of the economic base multiplier depends largely on the part of the (additional) income spent that remains within the region, which in return also depends directly on the leakage, i.e., the money leaving the region.

Using economic base multipliers is thus one way of estimating economy-wide impacts following an exogenous injection. In this section, we will in particular discuss the two most commonly used economic base multipliers: the employment multiplier and the income multiplier.

4.6.1.1 The Employment Multiplier

The employment multiplier (EM) is defined as the ratio of total employment (e) over basic employment (b) for a study region:

$$\text{EM} = \frac{e}{b} = \frac{\text{total employment}}{\text{basic employment}} \tag{4.62}$$

where,

$$e = \sum_i e_i \quad \text{and} \quad b = \sum_i b_i$$

All it requires to calculate the employment multiplier is to estimate aggregate basic employment (b). This can be done using the assumption, location

quotient, or minimum requirement method. For Boone County, Kentucky, using the location quotient method we have estimated total basic employment (b) as 24,478 (see Table 4.8). The employment multiplier (EM) for Boone County for the year 2002 can be calculated as:

$$\text{EM} = \frac{e}{b} = \frac{70,007}{24,478} = 2.86$$

We can read the multiplier as follows: an increase in basic employment due to an increase in export activities of 1 person will lead to a total increase in regional employment of 2.86 persons.

Although the multiplier is a single number, e.g., 2.86, it must be understood that it represents the ratio of total over basic employment. The multiplier is thus usable as a predictive tool for answering questions of the type: "**If... then…**". For example, what happens to total regional employment if basic employment in retail trade increases because of an expansion of the Florence shopping mall?

Based on the simple fact that total area employment (e) is the sum of basic (b) and non-basic employment (n), or:

$$e = b + n \tag{4.63}$$

we can rearrange and rewrite the multiplier notation using simple algebra. In return this will provide us with more ways to interpret the multiplier result. One alternative way of rearranging the multiplier notation is:

$$\text{EM} = \frac{e}{b} = \frac{b+n}{b} = 1 + \frac{n}{b} = 1 + 1.86 \tag{4.64}$$

The emphasis here is now on the distinction between direct and indirect effects. Clearly, the direct effect, or the initial change in basic employment, is represented by the ratio n/b, which equals one. This is not surprising, considering how we have defined the initial change in basic employment. If ten more retailers open stores at the Florence mall and create a total of 80 new jobs, all of which serve nonresidents, these 80 new jobs would thus represent the direct effect.

Therefore, after subtracting the direct effect from the total multiplier value, what remains must be the indirect effect, or the multiplier effect. It is expressed as the ratio of non-basic employment (n) over basic employment (b), or n/b. It accounts for all of additional employment that will be created in the region following the initial increase of basic employment. The magnitude of the multiplier effects, thus, clearly depends upon the ratio of non-basic over basic employment. For the example of the 80 new basic retail jobs in the Florence mall it would imply that an additional 149 jobs would be created (e.g., $80 \times 1.86 = 149$).

Tiebout showed how the ratio of non-basic over total area employment (n/e)—which in the Keynesian framework refers to the marginal propensity to

consume (mpc) —can be used to express the economic base multiplier. In the case of Boone County's 2002 employment multiplier, we can rearrange the multiplier definition using employment as

$$\mathrm{EM} = \frac{e}{b} = \frac{1}{b/e} = \frac{1}{\frac{e-n}{e}} = \frac{1}{1-\frac{n}{e}} = \frac{1}{1-\mathrm{mpc}} = \frac{1}{1-0.65} = 2.86 \qquad (4.65)$$

Here, the ratio of non-basic employment to total employment (n/e) is the equivalent to the marginal propensity to consume locally produced goods (mpp), the economic base equivalent of the Keynesian marginal propensity to consume (mpc). Considering that the consumption of locally produced commodities is a non-basic activity, the ratio of non-basic over basic employment can be used as a proxy for the marginal propensity to consume locally produced goods (mpp). The outcome must, however, be the same as before. And in the case of Boone County, the employment multiplier indeed equals 2.86.

Multipliers may change from year to year. We used data from one single year, namely 2002 in the calculation, therefore the multiplier refers to that particular point in time. For past and present years where data are readily available, we must recalculate basic multipliers for each year. The more challenging task, however, is to answer so-called "if ... then ..." questions, which often involves future projections.

So far, we have repeatedly stated that the employment multiplier is the ratio of total over basic employment. Knowing the employment multiplier therefore means having, to some extent, knowledge of the regional economic structure, namely, how much employment is dependent on export demand versus how much employment serves local consumption. Consequently, projecting future employment using economic base multipliers calculated from historic employment data explicitly assumes that the future economic structure of an area's economy remains unchanged. For short-term projections this assumption is quite reasonable as it takes usually several years for the whole economic structure to respond a change. For example, increasing basic retail employment in the Florence mall by 80 employees will not lead to a total employment increase of 229 jobs in the county within a few months. It will take time for the newly generated income to be re-spent locally and, in return, increase the need for more employment. Evaluating changes in total employment (Δe) following changes in basic employment (Δb) is thus one possible practical application of the employment multiplier.[①] Alternatively and in particular for regions demonstrating fast economic changes—for instance, fast employment growth—simple regression

① Klosterman (1990) also demonstrates how to estimate basic employment for long-term total employment projections using the constant-share method and an invariant historical multiplier (p. 189).

analysis provides the means to project the employment multiplier into the near future based on a series of historic employment multipliers.① Either way, we make assumptions about the future structure of the region under study as we choose an invariant employment multiplier or historic employment multipliers.

Having referred to the problem of time in economic base analysis, we want to conclude this discussion by emphasizing that the employment multiplier notation used in this section does not include a time reference for two simple reasons: first, it keeps the notations simpler, and second we explicitly stated that the multiplier refers only to the year for which it is been calculated.② For instance, the Boone County employment multiplier is for the year 2002 as we have used 2002 employment data to calculate it. The explicit conclusion from that is that the multiplier reflects the economic conditions for only this particular year.

Referring once again to the hypothetical example of the 80 new basic retail jobs in the Florence mall, the economic base projection model using 2002 Boone County employment multiplier (EM) can be written as:

$$\Delta e = \Delta b \cdot \mathrm{EM} \tag{4.66}$$

where, the symbol Δ refers to changes. Note that we are answering the so-called "If... then..." question. **If** basic retail employment in Florence mall increases by 80 employees due to more people from outside using the mall as a shopping destination, **then** the economic base theory tells us that the total employment (e) in the area will increase by 229 jobs following this increase in basic employment, or:

$$\Delta e = \Delta b \cdot \mathrm{EM} = 80 \times 2.86 = 229$$

Whereby for this particular case, the direct effect is the initial stimulus— or the 80 new basic retail jobs—and the indirect effect is the multiplier effect— or the 149 additional jobs created in the region resulting from the initial stimulus. And of course, total effect is the sum of direct and indirect effect. Last we want to reemphasize that the initial employment change must occur in the basic sector which means that these 80 newly created jobs will serve people from outside the county using the mall as shopping destination.

Although employment data are most widely used for calculating economic base multipliers, other economic data, such as wages, earnings, or income also may be suitable for estimating the basic activity level of a study region. Conceptually there is no difference to the basic multiplier using employment. For instance, the basic multiplier (BM) using wages can be expressed as:

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① Schaffer (1999) recommends regression analysis for calculating marginal multipliers (p. 9).

② Alternatively, the employment multiplier could be expressed as: EM^t where t refers to the year the data were collected.

$$\text{BM} = \frac{w}{bw} = \frac{\text{total regional wages}}{\text{total wages in the basic sector}} \tag{4.67}$$

4.6.1.2 The Income Multiplier (IM)[①]

In a simplified world without governments, major regional spending is attributable to local consumption, local investment, and exports. The spending in these three sectors in return leads to income for local residents. The main assumption for deriving an income multiplier IM is that both exports (X) and local investment (I) depend on forces outside the region. We already stated earlier that exports clearly depend on external market demand and, as such, on economic conditions outside the study region. Local investment, at least in the short-term, also reflects outside forces, such as interest rates and outside investment opportunities. As a result, both exports and local investments are considered exogenous and, therefore, are not explained by the economic base model.

Referring back to Fig. 4.1—the circular flow of income and expenditures—there is a direct positive relationship between household income and local consumption. Generally, the higher people's income is, the more they can spend either locally—on regional consumption—or non-locally—on imports or leakages. And, the higher the marginal propensity to purchase regionally produced products (mpp), the more they consume locally and, therefore, the higher the multiplier effect. Comparing the economic base multiplier to the Keynesian multiplier, we also made a cross-reference between the marginal propensity to purchase regional products (mpp) in the economic base model and the marginal propensity to consume (mpc) in the Keynesian model. While this is conceptually straight forwards, in the context of local income generation, we must refine the term marginal propensity to purchase regionally produced products (mpp).

Zooming in on how income is generated in a regional economy we will find that the regional income level actually depends on two factors:

(1) pcl: the propensity to consume locally captures how much of their income residents spend locally. Let us say for example residents in Boone County spend 80 percent of their income locally; pcl = 0.80. The remaining 20 percent must be spent on imports.

(2) ipls: the income propensity of the local sales dollar. Local firms and businesses can employ nonresidents or buy inputs from outside the region. Both cases represent a leakage where money is leaving the region. For example, an employee commuting from neighboring Hamilton County to Boone County for work increases the leakage as she will take her income back home. To complete the example of Boone County, we assume the ipls to be 0.8125.

① This section follows closely Charles Tiebout (1962), pp.58 – 61.

The income multiplier can then be defined as:

$$\mathrm{IM} = \frac{1}{1-(\mathrm{pcl}\cdot\mathrm{ipls})} \tag{4.68}$$

where IM is the income multiplier. The product of pcl times ipls resembles the formerly determined marginal propensity to purchase regional products (mpp). For Boone County the income multiplier thus is calculates as:

$$\mathrm{IM} = \frac{1}{1-(0.8\times 0.815)} = 2.86$$

Tiebout (1962) in the 1960's referred to the income multiplier as the simpler approach compared to the economic base multiplier. However, considering the Internet and today's computing power, Tiebout's statement might no longer hold. The ease of downloading employment, income, and earnings data from the Internet and the simplicity of deriving basic activities and economic base multipliers using spreadsheet software make the economic base multiplier a practicable tool for assessing economic impacts.

4.6.1.3 Critics of the Economic Base Multiplier

Every economic model is based on a set of assumptions. The big advantage of the economic base multiplier analysis are:

(1) it builds on a conceptually simple economic framework,

(2) it does not require a lot of training, time, or money to be carried out using a spreadsheet software,

(3) it helps make more informed decisions about pursuing new economic development projects,

(4) it emphasizes economic interdependencies, and

(5) the availability of necessary data makes it an applied method that should be included in the tool box of every economic development planner.

However, it also comes with shortcomings that one must keep in mind when using economic base multipliers:

(1) First, for calculating employment multipliers we need to estimate total basic employment. Therefore, employment multipliers depend highly on the accuracy of the preceding basic employment estimation and inherit all assumptions built into the method used to estimate basic employment. For instance, the magnitude of the employment multiplier depends to a large extent to the choice of the benchmark region and the level of industrial detail.

(2) The size of the regional economy itself is also crucial for the magnitude of the economic base multiplier. Generally, increasing sizes of regional economies lead to larger multipliers as the ratio of non-basic to basic activities (n/b) increases. Larger diversified metropolitan regions offer most commodities locally and, therefore, only rely to a small extent on exports. Outcomes are large economic

base multipliers, often in a magnitude beyond the point of plausibility. Contrarily, smaller and more specialized regions have smaller multipliers as they depend to a larger extent on exports.

(3) Time plays a role as it takes years for the total multiplier effect to take place.

(4) Multiplier analysis assumes the absence of supply constraints, which means that any increase in demand can be met through local production. Further, there are no changes in prices or the economic structure which could lead to a change in the ratio of non-basic to basic activities (n/b).

4.6.2 Shift-Share Analysis

So far, the economic base analysis has primarily employed single year data. We have compiled a regional economic profile, have calculated basic economic activities, and have used this information in the economic base projection model to answer how total economic activities in the region are expected to change as a result of an exogenous stimulus in the basic sector. Contrary to this rather **static** evaluation, **shift-share analysis** compares regional economic changes (e.g., growth or decline) for a selected time period to economic changes of a selected benchmark region. Shift-share analysis is a widely used economic base approach that assesses past observed growth or decline of an industry *i* between two points in time (e.g., $t \rightarrow t+n$). It is a more **dynamic** approach as it uses data for two points in time. Generally, shift- share analysis can be done for any two points in time data are available. But unless the study focuses on understanding historic economic trends, more recent data should be used. Time periods of five to ten years are commonly used for most analyses. Important to note is that the outcome of the shift-share analysis can vary substantially by using a five-year period versus a ten-year period. The underlying idea here is that regional industry growth or decline may have several causes; some may be purely regional and some may reflect to a large extent state-or national economic trends. More specifically, shift-share analysis breaks down a regional industry sector's change (e.g., growth or decline) into three individual components: national growth share (ns_i), industry mix share (im_i), and regional growth share (rs_i), and use this information to shed light into what made the regional economy grow differently from the reference region.

The first component compares regional economic growth in industry *i* to the general economic growth of the benchmark region—the **national growth share** (ng_i). The assumption is that overall observed economic growth in a benchmark region will inevitably be reflected in regional economic growth. For instance, given that Boone County is located in Kentucky an overall employment

increase in Kentucky for all industries combined is likely to positively influence employment growth in Boone County. In the case of using employment, the national growth share (ng_i) calculates the expected employment growth that would have occurred in Boone County's industry *i* if this industry sector's employment would have grown at exactly the same rate as combined employment in Kentucky. More formal, this can be written as:

$$\mathrm{ng}_i = e_i^t \cdot G^{t \to t+n} \tag{4.69}$$

where,

ng_i — the national growth share in industry *i*;

e_i^t — regional employment in industry *i* in the year *t*;

$G^{t \to t+n}$ — average growth rate for employment in the benchmark region for the time interval $t \to t+n$;

t — beginning year of the time period;

n — number of years included in the time interval.

A second component captures economic change attributable directly to the so-called **regional industry mix** (im_i). The aim of this component is to assess whether or not certain industries in the reference region grew faster or slower compared to overall regional growth of the reference region and to translate this observed difference in (employment) growth onto the corresponding industry sector in the study region. Outcome of this decomposition is to identify whether or not the study region specializes in industries that experience faster or slower than average growth in the reference region. For Boone County, industries with positive mix components thus will indicate regional specialization in industries that are growing at a faster rate than overall economic growth in Kentucky and vice versa. This observation is of importance as you might expect that a regional industry mix of state-wide fast growing industries will attribute more to regional growth than a regional industry mix of slow growing industries. The regional industry mix can be expressed as:

$$\mathrm{im}_i = e_i^t \cdot (G_i^{t \to t+n} - G^{t \to t+n}) \tag{4.70}$$

where,

im_i — the regional industry mix share in industry *i*;

$G_i^{t \to t+n}$ — growth rate for employment in industry *i* in the benchmark region for the time interval $t \to t+n$.

The third component accounts for the difference in growth between the study and the reference regions that can be credited solely to regional factors—**regional growth share** (rg_i). Some industries grow faster/slower in the study region than those in the benchmark region. In any case the regional growth share attributes the regional growth or decline to purely regional factors and as such

indicates regional economic strengths or weaknesses. The regional growth share evaluates a regional industry's competitive situation within the larger economy of the reference region due to regional comparative advantages such as industrial clustering, infrastructure and resource availability, or non-unionized labor markets. The formal definition of the regional growth share is:

$$\mathrm{rg}_i = e_i^t \cdot (g_i^{t \to t+n} - G_i^{t \to t+n}) \tag{4.71}$$

where,

rg_i — the regional growth share in industry *i*;

$g_i^{t \to t+n}$ — growth rate for employment in industry *i* in the study region for the time interval $t \to t+n$.

The outcome of adding these three components of growth together, see below, is the **total growth** (tg_i), which in turn is equivalent to the actual growth or decline of industry *i* in the study region, e.g., $g_i^{t \to t+n}$.

$$\begin{aligned} \mathrm{tg}_i &= \mathrm{ng}_i + \mathrm{im}_i + \mathrm{rg}_i \\ &= e_i^t \cdot (G^{t \to t+n}) + e_i^t \cdot (G_i^{t \to t+n} - G^{t \to t+n}) + e_i^t \cdot (g_i^{t \to t+n} - G_i^{t \to t+n}) \\ &= e_i^t \cdot (G^{t \to t+n} + G_i^{t \to t+n} - G^{t \to t+n} + g_i^{t \to t+n} - G_i^{t \to t+n}) \\ &= e_i^t \cdot g_i^{t \to t+n} \end{aligned} \tag{4.72}$$

The choice of the benchmark region for a shift-share analysis is of major importance for the outcome of the analysis. Generally a larger benchmark region is chosen of which the local region is a part. The state or the nation is a common choice. Alternatively, a larger metropolitan region might be chosen if compatible with the motivation for the study. We choose Kentucky as benchmark region for the study for the following reasons:

(1) Boone County lies in Kentucky;

(2) Both the county and the state are very rural in character;

(3) Many decisions influencing economic competitiveness follow political rather than regional boundaries.

For instance, tax incentives and the provision of utilities and infrastructure follow political boundaries closely rather than regional boundaries across states. We could also use the nation as the reference region, particularly for industries underlying more national trends. One may argue that national trends are more influential for the economic performance than state or regional trends for industry sectors like transportation, biomedical research, telecommunication, and information services.

The reminder of this section describes in detail how to break down total growth into three individual growth components for manufacturing industries in Boone County. Employment data for 1997 were converted from SIC to the

NAICS subject to data availability. However, no exact match is possible, particularly at the three-digit level; some data were not disclosed for reasons of confidentiality. Further, three-digit SIC sectors often split into two or more three-digit NAICS sectors. Consequently, the employment data in Table 4.17 must be considered an approximation rather than a reflection of true employment trends.

Table 4.17 Manufacturing employment data for Boone County and Kentucky(1)

		Boone County Employment 2002 (e_i^{t+n})	1997 (e_i^t)	Kentucky Employment 2002 (E_i^{t+n})	1997 (E_i^t)
31 – 33	Total Manufacturing	10,360	12,332	275,466	314,528
311	Food Manufacturing	1,498	1,265	23,551	23,613
314	Textile Product Mills	365	295	2,714	9,593
322	Paper Manufacturing	708	1,279	11,015	13,743
323	Printing and Related Support Activities	935	1,488	13,554	16,614
325	Chemical Manufacturing	686	778	13,958	18,530
326	Plastics and Rubber Products Mfg.	1,770	2,046	17,542	19,849
333	Machinery Manufacturing	1,545	2,359	21,010	36,702
336	Transportation Equipment Mfg.	1,317	923	56,932	57,359
N/A	Other Manufacturing	1,536	1,899	115,190	118,525
Total area employment		70,007	59,540	1,717,978	1,657,494

(1) Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

Employment data for Boone County and Kentucky were chosen for 1997 and 2002. Total manufacturing employment is broken down into three-digit NAICS sub-sectors. The most significant sub-sectors are listed explicitly while all remaining sectors are lumped into **Other Manufacturing**. The first analytical step is to calculate absolute and percent employment changes for Boone County and Kentucky for the five-year period between 1997 and 2002.

The growth rates listed in Table 4.18 basically provide all the information necessary for breaking down total growth (tg_i) into its three components. Absolute changes are calculated by subtracting employment in the later year from employment in the earlier year, or:

$$\Delta e_i^{t \to t+n} = e_i^{t+n} - e_i^t \tag{4.73}$$

where,

$\Delta e_i^{t \to t+n}$ — absolute change in regional employment in industry i from $t \to t+n$;

e_i^t — regional employment in industry i in year t;

e_i^{t+n} — regional employment in industry i in year $t+n$.

Table 4.18 Absolute and percent employment changes in Boone County and Kentucky

		Boone County		Kentucky	
		Absolute Change in Employment ($\Delta e_i^{t \to t+n}$)	Growth Rate ($g_i^{t \to t+n}$)/%	Absolute Change in Employment ($\Delta E_i^{t \to t+n}$)	Growth Rate ($G_i^{t \to t+n}$)/%
31 – 33	Total Manufacturing	– 1,972	– 15.99	– 39,062	– 12.42
311	Food Manufacturing	233	18.42	– 62	– 0.26
314	Textile Product Mills	70	23.73	– 6,879	– 71.71
322	Paper Manufacturing	– 571	– 44.64	– 2,728	– 19.85
323	Printing and Related Support Activities	– 553	– 37.16	– 3,060	– 18.42
325	Chemical Manufacturing	– 92	– 11.83	– 4,572	– 24.67
326	Plastics and Rubber Products Mfg.	– 276	– 13.49	– 2,307	– 11.62
333	Machinery Manufacturing	– 814	– 34.51	– 15,692	– 42.76
336	Transportation Equipment Mfg.	394	42.69	– 427	– 0.74
N/A	Other Manufacturing	– 363	– 19.12	– 3,335	– 2.81
Total Area Employment		10,467	17.58	60,484	3.65

Analogously, state-wide absolute employment changes are derived as:

$$\Delta E_i^{t \to t+n} = E_i^{t+n} - E_i^t \tag{4.74}$$

where,

ΔE_i^t — absolute change in state employment in industry i from $t \to t+n$;

E_i^t — state employment in industry i in the earlier year t;

E_i^{t+n} — state employment in industry i in the later year $t+n$.

For instance, the absolute employment change of 233 persons in food manufacturing (NAICS 311) in Boone County is calculated as:

$$\Delta e_i^{1997 \to 2002} = e_i^{2002} - e_i^{1997} = 1,498 - 1,265 = 233$$

Employment growth rates are calculated as:

$$\text{growth rate} = \frac{\text{employment in later year } t+n - \text{employment in earlier year } t}{\text{employment in earlier year } t} \tag{4.75}$$

In particular, we need three individual growth rates:

(1) the overall growth rate $(G^{t\to t+n})$ for employment in the benchmark region:

$$G^{t\to t+n} = \frac{E^{t+n} - E^t}{E^t}, \tag{4.76}$$

(2) the growth rate $(G_i^{t\to t+n})$ for employment in the benchmark region by industry *i*:

$$G_i^{t\to t+n} = \frac{E_i^{t+n} - E_i^t}{E_i^t}, \tag{4.77}$$

(3) and the growth rate $(g_i^{t\to t+n})$ for employment in the study region by industry *i*:

$$g_i^{t\to t+n} = \frac{e_i^{t+n} - e_i^t}{e_i^t} \tag{4.78}$$

where,

e_i^t — regional employment in industry *i* in year *t*;

e_i^{t+n} — regional employment in industry *i* in year $t+n$;

E_i^t — state employment in industry *i* at time *t*;

E_i^{t+n} — state employment in industry *i* at time $t+n$;

E^t — aggregated state employment at time *t*;

E^{t+n} — aggregated state employment at time $t+n$.

Using these growth rate formulas, we define the necessary growth rates for Boone County as follows:

(1) the average growth rate $(G^{t\to t+n})$ for employment in Kentucky is

$$G^{1997\to 2002} = \frac{1,717,978 - 1,657,494}{1,657,494} = 0.0365 = 3.65\%$$

indicating that total employment in Kentucky grew by 3.65% between 1997 and 2002.

(2) the growth rate $(G_i^{t\to t+n})$ for employment in Kentucky in food manufacturing:

$$G_{\text{food}}^{1997-2002} = \frac{23,551 - 23,613}{23,613} = -0.0026 = -0.26\%$$

meaning that employment in food processing establishments in Kentucky declined by 0.26% for the five year period.

(3) and the growth rate ($g_i^{t \to t+n}$) for employment in Boone County in food manufacturing:

$$g_{\text{food}}^{1997-2002} = \frac{1,498 - 1,265}{1,265} = 0.1842 = 18.42\%$$

showing that Boone County's employment in food processing establishments grew by 18.42%.

The decomposition of total growth (tg_i) into its three components, namely national growth share (ng_i), regional industry mix (im_i), and regional growth share (rg_i), is demonstrated below as a three-step procedure. While this task can easily be performed in one single table using spreadsheet software, for demonstration purposes we show each individual component calculation individually in a separate table.

4.6.2.1 National Growth Share Calculations

What portion of change—either growth or decline—in regional employment in industry I (tg_i) can be explained through the observed trend in overall growth (or decline) of the benchmark region? In the case of Boone County it explains how much each industry sector might have grown (or declined) over the observed time span because of an observable positive or negative growth trend in Kentucky. More specifically, overall employment in Kentucky grew from 1997 to 2002 by 3.65%. From this we might expect a positive spill-over on employment growth by industry in Boone County for this specific time period. The national growth shares (ng_i) are calculated by multiplying regional employment in industry *i* by the overall growth rate for the benchmark region, or:

$$\text{ng}_i = e_i^t \cdot G^{t \to t+n} \tag{4.69}$$

For example, the national growth share for food manufacturing (ng_{food}) is calculated as:

$$\text{ng}_{\text{food}} = 1,265 \times 0.0365 = 46$$

Food manufacturing employment in Boone County would have increased by 46 persons for the time period from 1997 to 2002 if it would have followed the overall employment growth in Kentucky of 3.65% for this five-year period. As

Table 4.19 clearly shows, all national growth shares must be positive as Kentucky employment increased by 3.65%.

Table 4.19 National growth share calculations, manufacturing industries, Boone County

		National Growth Share (ng_i)		Boone County Employment 1997 (e_i^t)		Average Employment Growth Rate in Kentucky ($G^{t\to t+n}$)
311	Food Manufacturing	46		1,265		0.0365
314	Textile Product Mills	11		295		0.0365
322	Paper Manufacturing	47		1,279		0.0365
323	Printing and Related Support Activities	54		1,488		0.0365
325	Chemical Manufacturing	28	=	778	×	0.0365
326	Plastics and Rubber Products Mfg.	75		2,046		0.0365
333	Machinery Manufacturing	86		2,359		0.0365
336	Transportation Equipment Mfg.	34		923		0.0365
N/A	Other Manufacturing	69		1,899		0.0365
31 – 33	Total Mfg. National Growth Share	450				

4.6.2.2 Industrial Mix Share Calculations

What portion of change—either growth or decline—in regional employment in industry i (tg_i) can be attributed to the fact that industries in the benchmark region might grow faster or slower than the observed trend in overall growth (or decline) of the benchmark region? As a matter of fact, the average growth rate for employment in the benchmark region ($G^{t\to t+n}$) is only a summary measure. Individual industries usually do not exactly mirror this overall growth rate. Some industries grow faster, some grow slower, and others even show opposite trends, e.g., decline while total employment in the benchmark region increases. For the food manufacturing industry in Kentucky, we have observed a marginal decrease of 0.26% (e.g., 62 jobs) for the period from 1997 to 2002. With an overall employment growth in Kentucky of 3.65% this means that food manufacturing industries did not follow the overall economic growth. How does this difference in growth of 3.91% (e.g., $-0.26\% - 3.65\%$) translate onto the food manufacturing industry in Boone County? The industrial mix component (im_{food}) is calculated by multiplying the study region employment by the difference in growth:

$$im_i = e_i^t \cdot (G_i^{t\to t+n} - G^{t\to t+n}) \tag{4.70}$$

For food manufacturing in Boone County, the industry mix share is

$$\text{im}_{\text{food}} = 1{,}265 \times (-0.0026 - 0.0365) = -49$$

Assuming an identical industry mix in Boone County to that in Kentucky, food manufacturing would have lost 49 jobs for the five-year period from 1997 to 2002. As Table 4.20 indicates, all industrial mix shares are negative. We further see that Boone County's manufacturing industries (31 – 33) would have lost a total of 2,691 jobs if there were no structural difference between the county and the state.

Table 4.20 Industry mix share calculations, manufacturing industries, Boone County

		Regional Industry Mix Share (im_i)		Boone County Employment 1997 (e_i^t)		Employment Growth Rate by Industry ($G_i^{t\to t+n}$)	Average Employment Growth Rate in Kentucky ($G^{t\to t+n}$)
311	Food Manufacturing	−49		1,265		−0.0026	−0.0365
314	Textile Product Mills	−222		295		−0.7171	−0.0365
322	Paper Manufacturing	−301		1,279		−0.1985	−0.0365
323	Printing and Related Support Activities	−328		1,488		−0.1842	−0.0365
325	Chemical Manufacturing	−220	=	778	×	−0.2467	−0.0365
326	Plastics and Rubber Products Mfg.	−312		2,046		−0.1162	−0.0365
333	Machinery Manufacturing	−1,095		2,359		−0.4276	−0.0365
336	Transportation Equipment Mfg.	−41		923		−0.0074	−0.0365
N/A	Other Manufacturing	−123		1,899		−0.0281	−0.0365
31–33	Total Mfg. Regional Industry Mix Share	−2,691					

4.6.2.3 Regional Growth Share Calculations

What portion of the change—either the growth or decline—in regional employment (tg_i) can be attributed directly to local factors and, as such, reflect the region's competitive position in a particular industry i? This share component measures to what extent the growth/decline of a specific industry i different from its state-wide counterpart. Employment in the food manufacturing industry in Boone County grew by 18.42%. The difference in growth in food manufacturing employment between the county and the state is translated directly into the regional growth share component using the formula:

$$\text{rg}_{\text{food}} = e_{\text{food}}^{1997} \cdot (g_{\text{food}}^{1997\to 2002} - G_{\text{food}}^{1997\to 2002}) \tag{4.79}$$

and results in:

$$\mathrm{rg}_{\mathrm{food}} = 1,265 \times \left[0.1842 - (-0.0026)\right] = 236$$

While food manufacturing industries lost statewide employment, Boone County on the other hand shows a strong competitive position as indicated by a large positive regional growth share component of 236 jobs. Manufacturing-wide, Table 4.21 indicates that Boone County is very competitive in food manufacturing, textile product mills, chemical manufacturing, machinery manufacturing, and transportation equipment manufacturing.

Table 4.21 National growth share calculations, manufacturing industries, Boone County

		Regional Growth Share (rg_i)		Boone County Employment 1997 (e_i^t)		Employment Growth Rate by Industry in Boone County ($g_i^{t\to t+n}$)		Employment Growth Rate by Industry in Kentucky ($G_i^{t\to t+n}$)
311	Food Manufacturing	236		1,265		0.1842	–	−0.0026
314	Textile Product Mills	282		295		0.2373	–	−0.7171
322	Paper Manufacturing	−317		1,279		−0.4464	–	−0.1985
323	Printing and Related Support Activities	−279		1,488		−0.3716	–	−0.1842
325	Chemical Manufacturing	100	=	778	×	−0.1183	–	−0.2467
326	Plastics and Rubber Products Mfg.	−38		2,046		−0.1349	–	−0.1162
333	Machinery Manufacturing	195		2,359		−0.3451	–	−0.4276
336	Transportation Equipment Mfg.	401		923		0.4269	–	−0.0074
N/A	Other Manufacturing	−310		1,899		−0.1912	–	−0.0281
31 – 33	Total Mfg. Regional Growth Share	269						

Adding the three components of growth together then results in total growth (tg_i) as indicated in Table 4.22. For food manufacturing, total employment change is calculated as:

$$\begin{aligned}\mathrm{tg}_{\mathrm{food}} &= \mathrm{ng}_{\mathrm{food}} + \mathrm{im}_{\mathrm{food}} + \mathrm{rg}_{\mathrm{food}} \\ &= 49 - 49 + 236 \\ &= 236\end{aligned}$$

Breaking down employment data into three individual components helps to shed light on the reasons why some industries grew and while others declined between 1997 and 2002. For instance, machinery manufacturing is the biggest loser of manufacturing employment in Boone County with 814 jobs. The main reason for this tremendous job loss lies in the industry mix share component

Table 4.22 Total growth calculations, manufacturing industries, Boone County

		Boone County Employment 1997	National Growth Share	Regional Industry Mix Share	Regional Growth Share	Total Employment Change	Boone County Employment 2002
31 – 33	Total Manufacturing	12,332	450	– 2,691	269	– 1,972	10,360
311	Food Manufacturing	1,265	46	– 49	236	233	1,498
314	Textile Product Mills	295	11	– 222	282	70	365
322	Paper Manufacturing	1,279	47	– 301	– 317	– 571	708
323	Printing and Related Support Activities	1,488	54	– 328	– 279	– 553	935
325	Chemical Manufacturing	778	28	– 220	100	– 92	686
326	Plastics and Rubber Products Mfg.	2,046	75	– 312	– 38	– 276	1,770
333	Machinery Manufacturing	2,359	86	– 1,095	195	– 814	1,545
336	Transportation Equipment Mfg.	923	34	– 41	401	394	1,317
N/A	Other Manufacturing	1,899	69	– 123	– 310	– 363	1,536

(e.g., 1,095) or that statewide machinery manufacturing declined relatively by 46.40% (e.g., – 42.76% – 3.65%) when compared to the total economy in Kentucky. Machinery manufacturing in Boone County increased its performance when compared with Kentucky as indicated by a positive regional share component of 195 jobs. In general, Boone County's manufacturing industries gained in competitiveness (e.g., regional growth share of 269), took advantage of an overall aggregate employment change in Kentucky (e.g., national growth share of 450), but was not spared by a state-wide employment drop in manufacturing industries (e.g., industry mix component of 2,691). The overall county-wide employment loss in manufacturing amounts to 1,972 jobs.

4.6.2.4 Summary

While shift-share analysis is a relative straight forward method of analyzing changes in economic performance by comparing economic change in a study region to that of a larger reference region, it also relies on a set of assumptions.

First, the choice of the benchmark region has a major impact on the outcome of the shift-share analysis. Industrial clustering and different comparative advantages of regions inevitably lead to differences in economic growth in general and for individual industries. For example, while employment grew in Kentucky by 3.65% between 1997 and 2002, at the national level employment

grew by 5.94% for the same time period. Thus using the nation as benchmark region will lead to different results and conclusions.

Second, the choice of the time period is rather arbitrary and often heavily influenced by data availability. Going too far back in time may raise the question whether observed trends are still relevant in present contexts. On the other hand, shorter time periods are more likely influenced by unusual short-term economic fluctuations. As a general rule, time periods of five to ten years seem appropriate for most analyses. Change of industrial classification system, such as the replacement of SIC system by the NAICS in the United States, complicates shift-share analysis for the periods when data conversion from one to the other system is necessary.

Third, like any other technique in economic base analysis it does not answer the question of why. The shift-share analysis helps to understand **what** happened and **where** it happened. It helps to identify strengths and weaknesses of local economies in comparison to larger benchmark regions. Unfortunately, it does not answer the question of **why** a regional economy has a comparative (dis)advantage over the benchmark region and what could be done to improve regional competitiveness and make a region more attractive for firms to choose it as their business location.

Finally, the level of industrial aggregation will alter the outcome of the shift-share approach. In general, using more detailed levels of aggregation (e.g., 3-digit or 4-digit NAICS) will provide more exhaustive results for understanding regional economic changes. Deciding for a less detailed level of industrial aggregation (e.g., 2-digit NAICS) runs the risk that valuable and important information on specific industry sectors is lumped together with other industries and as such lost for the analyst.

Review Questions

1. In order to make economic development policy recommendations, it is important to understand the regional economy, its markets and who the essential actors are. Describe the working mechanism of a local/regional economy as discussed in the chapter. Include all actors and markets.

2. What is the theoretical foundation of the economic base theory? More specifically, how can the economic base theory be used as a conceptual framework for explaining regional economic growth?

3. Explain in detail the importance of the benchmark (i.e., comparison) region for location quotients and shift-share calculations. What benchmark region would you choose for calculating location quotients and shift-share analysis for a county in California? Explain your answers.

4. The North American Industry Classification System (NAICS) was introduced in 1997. What are the major improvements of the NAICS over the 1987 U.S. Standard Industrial Classification (SIC) system?

5. What exactly does a location quotient identify? In other words, what would you use the LQ method for? Explain the assumptions and limitations of the location quotient method.

6. Which should be larger, the location quotient of a small town or a large metropolitan area? Explain your answer.

7. Name five typical basic businesses and five typical non-basic businesses.

8. Briefly explain how the minimum requirement approach works.

9. The employment multiplier is one way to predict economy-wide changes in employment following an increase in export demand. Briefly explain how you derive the employment multiplier and how it can be used. And more specifically, what is meant when referring to direct and indirect effects in multiplier analysis?

10. Shift-share analysis breaks down economic growth/decline into three individual components. Identify and describe these three components of economic growth/decline.

Exercises

Table 4.23 contains data on average annual employment for Metropolis, a hypothetical urbanized area for the years 1994 and 2004. In addition, Table 4.24 shows employment data for a benchmark region, again for 1994 and 2004. The employment data are grouped according to the 2-digit 2002 North American Industry Classification System (NAICS) identifying a total of 20 industry sectors.

Table 4.23 Annual average employment, Metropolis, 1994 and 2004

2002 NAICS Code	2002 NAICS Title	Metropolis Employment 1994	Metropolis Employment 2004
11	Agriculture, Forestry, Fishing and Hunting	20	30
21	Mining	40	30
22	Utilities	450	350
23	Construction	2,350	2,900
31 – 33	Manufacturing	6,000	4,700
42	Wholesale Trade	2,750	3,100
44 – 45	Retail Trade	8,400	8,300
48 – 49	Transportation and Warehousing	1,850	3,300
51	Information	1,800	2,050
52	Finance and Insurance	4,300	5,050

Continued

2002 NAICS Code	2002 NAICS Title	Metropolis Employment 1994	Metropolis Employment 2004
53	Real Estate and Rental and Leasing	900	1,300
54	Professional, Scientific, and Technical Services	2,900	4,100
55	Management of Companies and Enterprises	350	1,500
56	Administrative and Support and Waste Mgm.	3,500	5,200
61	Educational Services	2,800	3,850
62	Health Care and Social Assistance	5,050	7,200
71	Arts, Entertainment, and Recreation	2,500	900
72	Accommodation and Food Services	2,750	5,650
81	Other Services (except Public Administration)	1,800	2,350
92	Public Administration	3,800	4,100
Total		54,310	65,960

Table 4.24 Annual average employment, Benchmark Region, 1994 and 2004

2002 NAICS Code	2002 NAICS Title	Benchmark Region Employment 1994	Benchmark Region Employment 2004
11	Agriculture, Forestry, Fishing and Hunting	13,000	15,000
21	Mining	18,000	12,000
22	Utilities	48,000	35,000
23	Construction	203,000	254,000
31 – 33	Manufacturing	1,081,000	1,023,000
42	Wholesale Trade	223,000	248,000
44 – 45	Retail Trade	616,000	673,000
48 – 49	Transportation and Warehousing	140,000	200,000
51	Information	114,000	129,000
52	Finance and Insurance	198,000	225,000
53	Real Estate and Rental and Leasing	62,000	73,000
54	Professional, Scientific, and Technical Services	166,000	241,000
55	Management of Companies and Enterprises	11,000	82,000
56	Administrative and Support and Waste Mgm.	203,000	333,000
61	Educational Services	358,000	414,000
62	Health Care and Social Assistance	525,000	654,000
71	Arts, Entertainment, and Recreation	163,000	70,000
72	Accommodation and Food Services	249,000	415,000
81	Other Services (except Public Administration)	148,000	179,000
92	Public Administration	211,000	225,000
Total		4,750,000	5,500,000

Using the data provided in these two tables, compile an economic profile for Metropolis showing the city's economic specializations and identify growth patterns of its industry sectors.

1. Use graphs to identify regional specialization by comparing Metropolis's employment shares by industry with the employment shares of the benchmark region. In addition, make a graph that shows the employment growth or decline by industry sector.

2. Calculate the location quotients (LQ) for all industry sectors. Based on the magnitude of calculated location quotients, identify the industry sectors in which Metropolis appears to be specialized. Do the identified industry sectors of specialization match the ones identified graphically?

3. Using the location quotient method, identify basic employment for each industry sector and calculate the economic base multiplier.

4. Assuming an increase in employment in transportation and warehousing by 250 new jobs, what is the projected increase in total employment in Metropolis?

5. Do a complete shift-share analysis including calculations of national growth share, industrial mix share, and regional growth share. How much of total observed employment growth can be attributed to the local competitiveness of Metropolis?

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