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THE USE OF LOCATION QUOTIENTS IN ECONOMIC BASE MODELS IN DEVELOPING COUNTRIES: A CASE STUDY OF CHIRIQUI, PANAMA

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THE USE OF LOCATION QUOTIENTS IN ECONOMIC BASE MODELS IN DEVELOPING COUNTRIES: A CASE STUDY OF CHIRIQUI, PANAMA

By

Arturo J. Ríos V.

A THESIS

Submitted to Michigan State University in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

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ABSTRACT

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THE USE OF LOCATION QUOTIENTS IN ECONOMIC BASE MODELS IN DEVELOPING COUNTRIES: A CASE STUDY OF CHIRIQUI, PANAMA

By

Arturo J. Ríos V.

The implementation of the economic base model for a region requires knowledge of export activity. Direct measurements of export activity are rarely available; in most cases indirect methods are applied. A popular indirect method for the estimation of basic activity is the application of the location quotient for which the literature has reported its accuracy and limitations. In the case of developing countries, a number of suggestions have been made to correct and validate its use but have been neither implemented nor tested.

Using data from Panama, this study reviews the practicality of making adjustments to the location quotient. Empirical verification is made using results from industry surveys for the province of Chiriqui, Panama. It is found that the adjustments proposed improved the accuracy of the technique and that the use of the traditional unadjusted location quotient in economic base models should be avoided.





To my parents, brothers and sisters





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CHAPTER 1

INTRODUCTION

Economic base theory assumes regional economic activity can be divided into basic and non-basic sectors. The basic (or export) sector is oriented to the production of goods and services to be consumed or paid for by residents outside the region. It is assumed that economic growth of a region is entirely dependent on the performance of this basic sector. By exporting goods and services to other areas, a region obtains the necessary economic impulse to grow. The activity of the non-basic (or residentiary) sector is oriented to satisfy local demand and is supportive of the basic sector. It is assumed that when the basic sector expands or contracts, corresponding changes occur in the non-basic sector. In the economic base model, these changes can be measured through the computation of a base multiplier.

Aside from the assumptions of the economic base theory, measuring the economic base of a region is the main stumbling block for the implementation of this model. For each industry in a region, an economic base study requires the identification and measurement of all economic





activities tied to external sources of demand, either directly or indirectly through inter-industry linkages. Since in most cases there are no data on the geographic patterns of sales for every economic industry within a region nor on trade flows between regions, there are difficulties in estimating the nature and size of the basic sector.

Statement of the Problem

The separation of a local economy into basic and non-basic sectors has not been easy given the difficulties that stem from the lack of statistical data on regional sales between firms and trade flows between regions. Two different approaches have been suggested to address the problem of determining the economic base. The first involves the application of a direct survey of the regional economy, and the second relies on the application of secondary data. A direct survey of the economy is recommended since statistical estimates of basic activity are possible. Surveys, however, are not easy nor practical. They entail enormous monetary costs and time which many communities can not afford. In actuality, there have been only a few cases where direct surveys have been completed. The 1960 Los Angeles study is one of the



few widely known applications of a direct survey taken in the United States (Tiebout 1962). Indirect methods have been mostly used. They avoid the expense associated with survey work and rely on existing secondary data. These methods are based on a rule or rationale used to separate economic activity into basic and non-basic sectors.

The most popular indirect method is based on the location quotient (LQ), a ratio used for the separation of basic activity. There are numerous applications of the LQ technique. The limitations and advantages of this approach in the analysis of regions in the United States and Canada have been widely discussed in the literature (Mattila and Thompson 1955; Isard 1960; Tiebout 1962; Greytak 1969; Leigh 1970; Mathur and Rosen 1974; Isserman 1977, 1980; Gibson and Worden 1981; Norcliffe 1983). The major concerns of most of these studies have been over the assumptions and accuracy of the LQ method. For instance, it is questioned whether or not it is realistic to assume that equal patterns of per capita productivity and consumption level exist in all economic sectors throughout a country, and that no net national exports occur. It is also well documented that inaccuracies can result unless the economic sectors are measured with a sufficient degree of disaggregation.

Despite the above limitations and other criticisms, the appeal of the LQ method in economic base modeling has gone beyond the United States.



Because direct surveys are not necessary, it is one of the few methods which can be inexpensively applied to perform regional economic analysis in developing countries. However, very little is known as to whether or not this extension of the LQ method to developing countries is warranted. In effect, because the underlying assumptions of the LQ method will not likely be applicable in most developing countries, there is good reason to believe that the method is being misused. For instance, it is well known that developing countries are characterized by severe regional imbalances. As a result, the location quotient assumption of uniform consumption and productivity would not hold. Also, because most developing countries rely largely on imports, the assumption of no net national exports would be misleading.

To validate the use of the LQ method in a developing country, the following must be determined: (1) what would be the amount of error introduced by overlooking the assumptions, (2) whether adjustments can be made to correct for the distorting factors, and, if so, (3) what would be the effect of the adjustments on the calculation of regional export activity. Additionally, it would be useful to know if other major limitations and difficulties exist in applying LQ formulations to situations where data are limited. In other words, can we adjust the traditional LQ method and still obtain satisfactory results for developing countries? If adjustments can be





made, are there major differences between the allocations of export employment from the unadjusted and adjusted versions of the LQ? Is there any reduction of errors by implementing the adjustments? Previous studies have suggested adjustments to the LQ formulation (Brodsky and Sarfaty 1977; Isserman 1980; Norcliffe 1983). However, no empirical study exists to test the feasibility and usefulness of those adjustments in developing countries.

Objectives of the Study

The purpose of this study is to examine the applicability of the LQ method to developing economies by testing the method's assumptions, accuracy, and possible adjustments using a case study of a regional economy in Panama. To take into account the assumptions of the LQ method, this study specifically examines the effect of three types of adjustments (productivity, consumption, and net national exports) on the calculation of regional export activity. The accuracy of the adjustments is then studied by comparing adjusted LQ estimates of regional export activity with actual values derived from a survey.





Since the LQ method is one of the most widely used methods in regional analysis, the results of this study will help determine whether the technique is warranted given the characteristics of developing economies. While results from a single region may not be enough to make generalizations to all developing countries, this study might be the starting point for additional research.

Methodology and Data

The study is carried out using a region in the Republic of Panama, the province of Chiriqui located in the western part of the country. The selection of this area was due mostly to the importance of that region in the development of Panama and to the author's knowledge and familiarity with that region.

The unadjusted and adjusted versions of the LQ method are used to estimate regional basic employment for Chiriqui. The results are then compared with survey estimates of basic employment to assess their accuracy.

In conducting this study, the selection of the study year was not easy. Data were not available for all years. The most recent year for which



reliable figures existed was 1980. A published census, special reports, and computer runs were obtained for that year. Most data were obtained from the <u>Departamento de Estadística y Censo, Contraloría General de la</u> <u>República</u> (Department of Statistics and Census, National Comptroller Office). The main variables were:

- Regional and national employment by sector at the four digit level of aggregation classified according to the International Standard Industrial Classification, ISIC (United Nations 1968). These unpublished data were sufficient for the construction of the regional economic base model at an appropriate level of disaggregation.

- Regional and national median household income for 1980.

- Regional and national gross product by sector. Data from 1978 were used with the exception of manufacturing data which were obtained from 1983.

- Imports and exports by sector for 1981.

Because of difficulties in data gathering, it was not possible to secure all data for the same study year of 1980. Therefore, some data from 1978 and 1983 were treated as if they occurred in 1980. This treatment may not represent a major problem since two-three year fluctuations in those variables are minor.





The survey data gathered in August, 1989, were collected retroactively. Due to the existence of past records and the cooperation of the respondents, these data are judged to be quite reliable.





CHAPTER 2

REVIEW OF LITERATURE

Introduction

The use of the LQ method in economic base analysis has been widely cited in the literature. It has offered a simple means to estimate basic activity especially when direct measurements of the economic base were not possible. However, because of its underlying assumptions and limitations, the LQ method has also received much criticism. Other alternatives have been proposed but they have not been convincing. In some instances, modifications of the LQ method have been suggested but rarely implemented.

The Location Quotient Method

The LQ is a device used to measure the relative specialization of an industry in a region relative to the nation or another reference area. Economic activity is generally expressed in terms of employment. The





share of employment for a given industry in a region is related to a reference variable, usually the total national employment. The results are then compared using a simple ratio as indicated in the following formulation:

$$LQi = \frac{E_{ir}/E_r}{E_{r}/E_r}$$
(1)

where,

 LQ_i = Location quotient for sector i

 E_{ir} = Regional employment in sector i

E_r = Total regional employment

E_{in} = National employment in sector i

 $E_n = Total national employment$

A location quotient greater than 1.0 indicates that the region is more specialized relative to the nation (or another reference area) in the activities of that industry. A location quotient less than 1.0 indicates that the region is less specialized than the nation in the economic activity of an industry. Similarly, a location quotient equal to 1.0 indicates that the region has the same degree of specialization as the reference area.

The location quotient as presented above is a simple device for making regional comparisons. Variations of the formulation are possible to serve broader purposes. In some cases, the reference area is an area other than the nation, such as a group of similar regions, a parent region, or




even a group of nations. The variable to assess specialization does not necessarily have to be employment in an industry. While employment is the most usual variable to depict economic activity, depending on the orientation of the study, the variable may be something else, such as output, value added, or revenues. If the purpose is to assess the equity in the distribution of services such as schools, for instance, the appropriate reference variable could be student enrollment. As Bendavid-Val (1983) describes:

...the location quotient technique can help highlight regional relative inefficiencies, can assist in focusing on potential import substitutes or products with export expansion potential, and can provide an indication of industries for which further detailed study is most warranted. The location quotient has been found useful within the framework of linkage analysis, gravity studies, economic base studies, input output analysis, mix-and share analysis, and more. Because of its simplicity, the location quotient can be computed many times, relative to many reference variables, time periods, and reference areas, with minimum investment in analysis time, manpower, and money (p. 77).

Clearly, the LQ method is a flexible tool that can be adapted in response to different needs. However, the simplicity of this method can lead to its inappropriate use and to an overstatement of its significance. For instance, the location quotient method has been used in regional economic base analysis to estimate the basic or export portion of an economy. In this case, it is assumed that if the LQ_i for an industry is greater than 1.0, the region is more specialized than the nation in the





production of those particular goods and exports occur. Assuming that consumption levels are uniform in a country, an LQ_i value of more than 1.0 indicates that the region is producing far more than it can consume. The excess employment is supposed to be dedicated to export. Conversely, if the region's LQ_i is less than 1.0, the regional share of employment falls short of the amount needed for self-sufficiency and the region is assumed to be an importer of goods.

Major Findings. The use of the LQ method in the determination of basic economic activity has been the focus of extensive discussion in the literature since its widespread adoption in the 1950's. Mattila and Thompson (1955) referred to the quotient as the index of local specialization. They defined the index as an industry's share of regional employment relative to the industry's share of national employment. They stated that the index assumes uniform productivity and consumption per worker throughout the nation. These researchers interpreted the index as solely a measure of labor force specialization

"...and only by successively more tenuous inferences may it be extended to the role of an index of product specialization and, ultimately, product-market orientation of local industry." (p. 218).

An adjusted form of the LQ was suggested by subtracting the local economy from the benchmark economy to eliminate the "overlap".





One of the most important contributions on the use of economic base analysis was made by Tiebout (1962). He offered the use of the LQ method for estimating the export portion of a region but indicated that the major difficulties of using it were the assumptions of equal patterns of demand and productivity per employee in all regions in a country. Practical adjustments were suggested to account for regional variations of these factors using data on consumer expenditures and output per employee.

Tiebout also pointed out the product mix problem which tends to underestimate exports because many single products are involved within each industry category:

The results one gets using location quotients depends upon the S.I.C. digit level used. What does it mean? Recall that industries are classified in various digit levels, the more digits the finer the detail. Suppose a community specialized in building run-about motor-boats. This is part of the transportation equipment industry, S.I.C. 37, If location quotients are used at the two-digit level, no exports of boats may appear. Why? Because also in S.I.C. 37 are the automotive, aircraft, railroads, bicycles and other transportation equipment industries. The community imports these and so for the transportation equipment industry as a whole no exports appear. In fact, no exports may appear until the data gets down to S.I.C. 3732 - the boat building and repairing industry. Thus the level of exports depends on the digit level used. (Tiebout 1962, p.48)

Tiebout concluded that the shortcomings of the LQ method reduce its value but do not in any way eliminate it. He viewed the LQ as a simple and inexpensive method that avoids having to measure the direct as well as the indirect sales by industries in a region.





Greytak (1969) presented a statistical assessment of the LQ's ability to estimate exports. Using data on regional exports collected from a tabulation of the 1963 Census of Transportation for three states and four groups of states in the United States, Greytak found that the LQ method underestimated regional exports. The results obtained using the LQ differed so significantly from the actual values that Greytak could not even offer a qualified endorsement of this method. He offered structural adjustments to the LQ formulation, such as combining employment and population, but no significant improvement in accuracy was observed. The study, however, was conducted with data at the two digit SIC level of aggregation. More accurate results may have been possible with data at the four digit SIC level.

Leigh (1970) offered another empirical evaluation of the LQ method. He compared the LQ estimates of regional exports with non-local sales data for manufacturing industries in the Vancouver metropolitan area. He found the LQs almost always underestimated the regional exports. High LQs appeared to identify industries with high volumes of exports but medium to low LQs failed to identify industries which actually constituted the city economic base. Leigh confirmed the conclusions of Mattila and Thompson (1955), Greytak (1969), and others that LQs give unreliable and sometimes misleading estimates of basic activity. However, the study was not



conducted at the appropriate level of data aggregation nor were modifications made to account for the assumptions of the model. Only seven of fifteen industries were measured at the three or four digit SIC level. The estimates were more accurate for these industries than for those at the two digit level.

The Location Quotient and Other Methods

In addition to the LQ method, other methods have been offered to solve the problem of identifying the basic component of a regional economy. Direct survey of the entire economy is considered the best way to obtain the required data to implement economic base models. Economic information is collected by interviewing each firm in a region and estimating the proportions of export and local sales. From local sales indirect exports must be identified by tracing the flow of intermediate goods which are incorporated into finished products for exports. This often happens when products, which are sold locally, are used as input in the production of goods to be consumed outside the regional borders. Once direct and indirect exports are identified, the proportions are applied to the firm's total employment to determine the basic and non-basic components.





Direct surveys are subjected to a number of limitations. These limitations were summarized by Isard (1960) as follows:

1. Surveys are tedious, time consuming, and expensive;

2. Firm officials sometimes provide innaccurate answers with respect to the destination of the firm's sales; and,

3. It is difficult to identify indirect exports derived from intermediate sales to exporting firms within a region.

Given these limitations, among which expense and time are the most important, direct surveys are rarely implemented. As mentioned earlier, the study of Los Angeles by Tiebout (1962) is a well-known example of direct surveys. Tiebout compared export percentages based on survey with export estimates obtained from the LQ method. He found that the LQ method underestimated exports in all cases, and the average of the LQ estimates was less than half the export figure. Tiebout, however, did not apply any adjustment to the traditional LQ to correct for its assumptions. Also, instead of using disaggregated data, he used data at the two digit SIC level, thus underestimating exports.

In addition to surveys and LQs, other methods have been proposed as useful for the estimation of export activity. Ullman and Dacey (1960) presented the minimum requirements technique. This method is similar to the LQ method in the sense that it also uses a reference value. But instead





of using national employment as a base of reference, the minimum requirements technique identifies, from a collection of regions, one region as the reference. This region corresponds to the region that has the lowest share of employment in a particular sector. It assumes that the level of employment of that region is sufficient to meet its needs; it is the level required for self-sufficiency. Levels of employment above this reference value are again considered to be for export markets.

Greytak in his 1969 study also implemented the minimum requirements method but did not obtain convincing results as had been the case with the LQ method. However, Brodsky and Sarfaty (1977), in one of the few applications to developing countries, seemed more optimistic about the use of the minimum requirements method. They applied it to measure the economic base of Nicaragua using employment data at one digit level. They supported the use of the minimum requirements method, instead of the LQ approach, because it measures gross rather than net basic activity and does not need adjustments for foreign trade nor highly disaggregated data for its implementation. They suggested the location quotient method can be more appropriate when it is applied to large areas which tend to be more self-sufficient. These authors indicated that LQs may produce satisfactory results in countries like the United States, where the volume of foreign trade is proportionately small when compared to its





total economy, or where the national levels of employment in each industry category nearly reflect levels of self-sufficiency. But in developing countries, where the volume of international trade is of primary importance, the LQ produces incorrect results unless it is adjusted to account for this factor. They suggested that data on imports and exports by sector may reduce the error of the estimates and produce acceptable results.

Because of difficulties associated with the use of LQ type methods in the estimation of the economic base, different avenues have been proposed. Mathur and Rosen (1974) introduced a new econometric model in which export employment is estimated by ordinary least squares regression and times series data. They compared the results obtained using the new model with estimates from the LQ method using data for industries in the Cleveland Metropolitan Area. They found the new model gave greater estimates of basic employment and thus lower base multipliers than the traditional LQ method. Mathur and Rosen also concluded that the LQ method is not an appropriate tool to estimate the economic base of a region and argued that the econometric model is a superior technique. However, their methodology was also criticized. Isserman (1975) indicated that their model overestimated the amount of basic employment since it included a portion of non-basic employment which varies with "world"





employment. Furthermore, Isserman questioned the lack of actual values to test the validity of their estimates.

Alternative methods, so far, have not been convincing enough to abandon the use of the LQ method. Empirical results do not support the superiority of other methods. On theoretical grounds, all methods are rather weak.

Isserman (1980) offered a theoretical and empirical analysis of the most known export estimating techniques, namely, the Mathur-Rosen method, minimum requirements method, assumption method, and LQ method. He argued that none of the four methods is theoretically defensible. The assumption method is the worst since it has no theoretical rationale whatsoever.

In empirical terms, Isserman also showed the LQs underestimated exports but the minimum requirements method produced lower estimates for 22 of the 101 SMSAs. The assumption method generated higher estimates than the LQ method. Given the wide range of results obtained by using different methods, Isserman concluded that the selection of the method would determine the kind of results obtained. Moreover, Isserman suggested modifications of the LQ method that would produce improvements in the estimation. But he failed to test or attempt to





implement his proposed adjustments. Further research could reveal the effectiveness of those proposed modifications.

Gibson and Worden (1981) offered additional evidence on the use of alternative methods. In a study of twenty small towns in Arizona, they compared economic base multipliers derived from four different methods: the census survey, the sample survey, the minimum requirements, and LQs. Using the census survey results as a basis for comparison, they found that the minimum requirements method was a superior technique than the sample survey and the LQ method. The accuracy of the survey estimates was dependent on the sample size. Larger samples produced better results than smaller samples. The LQ estimates were not satisfactory since they overestimated the base multipliers. Gibson and Worden, however, did not make any correction in the traditional LQ method nor did they use disaggregate data at the three or four digit level. These authors admitted that had they used more disaggregate data, the LQ estimates would have been more accurate.





Adjustments to the Location Ouotient Method

Since the LQ method performs poorly and alternative methods have not been fully adopted in practice, making modifications in the LQ method seems the way to proceed.

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Isserman (1977) presented two procedural modifications of the LQ method designed to improve the accuracy of the estimated multipliers. First, he emphasized the need to use disaggregate data at the three or four digit level to reduce the product mix problem and increase the size of the export estimates. As mentioned earlier, disaggregate data permit the identification of basic activities otherwise hidden in major groups. Isserman added that previous empirical critiques of the method (Leigh 1970; Tiebout 1962; and Greytak 1969) were questionable because they used highly aggregated data (one or two digits). Second, he proposed to broaden the definition of export employment to include all federal employment, and hotel, tourist court, and motel employment to reduce the size of the employment multipliers, which had been previously overestimated. He showed these modifications substantially reduced the magnitude of the employment multipliers.

In addition, Isserman reiterated the need to use further modifications to incorporate differences in per capita productivity and consumption, and to



recognize the existence of net exports into the analysis. However, this fully adjusted version of the LQ has not been well tested or documented. To explore the applicability to developing countries, this adjusted version of the LQ is presented and implemented in this study.

Norcliffe (1983) offered another way to correct the LQ method but it does not look promising for developing countries. He modified the LQ method and developed consumption-based location quotients (CLQir) defined as:

$$CLQ_{ir} = \frac{P_{ir}/C_{in}}{C_{r}/C_{n}}$$
(2)

where,

P_u= Regional production in sector i C_u= National consumption in sector i C₌ Regional consumption

of itegronal consumption

Cn= National consumption.

By comparing regional production to national consumption in a sector, the formula attempts to correct for biases attributable to net national exports or imports in that sector. The use of a regional to national consumption ratio as a base is appropriate when there is a difference between P/P_n and C_r/C_n . This modification was introduced to include the effect of non-industrial





sources of income on the regional consumption patterns. As he states, a region with a small industrial base, but a large income from exogenous sources, consumes more of its own production and consequently exports less than might be expected. The contrary happens when the reverse situation prevails. The argument seems reasonable, but empirical tests using five Canadian primary processing industries did not provide good results. Except for the fishing and sawmilling industries, the results were poor.

Summary

The use of the LQ method in economic base models has been tested in regions of the United States and Canada using a gross level of industrial classification. The results have been mixed. In almost all cases basic activity tends to be underestimated. In order to find more reliable ways to estimate regional export activity, alternative indirect methods have been proposed but they have not been fully convincing either. Frequently, the alternative methods are based on conditions and assumptions which are even more difficult to hold.



Suggestions have been made to improve the accuracy of LQ estimations. In particular Isserman (1977), who suggested three types of adjustments to the LQ method, believes that better estimates of export activity are possible. However, no attempts have been made to implement and test those adjustments. The practicality of implementing these modifications and the efficiency of this approach in the study of regions in developing economies are unknown.

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CHAPTER 3

CONSTRUCTION OF THE ECONOMIC BASE MODEL FOR CHIRIQUI

Introduction

To explore the applicability of the LQ technique in developing countries, this chapter will develop an economic base model for a region in Panama. Theoretical and practical considerations are discussed in relation to the objective of measuring the economic base of a region in a developing country.

The Setting

The region used in this study is the province of Chiriqui in the Republic of Panama. Panama is located at the center of the American continent joining North and South America. It is bordered by the Caribbean Sea to the north, the Pacific Ocean to the south, Colombia to





the east, and Costa Rica to the west (see map, Appendix A). Panama is one of the smallest countries in Central America, with an area of only 77,000 square kilometers and a population of approximately two million people.

As is the case with most developing countries, Panama is a country with spatially uneven development. The modern and dynamic metropolitan area of Panama City, situated along the eastern side of the Panama Canal, can be contrasted with the traditional and lesser developed regions of the country. The historical evolution of this spatial structure is closely related to the construction of the Panama Canal at the beginning of the 20th century. After the interoceanic waterway was built by the United States, Panama City became a major center of commercial exchange and specialized services. Its growth far surpassed the growth of secondary urban centers in the rest of the country. The dynamic and cosmopolitan life of the national capital attracted migratory flows from the less urbanized provinces of the country and even from other countries. This trend has continued until recent years but to a lesser extent.

At present, big differences exist between the core metropolitan area of Panama and the outlying areas of the country. The most densely populated areas are located in the metropolitan area of Panama City. The major flow of money also takes place in Panama City. Not surprisingly about fifty



percent of the total population resides in this metropolitan corridor which joins the national capital with Colon, the second largest city. More than eighty percent of all economic activity in the country takes place there as well. Most of this economic activity belongs to the secondary and tertiary sector. Particularly important are the commercial functions and services such as banks and hotels. In contrast, the rest of the country is sparsely populated and far less developed in socioeconomic terms.

The province of Chiriqui, the region selected for this study, is located in the rural hinterland of Panama. Bordering Costa Rica in the western region of Panama, Chiriqui has an area of about 9,000 thousand square kilometers with a population of nearly 300,000 people. The main city is David with a population of more than 50,000 people.

Chiriqui is an important region in Panama. Relatively rich soils in Chiriqui have contributed to its agricultural diversity and high economic performance. Agriculture is the major activity in the region. Main crops include bananas (grown in large foreign-owned plantations), livestock, coffee, sugar cane, rice, potatoes, and tomatoes. The province produces a high portion of the output needed for national consumption and exports. About fifty percent of cattle production is consumed outside the borders of the province. More than eighty five percent of the coffee produced is exported. Also, Chiriqui produces more than fifty percent of the national

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exports of banana. In vegetables, this province is the main supplier at the national level. Its economic performance is superior to other provinces in Panama. For instance, in terms of labor productivity, the agricultural sector of Chiriqui is about fifty percent more productive than the rest of the nation.

The Economic Base Model

An economic base model is a construct for studying and understanding how the local economy works. It focuses on the structure and behavior of the employment and income generating activities of a region (Tiebout 1962; Wubneh 1984).

A region possesses a stock of resources --land, capital, and labor-which are used to produce goods and services for local use. A region does not produce everything it consumes nor does it consume everything it produces. A region needs to import goods and services locally consumed, and, to pay for these imports, it must earn money by exporting goods and services to other regions. Through exports, the region obtains money to pay for imports and/or to enhance the production of goods for local use. According to the economic base model, trade is a key element in regional


development and a primary impetus for growth (Wubneh 1984). It is assumed that economic growth of a locality depends upon external demand. In other words, the growth or decline of a regional economy is determined by how it performs as an exporter to markets outside its borders. Exports might be in the form of goods and services, which flow out of the region to satisfy exogenous demand, or they might be in the form of expenditures by outsiders in the region on goods and services which are consumed locally.

Based on this premise, economic base theory divides the regional economy into basic and non-basic sectors. The basic sector encompasses those industries which are considered to be exporters. This sector is responsible for the growth of the local economy since it fuels its economic growth. The activity of the non-basic sector is directed to fulfilling the consumption needs of the local residents. The basic sector drives the rest of the economy and is dependent on changes in external demand for its products.

The non-basic sector is sensitive to changes in the basic sector. When the basic sector expands as a result of an increase in external demand for goods and services, the inflow of money into the community causes corresponding changes in the non-basic sector. Conversely, if a decrease in





external demand for resources leads to a shrinkage of the basic sector, the non-basic sector feels the impact and moves in the same direction.

Economic base analysis recognizes that producers might sell their goods to both markets. For instance, a local industry of dairy products may sell a portion of its output to local markets and another portion to external markets. As a reflection of this, employment in this industry will have both basic and non-basic components as well. Thus, to construct an economic base model, the corresponding figures of basic and non-basic employment must be estimated for each industry in the region. The figures from both components are added together to obtain the total employment figure (Tiebout 1962).

The base multiplier. According to economic base theory, the relationship between basic and non-basic employment can be expressed by a simple constant ratio which is assumed to be stable over time. This ratio of basic employment to non-basic employment is known as the economic base ratio. Knowing the ratio, changes in non-basic employment can be derived from changes in basic employment.

For instance, suppose for 1980 the total employment in a region was 60,000 workers of which 20,000 worked in activities of the basic sector and the remaining 40,000 worked in industries belonging to the non-basic





sector. The base ratio was therefore 1:2. This means that for every basic job, there were two non-basic jobs. In an expanding economy, for every new basic job, two non-basic jobs would be created. Similarly, for every decline of one basic job, two jobs would be lost in the non-basic sector.

The base ratio is a useful value, but the base multiplier (k) is the preferred measure for predicting impacts on the regional economy from changes in basic activity. Thus, while the base ratio relates basic to non-basic employment, the base multiplier relates total employment to basic employment:

$$k = \frac{E_t}{E_t}$$
(3)

where,

 $E_t = Total employment$

 $E_{b} = Basic employment$

Once k is known, changes in E_t can be estimated multiplying k by changes in E_b .

This formulation assumes that all local employment is tied to the basic sector. In other words, that the relationship is linear with zero intercept. However, it is found that in many communities there exists a portion of employment that is "independent" from what happens to the basic sector. This is the case, for example, when a community houses a government





facility such as a military base. The model is still linear but with an intercept. This type of linear formulation was used by a number of researchers including Mulligan (1987) and Hinojosa and Pigozzi (1988). It is given as follows:

$$\mathbf{E}_{\mathbf{t}} = a + b(\mathbf{E}_{\mathbf{b}}) \tag{4}$$

where a is the "autonomous" portion of employment and b is a constant.

By differentiation, variations of E_t with respect to E_b are equal to:

$$b = \frac{\Delta E_t}{\Delta E_h} \tag{5}$$

Thus the constant b is the base multiplier. Using equation (5), this multiplier can be used to predict changes of total employment from changes in the basic sector.

It is customary to assume that the multiplier process takes place over time but the period within which it operates is not well defined. Isserman (1977) and Eply (1983) have indicated the base multiplier is rather a short run phenomenon whose full impact is felt within five years. McNulty (1977) suggested that the multiplier effect is rather a long run phenomenon usually taking more than four years. The debate continues on this issue.



Finally, it is appropriate to notice that, as opposed to other types of multipliers (for example, input-output multipliers), there is only one economic base multiplier for each region. The base multiplier is an aggregate measure of how one group of sectors (basic) are related to the rest of the sectors within the entire regional economy. In economic base analysis, it is not possible to derive sector specific multipliers.

Operational Considerations. In conducting an economic base study one faces operational problems of varying magnitudes. They start with the definition of the study area. Special considerations in defining the size of the study area are: the purpose of the study, the nature of regional ties, the availability of data, and the time and monetary costs (Wubneh 1984). Above all, the analyst must state clearly his objectives and be aware of the changes that may occur in the base multipliers depending on the size of the study area selected. For instance, if the analyst is interested in an urban area, he/she must consider seriously the inclusion of the next larger area (county in the United States) to take into account the commercial links with areas in the periphery. If only the city is included in the study, the proportion of exports will be larger than in the next larger area. A city usually has intensive trade with the surrounding areas. As a larger





Sometimes, for practical reasons political boundaries are used to define the appropriate study area. Usually, it is easier to find data for political subdivisions than for other non-political entities. The study could thus be applied to a county, province, or state. There is no single rule for defining study areas, but it must be remembered that the unit selected must constitute an economic entity that makes sense when being analyzed in isolation

Once the geographic area of study has been defined, the analyst must select a unit of measure for economic activity. The most commonly used unit of measure is employment, mainly because it is readily available and has the advantage of being easily converted into population and households by means of statistical conversion ratios (BenDavid-Val 1983). Another advantage of employment is that it moves in the same direction as other measures of economic activity (Tiebout 1962).

However, some difficulties do arise from the use of employment as a unit of measure. First, adjustments have to be made for part-time and seasonal employment. These types of employment need to be converted into full-time equivalents. The second problem has to do with commuters. Individuals who commute into the region to work and others leaving the

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region must be accounted for so that employment data reflect actual values. Collecting data by place of residence rather than by place of work could solve this problem. A more difficult problem is the insensitivity of employment to technology, productivity and other related factors. Employment does not reflect differences in labor skills and quality. Using payrolls as a weighting factor is a means to deal with this problem (Isard 1960; Wubneh 1984). If available, other units of measurement might be used; income and output are usually recommended.

After the unit of measurement has been chosen, the contribution of industries to basic and non-basic activity must be identified. When added up, the sum of basic and non-basic employment must be equal to total employment. From here, the base multipliers are estimated using equation (5) as described earlier.

Uses of an Economic Base Study. An economic base study serves multiple purposes. It can be used by government as well as private individuals and enterprises. An economic base study can provide better understanding of current sources and levels of employment and income in a community (Tiebout 1962). For example, for a province such as Chiriqui, Panama, an economic base analysis can reveal which industries are more important to the region as indicated by their magnitude of basic

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employment and multiplier effects, and which industries are relatively under-represented in the local economy. Analysis of historical data can indicate the strength of basic industries. If the overall behavior of these industries is sensitive to cyclical fluctuations, different policies may be desired to make them more stable. Key industries can be identified and targeted in order to maintain certain levels of economic stability and development.

Likewise, a base study is useful for investors inside and outside a region. Good investment opportunities can be discovered by predicting employment changes in a region.

A base study can also pinpoint the weaknesses of a local economy. It can indicate, for example, the amount of local export employment which is tied to vulnerable outside markets. Given the high degree of external dependency in countries like Panama, this kind of information is useful for developing more diversified economies.

The base multiplier is a useful tool for evaluating the impact of new investments in a region. For instance, it is possible to forecast the number of jobs created when a firm moves to a region. The base multipliers can also estimate levels of basic employment needed in order to reach specific targets of total regional employment.





Unadjusted Location Quotients for Chiriqui

The location quotient, as used in equation (1), Chapter 2, measures the excess of regional percent employment over the national percent. The national percent is considered to be the "average" amount of employment required to satisfy local needs. Therefore, if the LQ for a sector i is greater than one, regional export activity is assumed to exist in that sector:

$$X_{ir} = E_{ir} - (E_{in}/E_{n})E_{r} \qquad (6)$$

or $X_{ir} = E_{ir} - E_{i}/LQ_i$ (7)

where X_{ir} is equal to regional export activity in sector i, and the other elements are defined as the same as in equation (1).

The use of this LQ approach involves assumptions which might not hold in the real world. To begin with, for the national percent of employment to represent the proportion of regional activity required for local use, there must be equal patterns of productivity and consumption per capita within each industrial category in all regions of the country. Second, it must be assumed that the consumption of an exporting region in a given sector is entirely satisfied by its own production. This assumption implies there is no simultaneous exporting and importing of the same





goods. Third, it is assumed there are no net national exports (either positive or negative) by any industry. As Isserman (1977, p. 35) stated,

"Since a region with, for example, 10 percent of the nation's total employment is assumed to consumed ten percent of the nation's production of each industry, the entire nation must be assumed to consume an amount exactly equal to the nation's entire production."

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The nation itself must be self-sufficient.

To the extent that the above assumptions are not met, specially in situations such as developing countries, the results of the LQ method are questionable. In countries like Panama, there is no doubt that the assumptions of the model are far from being fulfilled.

The LQ economic base model is usually constructed using employment data by economic sector at the most detailed level of aggregation, generally at the four digit SIC level. However, some problems are apparent in the case of Chiriqui. In Panama, employment data by sector are not published in sufficient detail. For a region like Chiriqui, they are only published at the one-digit level (ISIC code). Even at the national level the employment data in published form are only available at the two digit level.

The lack of detail poses a serious question about the resulting accuracy of LQ allocations of basic employment. It is well known that regional exports are significantly underestimated unless the quotients are expressed using more disaggregated data (Tiebout 1962; Isserman 1977). Fortunately, the Department of Statistics and Census in Panama keeps



computer printouts and hand compilations containing regional employment data at four digits (ISIC code). These correspond to the records of the 1980 national census. These records were obtained through special permission from the statistical office. After careful examination, it was determined that the data were reliable and useful for the purposes of this study. The 62 sectors used and the corresponding ISIC codes are defined in Appendix B.

To study the implications of using results from the traditional LQ formulation, economic base estimates were prepared for the province of Chiriqui using Equations (1), (3), (6), and (8) as shown in Table 1, Chapter 4. The results are discussed in the next chapter.

Adjusted Location Quotients for Chiriqui

The use of the unadjusted LQ method may produce questionable results in developing countries. As Brodsky and Sarfaty (1977) implied, it would be a mistake to believe national values represent levels of economic activity required for regional self-sufficiency. Countries like Panama either depend largely on imports to satisfy national consumption or are heavy exporters of only a few products. In fact, net export data for Panama





during the late 1970's and early 1980's (Anuario de Comercio Exterior 1984, p. 7) revealed this country had an annual negative balance of nearly one billion dollars in its international trade. Likewise, export data (Ibid, pp. 577-581) showed that more than fifty percent of Panama's exports during the same period were made up by three products (banana, petroleum products, and shrimp).

In Panama there are also significant regional differences in patterns of production and consumption. In contrast to the hinterland, workers in the metropolitan area of Panama City are usually more skilled and better educated, and have better conditions for achieving higher levels of productivity. For instance, according to the 1980 national census, the illiteracy rate in the province where Panama City is located was 5.3, well below the national average of 13.2. The percentage of school attendance was also higher (90.8) than the national average (84.0). Another factor contributing to higher productivity in the metropolitan area of Panama City is the exposure of industries to modern technology and the benefits of urban infrastructure and economies of scale.

Similarly, regional consumption levels vary mainly because of regional differences in income. In Panama, the per capita income in rural areas is about 1/3 the per capita income of the metropolitan area of Panama City.





Thus consumption levels in the rural provinces will be far less than in the metropolitan area of Panama City.

To address these problems, the literature suggests adjustments to the LQ method to improve its accuracy. These modifications are considered to be essential to account for the large deviations in developing countries. They were particularly formulated by Isserman (1977) who suggested the introduction of three coefficients to adjust for differences in productivity, consumption, and net national exports. For a given sector i, these coefficients would produce a corrected LO,' equal to:

$$LQ_{i}' = LQ_{i} \frac{V_{i}}{c_{i}(1-e_{i})}$$
 (8)

where:

v_i = productivity adjustment coefficient

c_i = consumption adjustment coefficient

e_i = net export adjustment coefficient.

Productivity adjustment. The v_i ratio, which adjusts for differences in labor productivity, is the ratio of gross product per employee in sector i in the region relative to the nation. In the case of the province of Chiriqui, it means that if v_i is more than one, the province has greater





labor productivity than the nation and may have a regional surplus to export. Conversely, if v_i is less than one, the province is less productive than the nation, and has less to export.

National productivity values can be estimated from national income and product accounts. However, these accounts are rarely prepared for subnational areas. It is usually easier to find economic data for the whole country or for the metropolitan region of Panama. For provinces, decennial and annual updates of economic activity data are published only at the one digit level of detail. Fortunately, because in the early 1980's the government of Panama wanted to answer questions about regional equity. the Department of Statistics and Census undertook in 1983 a special study of income and product accounts for four regions. From this study, it was possible to obtain data for firms with five or more employees within the manufacturing sector. The information came from industry directories maintained by the Comptroller's Office or by various ministries. The directories provided useful details such as number of employees and output by type of establishment for each region. The province of Chiriqui roughly corresponds to eighty five percent of one of these regions (Western region), Labor productivity values in the province were thus assumed to be equal to those of the Western region.





Productivity data were not available for all subsectors. In some subsectors only one or two establishments existed. For reasons of confidentiality those data were not disclosed. In these cases, sectors with disclosure problems were merged with others for which information existed. Subsector productivity was assumed to be equal to the productivity of the whole sector.

Some examples can better illustrate this process. The adjustment value for productivity for sectors 121 and 122 was considered to be equal to the value of the larger sector 12. The v_i value for sectors 3118, 3121, and 3122 was assumed to be equivalent to the average of the three subsectors. Similar procedures were applied to other subsectors as shown in Appendix C.

Another way to remove data gaps was the use of data from a larger area. For instance, in activity 3113 (canning and preserving fruits and vegetables), where the province comprised most of the national employment in that subsector, regional productivity was assumed to be equal to the national productivity of that subsector.

For economic sectors other than agriculture, fishing, and manufacturing, the productivity ratio, v_i, was estimated using 1978 output data from a study published by the Planning Ministry (Ministerio de





Planificación y Política Económica, 1982). A sector by sector detailed account of how data gaps were resolved is offered in Appendix C.

<u>Consumption adjustment</u>. The consumption adjustment coefficient, c_i, captures differences between regional and national consumption patterns occurring in sector i. If the region has a higher consumption pattern than the national level, it will have less to export. Conversely, if consumption is low, more production will be available for markets outside the region.

The consumption adjustment coefficient is calculated using sector specific regional and national consumption data. These data are very difficult to obtain in a country like Panama. Consumption data could not be obtained for any region or province in Panama. Data availability problems for this kind of correction were also mentioned by Isserman who suggested the use of income as a proxy. This is a reasonable assumption since income is probably the major factor influencing the level of consumption. In the province of Chiriqui, the median household income in 1980 was approximately seventy seven percent of the corresponding national value. Thus, it was assumed that across all sectors, provincial consumption was correspondingly lower.





Net national export adjustment. The third modification to the LQ addresses the question of whether national values of employment can be used to describe self-sufficiency levels. The e, coefficient, which corrects for net exports, is the ratio of national net exports (exports less imports) in sector i to national output in the same sector. If national exports exceed imports in an economic sector, the term (1-e,) has the effect of subtracting from national employment the portion that is tied to international trade. On the other hand, if imports exceed exports in a sector, this adjustment adds employment to the national percent to reflect proper levels of employment needed for national self-sufficiency.

The collection of data for this adjustment presented two major difficulties. First, international trade statistics are reported using an international commodity classification system that is not directly transferable to ISIC classification terms. Only after carefully matching commodities and industry activities in a country, can net export data be expressed in ISIC terms. The difficulty arises from the uncertainty of assigning a given product to one or more industrial categories, especially when working in greater detail. Nevertheless, this is more the exception than the rule. The data used in this study were obtained from a special project undertaken by the Department of Statistics and Census of Panama to reference trade accounts by economic sector.



A second difficulty stems from data gaps in the trade documents. International trade statistics for Panama, obtained from the International Commerce Division, report figures only for industries engaged in primary and secondary activities. For other sectors, those not engaged in the production of raw materials or manufacturing, it was not possible to obtain information. There was no way to determine whether this was because no statistics were kept or because no exports took place. It was assumed that Panama did not have exports in those areas. The calculations for the net national export adjustment for all sectors are included in Appendix D of

After addressing these problems in the process of data collection, it was possible to disaggregate the economy of the province of Chiriqui into 62 sectors, most of them at the three or four digit level and to construct the economic base model. It should be noted that the Canal area employees were assigned entirely to the export component of the model since the Panama Canal functions mainly to serve outside users.

this study.

The three adjustments were computed according to equation (8) and results are shown in Table 1, Chapter 4.

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Summary

The economic base model was applied to the province of Chiriqui, Republic of Panama. Chiriqui was considered to be a good test area because of its importance in the economy of the country and because of its rural location where the assumptions of the model are less likely to hold. Particular attention was given to the three assumptions for which adjustments were proposed. Difficulties in implementing the models were described. The most common problem was the lack of spatial and sectoral disaggregation of economic activity data in published form. However, the existence of unpublished data made possible the calculation of basic activity for the unadjusted as well as the adjusted version of the LQ. While the data problems seem to be manageable for the 1980 census year of this study, it is believed that for intercensal years the construction of a base model would be more difficult.





CHAPTER 4 DISCUSSION OF RESULTS

Introduction

In this chapter, the regional export estimates obtained from the LQ formulations are discussed. The effect of the adjustments to the traditional LQ are also shown and discussed. The accuracy of the estimates is tested by comparing results from the LQ formulations to those obtained from a survey of local industries. Firms within key economic sectors were interviewed to determine their direct and indirect export activity.

Basic Employment from the LQ Method

Table 1 shows the LQ estimates of basic employment calculated using Equations (1), (6), and (8). According to the unadjusted LQ, 16 industries were identified as basic.





Table 1: Estimates of regional basic activity Province of Chiriqui, Panama -- 1980

Sector	Employment							Estimated Basic Employment	
	National	Regional	LQ	V ₁	Cı	1-e ₁	LQ'	LQ	LQ'
11	137849	30547	1.61	1.56	0.77	0.86	3.76	11529	22417
121	515	16	0.23	0.14	0.77	1.22	0.03	0	0
122	414	50	0.88	0.14	0.77	1.81	0.09	0	0
13	3682	231	0.45	0.83	0.77	0.09	5.58	0	190
23	36	9	1.81	0.87	0.77	1.08	1.90	4	4
29	687	60	0.63	0.87	0.77	1.35	0.53	0	0
3111	1399	216	1.12	0.94	0.77	1.13	1.21	23	37
3112	2023	307	1.10	0.90	0.77	1.08	1.19	28	48
3113	917	662	5.23	1.00	0.77	1.93	3.52	535	474
3114	996	70	0.51	0.94	0.77	0.90	0.69	0	0
3115	1017	17	0.12	0.92	0.77	1.41	0.10	0	0
3116	985	320	2.42	0.91	0.77	1.09	2.62	193	203
3117	3014	318	0.76	0.91	0.77	1.01	0.89	0	0
3118	8821	1058	0.87	0.59	0.77	0.44	1.49	0	349
3119	283	13	0.33	0.92	0.77	1.80	0.22	0	0
3121	814	76	0.68	0.59	0.77	1.14	0.45	0	0
3122	182	4	0.16	0.59	0.77	1.33	0.09	0	0
3131	667	77	0.84	0.53	0.77	1.06	0.54	0	0
3132	77	28	2.64	0.53	0.77	1.42	1.28	17	6
3133	1436	333	1.68	0.53	0.77	1.06	1.09	135	27
3134	998	174	1.26	0.42	0.77	1.01	0.68	36	0
314	490	47	0.70	0.80	0.77	1.01	0.71	0	0
321	451	12	0.19	0.86	0.77	8.00	0.03	0	0
322	7888	641	0.59	0.86	0.77	1.18	0.56	0	0
323	429	71	1.20	0.82	0.77	1.00	1.28	12	15
324	1510	111	0.53	0.52	0.77	1.39	0.26	0	0
331	1373	228	1.20	2.81	0.77	1.28	3.44	39	162
332	3882	396	0.74	2.55	0.77	1.10	2.22	0	218
341	932	34	0.26	0.33	0.77	1.69	0.07	0	0
342	2463	64	0.19	0.33	0.77	1.34	0.06	0	0
35	2773	44	0.12	0.62	0.77	1.38	0.07	0	0
361	241	7	0.21	0.22	0.77	1.71	0.04	0	0
362	307	2	0.05	0.22	0.77	1.80	0.01	0	0
369	2677	181	0.49	0.22	0.77	1.08	0.13	0	0
37	561	15	0.19	NA	0.77	3.51	0.06	0	0
381	2110	128	0.44	0.66	0.77	2.14	0.18	0	0
382	89	7	0.57	0.66	0.77	70.34	0.01	0	0
383	215	8	0.27	0.66	0.77	11.03	0.02	0	0



Table 1	- co	ontinue	d
			_

C	Employment		10	v	c	1	1.0'	Estimated Basic Employment	
Sector	National	Regional	ĽŲ	V ₁	C ₁	1-01	LQ	LQ	LQ'
384	428	9	0.15	0.66	0.77	19.93	0.01	0	0
385	86	2	0.17	0.66	0.77	11.87	0.01	0	0
39	386	148	2.78	0.03	0.77	4.79	0.03	95	0
41	5219	1098	1.52	0.35	0.77	1.00	0.69	378	0
42	2614	187	0.52	0.76	0.77	1.00	0.51	0	0
5	30565	5011	1.19	0.51	0.77	1.00	0.78	794	0
61	12408	1057	0.62	0.50	0.77	1.00	0.40	0	0
62	39067	5493	1.02	0.50	0.77	1.00	0.67	103	0
63	14482	1387	0.69	0.50	0.77	1.00	0.45	0	0
7	29128	2569	0.64	0.22	0.77	1.00	0.18	0	0
81	8577	621	0.52	0.68	0.77	1.00	0.46	0	0
82	1649	86	0.38	0.52	0.77	1.00	0.25	0	0
831	3705	136	0.27	0.52	0.77	1.00	0.18	0	0
832	4647	231	0.36	0.52	0.77	1.00	0.24	0	0
833	541	22	0.29	0.52	0.77	1.00	0.20	0	0
91	29204	2186	0.54	1.52	0.77	1.00	1.07	0	149
92	1697	105	0.45	0.81	0.77	1.00	0.47	0	0
93	49233	6604	0.97	0.81	0.77	1.00	1.02	0	113
94	6624	347	0.38	0.81	0.77	1.00	0.40	0	0
951	6734	974	1.05	0.81	0.77	1.00	1.10	45	86
952	1079	57	0.38	0.81	0.77	1.00	0.40	0	0
953	28738	2976	0.75	0.81	0.77	1.00	0.79	0	0
959	3822	510	0.97	0.81	0.77	1.00	1.01	0	6
96	797	5	0.05	0.81	0.77	1.00	0.05	0	0
Sub- total	476633	68412						13966	24504
spec.	7019	641							
Area	17020	22						22	22
Total	500672	69075				Base	Multipli	13988 ier4.94	24526 2.82

Sources of Data:

Contraloría General de la República. Indicadores Económicos y Sociales; Años: 1981-85, (Panamá: Dirección de Estadística y Censo, 1987), pp. 4-6.

Panamá en Cifras; Años 1982-1986, (Panamá: Dirección de Estadística y Censo, 1988), p. 94.

Situación Económica: Anuario de Comercio Exterior: Año 1981, (Panamá: Dirección de Estadística y Censo), pp. 199-396. Tabulations of the 1980 National Census of Panama (Computer printouts and

_____. Tabulations of the 1980 National Census of Panama (Computer printouts and hand compilations), August, 1989.



A major portion (82%) of all basic employment belonged to the agricultural and livestock production sector (sector 11). This confirmed the widely held notion that this sector is the most important in Chiriqui. Not surprisingly, the second largest portion of basic employment was found in sector 3113 (canning and preserving fruits and vegetables), which is closely related to sector 11. The amount of export employment was relatively small in most other sectors. The regional economic base multiplier for the unadjusted case was equal to 4.94. Although this result was derived from four digit employment data, it is considered high in comparison to multipliers reported for studies in developed countries. In developing economies, because of weaker linkages among local industries, the base multiplier is expected to be lower.

The introduction of the three adjustments in LQ_i produced dramatic changes in the size of the regional export estimates. Although the number of basic industries did not change very much (from 16 to 17), there were important qualitative and quantitative changes in the distributions of basic activity. Five industries which were considered basic were no longer in this category; this was a loss of about 10% of basic jobs. Six new sectors emerged as being basic with a gain of about 7% of basic employment. The most important changes occurred, however, in the eleven sectors that remained basic. There, the number of basic jobs increased from 12,560 to



23,479 - almost twice as many jobs. Grouping all industries together, the corrections increased the export estimates by 75% and thus reduced the base multiplier to a value of 2.82. A value more compatible with expectations.

The three coefficients seem to have worked in the right direction. The v_i ratio increased the amount of basic employment in sectors in which the province had higher productivity than the nation and decreased it when the opposite situation prevailed. The c_i ratio increased the regional estimates of basic employment since it was assumed to be lower than in the nation. Also, the net export employment, e_{μ} caused changes in the estimates either by increasing the amount of regional basic employment when the nation was an exporter, or by decreasing such amount when it was an importer.

Of particular interest are the changes in the agricultural sector (sector 11). In this sector, because (1) the province was more productive than the nation, (2) its regional consumption was lower, and (3) the nation was an exporter, there was a compounded triple effect in the same direction. It increased the amount of regional export employment from 11,529 to 22,417. The agriculture sector now accounted for most of the basic activity in Chiriqui with 91% of all basic jobs.



Another sector that is commonly defined as a basic activity in Panama, as well as in Chiriqui, is the fishing industry (sector 13). For this sector, the unadjusted LQ was less than one, with no basic jobs allocated. Since the whole country is an exporter of fish products, the percent national employment in that sector overstated the amount needed for self-sufficiency. According to the e, value obtained for that sector, only nine percent (9%) of the employment in fisheries is required to satisfy national needs. A similar example is given by sector 3118 (sugar factories and refineries) in which the country as well as the province are exporters of sugar cane. For this sector, the unadjusted LQ did not identify any basic employment. These are good illustrations of large errors that could be made if corrections were ignored.

The effect of assuming lower levels of consumption in Chiriqui than in the nation is observed in sectors 3111 (slaughtering, preparing and preserving meat), 3112 (manufacture of dairy products), and 3116 (grain mill products) for which regional export estimates increased in spite of the countervailing effects of the other two adjustments.

The limitation of using improper percentages of national employment to reflect levels of self-sufficiency in Panama is also observed in sectors in which the country imports a high portion of the national consumption. In sector 3113 (canning and preserving fruits and vegetables), even after



assuming that the consumption level in the province is lower than in the nation, because the country as a whole is an importer of these goods, the percent of national employment underestimates the level required for national self-sufficiency. Here, the e, value increased the national figures by 93%, thus reducing the size of the provincial basic employment. Because Panama is not a very industrialized country, levels of national employment in some sectors do not reflect self-sufficiency. For instance, in sector 382 (manufacture of machinery) the country would need seventy times as many jobs to meet levels of self-sufficiency, and in sector 385 (manufacturing of professional and scientific equipment) nearly twelve times more jobs would be needed.

In summary, the productivity adjustment tends to increase the size of the LQs for sectors in which the province is thought to have comparative advantage. The consumption adjustment, which recognizes lower consumption levels in the province, always tends to increase the LQ estimates. Finally, the net export adjustment only increases the regional basic employment estimates when the country is an exporter. In sectors where Panama is a net importer, the latter adjustment actually lowers the LQ because it works on the denominator.

The adjustments made were supposed to increase the accuracy of the LQ estimates of regional export employment. However, it would not be





Basic Employment from Survey Data

The survey of local industries was undertaken in August, 1989. A total of eleven industries were surveyed. Because of their importance in employment and output, they were thought to represent the key economic activities in the province. The economic sectors covered by the survey amount to about forty four percent of the total employment in Chiriqui. The ISIC codes of the industries selected and their relative sizes are shown in Table 2.

Table 2.	Industries	Surveyed
----------	------------	----------

Industry	ISIC	Size of the industry relative
surveyed	code	to its sector
Cattle production	111	0.10 % of sector's output
Slaughterhouse	3111	37.10 % of sector's output
Coffee production	111	30.00 % of sector's output
Banana production	111	80.00 % of sector's output
Rice production	111	99.00 % of sector's output
Rice mill	3116	7.60 % of sector's employment
Sugar mill	3118	100.00 % of sector's output
Liquor	3131	96.00 % of sector's employment
Fruit juice	3113	100.00 % of sector's output
Beer production	3133	61.30 % of sector's employment
Vegetable production	111	25.70 % of sector's output





As noted earlier, the economy of the province of Chiriqui is based mainly on agriculture. Hence, the sample contains a large proportion of industries selected from this sector. A brief description of the sample industries follows:

<u>Cattle production</u>. The province of Chiriqui produces a significant share of the national output in this sector. Many people make a living in livestock production activities. Because there are so many producers, it was not possible to interview all of them. Instead, a representative of the industry, the president of the regional association of cattle producers, provided the needed figures. He considered himself a middle size producer who owned 200 heads of cattle and understood the industry very well.

Slaughterhouse. This is an activity closely related to cattle production. Many cattle producers sell their products to slaughterhouses which in turn sell their output to local and outside consumers. By interviewing a typical slaughterhouse, indirect regional exports from cattle production activities were identified. The establishment selected was the largest and the most important in the province. The information was provided by the manager who based his figures on past records of sales. The annual average of heads of cattle slaughtered was nearly 23,000.

<u>Coffee production</u>. Chiriqui produces more than sixty percent of the national output of coffee production, most of which is sold to the province



of Panama and other countries. The information on exports was obtained by visiting Boquete which is the main coffee producing area in the region and the country. The survey data were obtained from the president of the regional association of coffee producers. The total annual output of the association surpassed 1,500 metric tons of coffee beans.

Banana Production. Chiriqui is the main national producer of bananas. It produces more than fifty percent of the national output, which is mainly oriented to satisfy external demand. The activity in the region is managed by the Chiriqui Land Company, a transnational corporation headquartered in the town of Puerto Armuelles in the southwest part of Chiriqui. The survey information, based on old records of sales pertaining to the company, was provided by personnel in charge of the Department of Sales. The Chiriqui Land Company is one of the major employers in the area with more than 6,000 employees.

<u>Rice production</u>. Chiriqui produces nearly fifty percent of the national production of rice. As with other economic activities, there is an association of rice growers that controls the production and distribution of a large percentage of the rice produced in the province. In terms of employment, activities related to the association provide jobs to almost 2,000 people. The survey was conducted by visiting the office of this association in David, Chiriqui.



Rice mill. Since a portion of rice production is sold to rice mills within Chiriqui, one rice mill plant was surveyed to derive information on the amount of indirect exports of rice. The establishment surveyed is one of the most important mills in the region because it handles a high percentage of the rice production in the province. The survey was answered by the manager of the Department of Sales.

Sugar mill. The establishment surveyed, owned by the national government, is the only sugar mill in Chiriqui. This mill processes almost all the sugar cane production in the province. It is a relatively large establishment that provides jobs to nearly 3,000 people. The survey information was obtained by visiting and consulting personnel in charge of the office of sales in Alanje, Chiriqui. From their data, it was possible to derive direct and indirect exports of sugar. Because sugar is sold to some local producers, these producers were also interviewed. This is the case of the liquor production sector.

Liquor. A direct visit was made to the largest liquor industry in the province. It employed more than 70 people. The manager of the Department of Sales provided information on past patterns of sale distribution. Some difficulties in reconstructing sales figures arose because the manager was not the same as the one in 1980.



Fruit juice. The production of fruit juice in the province of Chiriqui is controlled by <u>Cítricos de Chiriquí</u> (The Chiriqui Citrus Company), an enterprise initially owned by the United States but nationalized in the mid 1970's by the government of Panama. By the end of that decade, the property consisted of 2,000 hectares and a juice concentration plant. The plant's principal product is orange juice concentrate of which 140 thousand gallons are produced each year. The company is by far the largest industry in Panama. Knowledgeable personnel provided information on its economic activity. The information, based on annual records of production and sales, was obtained from the office of Rovira. Chiriqui.

Beer production. The beer production industry, which is owned by the private sector, is another significant economic activity in the region. The company surveyed, <u>Cervecería Chiricana S.A.</u>, provided about 200 jobs in 1980. The data about this industry were provided by the Chair-person of the Sales Department.

<u>Vegetable production</u>. This industry involves the production of vegetables such as potatoes, onions, cabbage, carrots, tomatoes, celery, and beet for which the province of Chiriqui is the main producer at the national level. The survey was conducted by visiting and interviewing the accountant of the major association of vegetable producers in the town of Boquete. The association, which was formed to facilitate product





marketing, is made up by 250 members of which 130 were active

producers.

The questionnaire used in the survey was similar to the one suggested by Tiebout (1962). It was designed to estimate direct and indirect contributions to basic employment. The questionnaire included the following questions:

- 1. Describe the major groups of products of your establishment (s):
- Consider your sales in 1980 or in any year before 1987 and estimate:

 The percentage sold outside of the province of Chiriqui plus all sales to the national government
 - b. The percentage sold inside of the province
- 3. Taking a typical dollar of sales this past year estimated in 2a (outside of the province), how would you distribute this dollar of sales among the following groups:
 - a. Percentage sold to the national government
 - b. Percentage sold to other than national government
- 4. Taking a typical dollar of sales in this past year estimated in 2b (inside of the province of Chiriqui), whom did you sell it to? (for example, industry, wholesale trade, retail trade, etc.). Indicate percentages.
- 5. If the reference year is not 1980, how different were the patterns of production and distribution of the sales compared with 1980's?
- 6. În order to give us some idea of the size of the establishment (s) covered by this questionnaire, would you please indicate the approximate number of people you employed:

The results of the survey provide information about sales inside and outside of the province of Chiriqui. Particularly important are questions 2, 3, and 4. Question 2 allocates sales inside or outside of the province.



Question 3 identifies outside sales either as private exports or exports to the national government. Question 4 identifies direct sales to other producers in the province. This question is important to trace the flow of products to determine if exports occur indirectly. Question 4 also provides information on local consumption (see illustration in Appendix E). In most cases obtaining data for activities that took place nine years earlier was not very difficult due to the preservation of past sales records and the cooperation of industry officials. In a few cases, however, the data were derived by reference to the actual performance as in Ouestion 5.

In some cases, employment data in this survey were adjusted for seasonal and part-time employment (weighted according to the time worked by employees). Seasonal employment was converted to a full-time equivalent by multiplying by a factor reflecting the equivalent fraction (number of weeks worked by seasonal employees divided by 52, the number of weeks in a year). Similarly, part-time jobs were adjusted by using the corresponding fraction (number of hours worked divided by eight, the amount of working hours in a day).

Basic employment derived from the survey is presented in Table 3 along with estimates from the application of LQ ratios. To assess the magnitude of error, the total absolute deviation from survey outcomes is shown for each type of LQ.





	LQ Estimates of Basic Employment for Different Types of Adjustments						
Basic Employment	Unadi	Individua	Fully				
from Survey	LQ	v	C,	e	LQ'		
28284	11529	18330	15904	14109	22417		
130	23	11	67	0	37		
609	536	535	565	417	474		
230	193	179	224	181	203		
905	0	0	121	519	349		
12	0	0	6	0	0		
167	135	0	180	123	27		
30337	12416	19055	17067	15349	23507		
	17001	11292	12206	14099	6920		
	Basic Employment from Survey 28284 130 609 230 905 12 167 30337	LQ Esti for Diff Employment from Survey 28284 11529 130 23 230 193 905 0 12 0 167 135 30337 12416	LQ Estimates of Bas for Different Types Basic Individue Employment Unadj. from Survey LQ vi 28284 11529 18330 130 23 11 0905 0 0 12 0 0 167 135 0 30337 12416 19055	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		

Table 3: Comparison of Basic Employment Derived from Survey and LQ Formulations, Province of Chiriqui - 1980

Source: Survey of establishments in the province of Chiriqui, Panama, August, 1989, by author.

Note: Errors are absolute deviations from survey results.

Comparison of Results

Table 3 compares results obtained from the use of the LQ formulations with regional export activity derived from the survey. Specifically, this table shows estimates of employment for the unadjusted case, for individual adjustments (productivity, consumption, and net exports), and for the fully adjusted case. Because survey data did not cover all industries in the province, these comparisons are limited to seven sectors.

According to Table 3, it is evident that the adjustments improve the accuracy of the regional estimates of basic employment. When the unadjusted LQ method is





used, regional export employment amounts to only 41% of the actual basic employment. When the adjusted LQ method is used, this underestimation of export employment is substantially reduced. The fully adjusted LQ method permitted the estimation of 77% of all regional basic employment. Similarly, the sum of absolute deviations from survey values was markedly reduced. Of particular interest are the results for sector 11 in which the adjustments permitted the identification of twice as many jobs as in the traditional method.

The results show that the combination of the three adjustments seems to work in the right direction. They all contributed to the minimization of error, except for the beer production industry (sector 3133) where the adjusted values increased the error of estimation. The productivity adjustment permitted the identification of 63% of all regional basic jobs in the seven sectors studied --an amount substantially higher than in the case of the unadjusted version. The other two adjustments also contributed to increases in the regional estimates of basic employment but to a lesser extent.

Table 3 shows clearly that without the adjustments the number of basic jobs would have been substantially underestimated. This underestimation would have been even worse if highly aggregated data were used. To illustrate this point, in Appendix F, export employment activity for Chiriqui was derived using one digit level employment data. In the agriculture sector (major division 1), the amount of basic employment did not differ significantly from the amount estimated using more disaggregated data. This apparent indifference to disaggregation arises because all the basic employment in sector 1 comes from subsector 11 (see Table 1, Chapter 4). However, in sector 3, where basic employment comes from several subsectors.





qualitative as well as quantitative errors are observed when data are highly aggregated. In this sector 3, with one digit data, no basic jobs are allocated. Existence of export activity in some subsectors is offset by deficiencies in other subsectors. But when sector 3 is disaggregated, as in Table 1, export jobs are identified. In fact, survey data show that basic employment does exist in several subsectors. For instance, for six sectors surveyed, there are more than 2,000 export jobs (Table 2). This clearly shows the additional importance of using disaggregated data.

Summary

According to results from survey data, the proposed adjustments to correct for productivity and consumption variations, and for net national exports produced dramatic changes in the estimates of regional export activity. In the case of Chiriqui, the changes resulted in an overall increase of regional export employment of about 75%. The result reveals that all three adjustments are necessary for making the LQ method work. The use of disaggregated data is also recommended.


CHAPTER 5

CONCLUSIONS

The main purpose of this study was to evaluate the difficulties and limitations of using the LQ method in economic base models in a developing country like Panama. Because the LQ assumptions state conditions that are not met in countries such as Panama, the use of this method does not seem advisable. So far, no other empirical studies exist to show that estimates from the LQ method produce reasonable results in developing countries. To show the magnitude of error introduced by the LQ method, a survey was conducted to derive actual regional export values. The results obtained confirm the notion that the LQ method underestimates, substantially, the amount of regional basic activity. The errors are of a qualitative as well as quantitative nature. Proposed adjustments for productivity, consumption, and net national export effects were also implemented in this study of Chiriqui's economy. Comparisons with survey results show that the proposed adjustments to the traditional LQ formulation produce significant reductions of error. Each of the corrections plays an important role in the implementation of the economic base model.

The results obtained using the adjusted LQ version in this study were even better than those obtained from using unadjusted LQ's in developed countries. Previous studies in the United States (Tiebout 1962; Greytak 1969; Leigh 1970; and Gibson and Worden 1981) report that the LQ method usually identifies less than



sixty percent of actual exports in a region. This study in Panama finds that the adjusted LQ method can identify up to 77 percent of all exports in a region. What this means is that even in developed countries adjustments to the LQ approach may be necessary. The adjustments made to the LQ method, however, seem to be essential for economic base studies in developing countries. Shortcuts in the construction of the model by using highly aggregated data or by sidestepping the adjustments of the model should be avoided because results will likely be incorrect.

The major difficulties in implementing an economic base model in Chiriqui were associated with data availability and collection. Sector specific data were not always readily available although they existed in an unpublished form. By going beyond what is offered by published sources, it was possible to overcome most of the problems faced during the data gathering period. In the particular case of Panama, the attainment of important pieces of data through special searches in the archives of government agencies proved fruitful. It permitted the construction of the model in a sufficient degree of detail.

Given the substantial improvements observed in the LQ estimations of export activity, the results of this study may be encouraging for researchers as well as for practitioners of regional development. A renewed interest in the use of the LQ method may arise at a time when most indirect methods to identify the regional economic base perform poorly. The results presented here might open the door for additional research oriented to strengthening the efficiency of the adjustments. Since the survey did not include sectors beyond those engaged in primary and secondary activities, still more needs to done before definitely adopting the results. In this study, income was used as a substitute for consumption. Better results might be



possible with the use of direct measurements of regional consumption patterns. Also, the application of the adjustments in other regions might provide more evidence to support the conclusions of the study.

Practitioners and decision makers may also benefit from this study which shows that reasonable results may be obtained without having to construct expensive econometric models. If the LQ method is used carefully, it may provide a simple and inexpensive means to do regional analysis. But this can only be done with the cooperation of agencies in charge of gathering and maintaining the appropriate data.







APPENDICES







APPENDIX A

Map of Republic of Panama











APPENDIX B

Classification of Economic Activities According to ISIC Code





APPENDIX B

Classification of Economic Activities According to ISIC Code

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Division Major Group Group	Title of Category
Major Division 1.	Agriculture, Hunting, Forestry and
	Fishing
11	Agriculture and Hunting
121	Forestry
122	Logging
13	Fishing
Major Division 2.	Mining and Quarrying
23	Metal Ore Mining
29	Other Mining
Major Division 3.	Manufacture of Food, Beverage and
	Tobacco
3111	Slaughtering, preparing and preserving meat
3112	Manufacture of dairy products
3113	Canning and preserving of fruits and vegetables
3114	Canning, preserving and processing of fish, crustacea and similar foods
3115	Manufacture of vegetable and animal oils and fats
3116	Grain mill products
3117	Manufacture of bakery products
3118	Sugar factories and refineries
3119	Manufacture of cocoa, chocolate and sugar confectionery
3121	Manufacture of food products not elsewhere classified
3122	Manufacture of prepared animal feeds
3131	Distilling, rectifying and blending spirits
3132	Wine industries
3133	Malt liquors and malt
3134	Soft drinks and carbonated water industries
314	Tobacco manufactures





(APPENDIX B - continued)

Divisi	on Major Grou Group	p Title of Category
	321	Manufacture of textiles
	322	Manufacture of wearing apparel, except footwear
	323	Manufacture of leather and products of leather, leather substitutes and fur except footwear and wearing apparel
	324	Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear
	331	Manufacture of wood and wood and cork products, except furniture
	332	Manufacture of furniture and
		fixtures, except primarily of metal
	341	Manufacture of paper and paper products
	342	Printing, publishing and allied industries
35		Manufacture of Chemicals and of
		Chemical, Petroleum, Coal, Rubber and Plastic Products
	361	Manufacture of pottery, china and earthenware
	362	Manufacture of glass and glass products
37	369	Manufacture of other non-metallic mineral products Basic Metal Industries
	381	Manufacture of fabricated metal products, except machinery and equipment
	382	Manufacture of machinery except electrical
	383	Manufacture of electrical machinery, apparatus, appliances and supplies
	384	Manufacture of transport equipment
	385	Manufacture of professional and scientific, and measuring and
		controlling equipment not elsewhere classified, and of photographic and optical goods
39		Other Manufacturing Industries
1	Major Division 4.	Electricity, Gas and Water
41		Electricity, Gas and Steam
42		Water Works and Supply





(APPENDIX B - continued)

Division Major Group Title of Category Group

	Major Division 5	Construction
	Major Division 6.	Wholesale and Retail Trade
61		Wholesale Trade
62		Retail Trade
63		Restaurants and Hotels
	Major Division 7.	Transport, Storage and Communication
	Major Division 8	Financing, Insurance, Real State and Business Services
81	Fina	incial Institutions
82		Insurance
-	831	Real state
	832	Business services except machinery
		and equipment rentals and leasing
	833	Machinery and equipment rental and leasing
	Major Division 9.	Community, Social and Personal Services
91		Public Administration and Defence
92		Sanitary and Similar Services
93		Social and Related Community Services
94		Recreational and Cultural Services
	951	Repair services not elsewhere classified
	952	Laundries, laundry services, and cleaning and dveing plants
	953 Dor	nestic services
	959	Miscellaneous personal services
96		International and Other Extra-
		Territorial Bodies

Source:

United Nations. Department of Economic and Social Affairs. International Standard Industrial Classification of all Economic Activities, Statistical Papers, Series M, No. 4, Rev. 2 (New York: United Nations, 1968), pp. 41-48.







APPENDIX C

Labor Productivity Ratios by Sector





APPENDIX C

Labor Productivity Ratios by Sector

Sector (ISIC)	vi value*	Notes
11	1.56	
121	0.14	Based on sector 12 productivity
122	0.14	Based on sector 12 productivity
13	0.83	
23	0.87	Based on sector 2 productivity
29	0.87	Based on sector 2 productivity
3111	0.94	Based on merged data for sectors 3111 and 3114
3112	0.90	-
3113	1.00	Most of the national employment is in Chiriqui
3114	0.94	Based on merged data for sectors 3111 and 3114
3115	0.92	Based on sector 311 average
3116	0.91	C C
3117	0.91	
3118	0.59	Based on merged data for sectors 3118, 3121, and
3122		5
3119	0.92	Based on sector 311 average
3121	0.59	Based on merged data for sectors 3118, 3121 and
3122.		,
3122	0.59	Based on merged data for sectors 3118, 3121, and
		3122
3131	0.53	Based on merged data for sectors 3131 and 3133
3132	0.53	5
3133	0.53	Based on merged data for sectors 3131 and 3133
3134	0.42	
314	0.80	Based on sector 3 average
321	0.86	Based on sectors 321 and 322 total
322	0.86	Based on sectors 321 and 322 total
323	0.82	Based on sector 32 average
324	0.52	
331	2.81	Based on sector 33 average
332	2.55	Based on merged data for sectors 3320 and 3412
341	0.33	Based on sector 34 average
342	0.33	Based on sector 34 average





(APPENDIX C - continued)

Sector	vi	Notes
(ISIC)	value*	
35	0.62	Based on sectors 3551, 3559, 3560, and 3620
361	0.22	Cata Based on sector 36 average
362	0.22	Based on sector 36 average
360	0.22	Based on sector 36 average
309	0.22	Not available
281	0.66	Pased on sector 28 average
202	0.00	Based on sector 29 average
282	0.00	Based on sector 39 average
201	0.00	Based on sector 28 average
205	0.00	Based on sector 28 average
305	0.00	Based on sector 2000 date
39	0.03	Based on sector 5909 data
41	0.55	
42	0.76	
5	0.51	D
61	0.50	Based on sector 6 average
62	0.50	Based on sector 6 average
63	0.50	Based on sector 6 average
7	0.22	
81	0.68	
82	0.52	Based on sector 8 average
831	0.52	Based on sector 8 average
832	0.52	Based on sector 8 average
833	0.52	Based on sector 8 average
91	1.52	
92	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data
93	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data
94	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data
951	0.81	Based on sectors 92, 93, 94, 95, and 96 merged





(APPENDIX C - continued)

Sector (ISIC)	vi value*	Notes
952	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data
953	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data
959	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data
96	0.81	Based on sectors 92, 93, 94, 95, and 96 merged data

Source of Data:

Contraloría General de la República. Establecimientos Dedicados a la Industria Manufacturera en la República por Región, Según Actividad: 1983 (Unpublished).

Ministerio de Planificación y Política Económica. Metodología y Estimación del Producto Interno Bruto por Provincia; Años 1970-1978 (Panamá: Dirección de Planificación y Coordinación Regional, 1982).

* Regional output per employee divided by national output per employee.





APPENDIX D

Adjustment for Net National Exports



APPENDIX D

Adjustment for Net National Exports

ISIC					
Code	Exports*	Imports*	Output**	ei***	1-ei
TOTAL	319691908	1020043419	2055103938	-0.34	1.34
11	85958268	39139112	345059000	0.135	0.86
121	0	1063292	4822928	-0.22	1.22
122	63940	3219699	3877072	-0.81	1.81
13	46950834	118825	51331938	0.912	0.08
23	0	25285	329640	-0.07	1.07
29	0	2262216	6470360	-0.34	1.34
3111	5098880	12654452	56145000	-0.13	1.13
3112	6857842	14010572	87953000	-0.08	1.08
3113	6738639	15258585	9134000	-0.93	1.93
3114	9771096	4344257	53426000	0.101	0.89
3115	1298331	15072925	33548000	-0.41	1.41
3116	49548	6912776	75149000	-0.09	1.09
3117	183219	672371	44450000	-0.01	1.01
3118	55115099	811249	97458000	0.557	0.44
3119	1081086	4308489	4057000	-0.79	1.79
3121	1296962	7625222	44431000	-0.14	1.14
3122	114872	9227052	27525000	-0.33	1.33
3131	3235698	5142295	30216000	-0.06	1.06
3132		2219003		-0.42	1.42
3133	8250	3150575	51860000	-0.06	1.06
3134	19946	251140	27393000	-0.00	1.00
314	2184176	2539491	37802000	-0.00	1.00
321	406123	67187674	9547000	-6.99	7.99
322	13977615	25756218	66864000	-0.17	1.17
323	3120411	3104091	7185000	0.002	0.99
324	757973	8487189	19641000	-0.39	1.39
331	562029	5420550	17506000	-0.27	1.27
332	66384	1952248	18689000	-0.10	1.10
341	3538554	49395916	66444000	-0.69	1.69
342	44335	13147078	38491000	-0.34	1.34
35	63777941	264413369	528628000	-0.37	1.37





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(APPENDIX D - continued)

ISIC	-	12000			
Code	Exports*	Imports*	Output**	ei***	1-ei
361		4857485	6861000	-0.70	1.70
362	1481376	10053473	10734000	-0.79	1.79
369	91300	5697109	70867000	-0.07	1.07
37	3025617	60512268	22928000	-2.50	3.50
381	1070333	59983584	51875000	-1.13	2.13
383	378764	90422848	8977000	-10.0	11.0
384	357591	140693573	7413000	-18.9	19.9
385		30596733	2814000	-10.8	11.8
390	1008876	28333130	7202000	-3.79	4.79

Sources of Data:

Contraloría General de la República. Valor C.I.F. de las Exportaciones e Importaciones de Panamá: 1980-1988 (Computer Printouts) (Panamá, 1989).

______ Situación Económica, Industria: Encuesta, 1981. (Panamá: Dirección de Estadística y Censo, 1985).

_____. Anuario de Comercio Exterior, (Panamá: Dirección de Estadística y Censo, 1985).

 C.I.F. value in dollars of Panama national exports and and imports, respectively, 1980.

** Value in dollars of national output by economic sector 1981.

*** Net national exports divided by sector's output.

Note: The value of e, for sector 3132 was calculated based on sector 3131 productivity.







APPENDIX E

Export Employment Allocations from Survey




Employment Allocation, Sugar Mill

Province of Chiriqui, 1980





Employment Allocation, Cattle Production

Province of Chiriqui, 1980

























APPENDIX F

LQ Estimates of Regional Basic Employment at One Digit Level Province of Chiriqui - 1980





APPENDIX F

ISIC Code	Employment		10	Estimated	
	National	Regional	ĽŲ	Employment	
1	142460	30844	1.57	11190	
2	723	69	0.69		
3	52920	5837	0.80		
4	7833	1285	1.19	204	
5	30565	5011	1.19	794	
6	65957	7937	0.87		
7	29128	2569	0.64		
8	19119	1096	0.42		
9	127928	13764	0.78		
Sub-					
total Non-	476633	68412		12188	
spec.	7019	641			
Canal					
Area	17020	22		22	
Total	500672	69075	12210		
		Base M	Aultiplier =	5.66	

LQ Estimates of Regional Basic Employment at one Digit Level, Province of Chiriqui - 1980

Source: Tabulations of the 1980 National Census of Panama (Computer printouts and hand compilations), August, 1989.







REFERENCES





REFERENCES

Bendavid-Val, Avron. 1983. Regional and Local Economic Analysis for Practitioners. New York: Praeger Publishers.

Brodsky, Harold and David E. Sarfaty. 1977. "Measuring the Urban Economic Base in a Developing Country." Land Economics, Vol. 53 (4): 445-454 (November).

Contraloría General de la República, Panamá. 1980. Clasificación Industrial Nacional Uniforme de las Actividades Económicas; Clave Numérica. Panamá: Dirección de Estadística y Censo.

_____. Establecimientos Dedicados a la Industria Manufacturera en la República Por Región, Según Actividad: Año 1983 (Establecimientos con 5 y más Personas Ocupadas) (Unpublished). Panamá.

_____. 1987. Indicadores Económicos y Sociales: Años 1981-1985. Panamá: Dirección de Estadística y Censo.

_____. Hogares Particulares en la República, por Ingreso Familiar, Según Provincia, Sexo del Jefe y Tamaño del Hogar: Censo de 1980 (Unpublished). Panamá.

_____. 1988. *Panamá en Cifras; Años 1982-1986*. Panama: Dirección de Estadística y Censo.

_____. Población de 10 Años y más de Edad Ocupada, por Sexo y Grupos de Edad, Según Rama de Actividad Económica, 1980 (Unpublished). Panamá.

____. 1985. Situación Económica, Anuario de Comercio Exterior: Año 1981. Panama: Dirección de Estadística y Censo.





- Eply, Donald R. 1983. "Further Evidence on a Short-run Economic Base Multiplier." The Annals of Regional Science, 17 (3): 77-83 (November).
- Frey, Donald E. 1989. "A Structural Approach to the Economic Base Multiplier." Land Economics, Vol. 65 (4): 352-358.
- Gibson, Lay James and Marshall A. Worden. 1981. "Estimating the Economic Base Multiplier: A Test of Alternative Procedures." *Economic Geography*, Vol. 57 (2): 146-159.
- Greytak, David. 1969. "A Statistical Analysis of Regional Export Estimating Techniques." Journal of Regional Science, Vol. 9 (3): 387-395.
- Hinojosa, René C. and Pigozzi, Bruce Wm. "Economic Base and Input-Output Multipliers: An Empirical Linkage." Regional Science Perspectives, Vol. 18 (2): 3-13.
- Isard, Walter. 1960. Methods of Regional Analysis. Cambridge, Massachusetts: The M.I.T. Press.
- Isserman, Andrew M. 1975. "Regional Employment Multiplier: A New Approach.": Comment. Land Economics, Vol. LI (2): 291-293 (August).

_____. 1980. "Estimating Export Activity in a Regional Economy: A Theoretical and Empirical Analysis of Alternative Methods." International Regional Science Review, Vol. 5 (2): 155-184.

- Leigh, Roger. 1970. "The Use of Location Quotients in Urban Economic Base Studies." Land Economics, Vol. XLVI (2): 202-205.
- Lewis, W. Cris. 1976. "Export Base Theory and Multiplier Estimation: A Critique." Annals of Regional Science, Vol. X (2): 58-70.
- Mathur, V. and Rosen H. 1974. "Regional Employment Multipliers: A New Approach." Land Economics, Vol. 50: 93-96.





- Mattila, J. M. and W. R. Thompson. 1955. "The Measurement of the Economic Base of the Metropolitan Area." Land Economics, Vol. 31: 215-228.
- Mayer, Wolfang and Pleeter, Saul. 1975. "A Theoretical Justification for the use of Location Quotients." *Regional Science and Urban Economics*, Vol. 5 (3): 343-355.
- McNulty, James. 1977. "A Test on the Time Dimension in Economic Base Analysis." Land Economics, Vol. 53: 359-368
- Ministerio de Planificación y Política Económica. 1982. Metodología y Estimación del Producto Interno Bruto por Provincia; Años 1970-1978. Panama: Dirección de Planificación y Coordinación Regional.
- Mulligan, G. 1987. "Employment Multipliers and Functional Types of Communities: Effects of Public Transfer Payments." Growth and Change, Vol. 18 (3): 1-11.
- Norcliffe, G. B. 1983. "Using Location Quotients of Estimate the Economic Base and Trade Flows." *Regional Studies*, Vol. 17 (3): 161-168 (June).
- Tiebout, Charles M. 1962. The Community Economic Base Study. Supplementary Paper No. 16. New York: Committee for Economic Development.
- Ullman, Edward L. and Dacey, Michael F. 1960. "The Minimum Requirements Approach to the Urban Economic Base." *Regional Science Association, Papers and Proceedings*: 175-194.
- United Nations. Department of Economic and Social Affairs. 1968. International Standard Industrial Classification of all Economic Activities. New York: United Nations.
- Wubneh, Mulatu. 1984. Economic Base Analysis of Small Communities: A Guide for Practitioners and Public Officials. Greenville, North Carolina: Regional Development Institute, East Carolina University.







