The Economic Impact of Tijuana's Maquiladora Industries on San Diego's Economy

by

Michael Scott Orrantia

B.A., Development Studies
The University of California, Berkeley
(1988)

Submitted to the Department of Urban Studies and Planning
in Partial Fulfillment of
the Requirement of the Degree of
Master in City Planning

at the

Massachusetts Institute of Technology

May 1990

Signature of Author _____

Department of Urban Studies and Planning
May 18, 1990

Certified by _____

Karen R. Polenske
Professor, Regional Political Economy and Planning
Thesis Supervisor

Accepted by _____

Donald A. Schon
Chairperson, Master in City Planning Program

The Economic Impact of Tijuana's Maquiladora Industries on San Diego's Economy

by

MICHAEL SCOTT ORRANTIA

Submitted to the Department of Urban Studies and Planning on May 18, 1990 in partial fulfillment of the requirements for the Degree of Master in City Planning

ABSTRACT

We used the San Diego Metropolitan Forecasting and Simulation Model to assess the economic impact that Tijuana's maquiladora industries have on San Diego's economy with respect to San Diego acting as a supplier of inputs to the maquiladoras. To forecast the economic impacts, we used past trends in the growth of the number of maquiladoras in Tijuana and the growth in the amount of imports to Tijuana's maquiladoras to estimate the future value of exports from San Diego.

The results of the forecast for the period between 1988 and the year 2000 indicate that increased growth in maquiladora activity will add about 24,000 new jobs, most of them in the manufacturing sector, and the gross regional product will increase by about 3 billion dollars. Tijuana's maquiladora activity is beneficial to San Diego's economy.

Thesis Supervisor: Karen R. Polenske, Ph.D.

Title: Professor of Regional Political Economy and Planning

ACKNOWLEDGEMENTS

I am very grateful to my advisor, Karen R. Polenske and would like to thank William Wheaton for acting as my second reader.

I would especially like to thank George I. Treyz for permitting me to use the San Diego REMI Model to conduct my research; without this model, my research would have been almost impossible. In this same spirit, I would like to thank Glen Weisbrod of Cambridge Systematics, Inc. for helping me copy the REMI model and for his time and patience in this regard.

I must also give tremendous thanks to my wife, Tammy, and son, Nicholas, for their love, support, and patience, without which I could not have persevered. Finally, I would like to give a special thanks to my mother-in-law, Michele, who traveled great distances to stay with my son, Nicholas, while I finished this thesis.

I take full responsibility for all errors and omissions in this thesis.

Table of Contents

Chapter

Chapter 1

Introduction

The main intent of this thesis is to determine the economic impact that Tijuana's maquiladora industries have on San Diego's economy as measured by employment, output, and income. Maquiladora plants temporarily import raw materials, parts, or components into Mexico for manufacturing or assembly, and the finished or semi-finished products are then exported from Mexico; no tariffs are paid on the imported inputs while in Mexico. Staff at the San Diego Economic Development Corporation, a non-profit company analyzing and promoting industrial growth along the San Diego-Tijuana border, estimate that about 95% of the inputs used in maquiladora assembly are produced in the United States. We want to determine the direction of the maquiladora-related economic activity in San Diego so that local agencies designed to support small businesses and provide job training are prepared in advance for the types of employment and resource demands associated with this growing economic activity. We hope that this type of economic forecasting and program targeting will enhance San Diego's ability to attract more investment related to the growing maquiladora activity in the San Diego-Tijuana region.

In 1965, the Mexican government initiated the Border Industrialization Program (BIP), which allowed foreign

corporations to establish wholly owned subsidiary operations in Mexico; the intent was to mirror the labor-intensive assembly operations used in East Asia that involve foreign workers and U.S. corporations. Maquiladora plants located in Mexico pay no tariffs on imported inputs so long as the firm then exports the finished or semi-finished goods. Maquiladora firms exporting their goods to the United States are required to pay tariffs only on the value added of these goods. Though the BIP has been in existence for 25 years, the number of maquiladoras has only recently become substantial in the San Diego-Tijuana region (e.g., in Tijuana, of the nearly 520 maquiladoras, 60% have been established in the past four years).

The maquiladora industry is one of the fastest growing sectors of the Mexican economy and is second only to the petroleum industry as a producer of foreign exchange. The effect of the BIP for the United States has been to allow firms operating a maquiladora to reduce their production costs significantly, thus improving their competitiveness in the world economy. At present, neither the United States nor Mexican governments plan to change the program; in fact, the maquiladora industry is growing faster now than at any other time. Therefore, this research is relevant and timely, given that in the future the maquiladora industries will become a more

significant part of the U.S.-Mexican economy than it has been in the past.

Prior to 1986, there were 212 maquiladoras operating in Tijuana that employed approximately 30,250 production workers (San Diego Economic Development Corporation, 1989; United States International Trade Commission, 1986). Today, more than 500 maquiladoras are operating in Tijuana, and Rodriguez (1987) expects that in the near future, 1,000 maquiladoras will employ more than 200,000 people. This tremendous economic growth and activity is spilling across the border into San Diego. Smith (1985) estimates that maquiladora-related economic activity in San Diego will create about 77,000 new jobs in San Diego and nearly 4,000 acres of industrial space related to maquiladora industries will be developed. Most of the industrial development is located in Otay Mesa, the border region of San Diego that, up until recently, has not been the target of much public or private development.

> The industrial development within the Otay Mesa Development District has increased significantly. Between 1985 and 1988, tentative maps for 2,300 acres had been approved. Within the city and county, total assessed value of Otay Mesa property increased from $120 million to $291 million in four years. The Otay Mesa Chamber of Commerce has identified 78 businesses operating on the Mesa. Approximately 50 percent of them are directly related to the maquiladora industry; another 25 percent are the result of the burgeoning secondary market for support industries (San Diego Economic Development Corporation, 1989).

The consensus of the San Diego business community is that benefits derived from the Maquiladora industries are: (1) a broadened economic base due to companies moving to San Diego to take advantage of the city's proximity to the maquiladora industries; and (2) competitive advantage for San Diego business nationally and internationally due to the availability of cheap labor across the border (San Diego Economic Development Corporation). As far as we know, however, no one has conducted a detailed study that quantifies the linkages between Tijuana's maquiladora industries and San Diego's economy.

In this study, we estimate the employment, output, and income that is generated in San Diego as a result of San Diego acting as the supplier of inputs to Tijuana's maquiladora industry. These impacts are calculated using a regional macroeconometric forecasting model for San Diego County. We begin the impact analysis with 1985 estimates and, based on trends and anticipated growth, forecast them to the year 2000.

Although many analysts, such as Fernandez-Kelly (1983), have investigated the social and economic impact that maquiladoras have in Mexico, very few have looked at the economic impact in the United States. George and Tollen (1985) studied the economic impact of the maquiladoras in El Paso, Texas, but their conclusions

drawn from the research done in El Paso cannot be automatically extended to San Diego, because the cities of San Diego and El Paso differ in many ways (e.g., economic base) and the types of maquiladora industries (e.g., size, organization, type of production) in Ciudad Juarez are very different from those in Tijuana. Additionally, though the El Paso-Ciudad Juarez region has the largest number of maquiladoras, the San Diego-Tijuana region has land on both sides of the border on which to build and has easy access to the Pacific Rim economy. Besides a survey report done by the San Diego Economic Development Corporation, we know of no study that analyzes, in detail, the present and future economic impacts that the maquiladora industries in Tijuana, Mexico have in San Diego.

This research is significant in that the economic activity in San Diego and Tijuana reflects the dynamics of the emerging global economy. According to the staff at the San Diego Economic Development Corporation, of the 413 maquiladoras operating in Tijuana in June of 1988, 42 percent have U.S. parent companies located throughout San Diego county. Most of the new investment in the maquiladora industries will come from major Japanese companies, such as NEC, Panasonic, Seiko Epson, Hitachi, and others (United States International Trade Commission, 1986). South Korean firms are planning to set up

operations in the San Diego-Tijuana region as well. Many of these foreign firms set up operations in both Tijuana and San Diego, organizing production, finances, and marketing in a way that maximizes the firms' production efficiency given the available resources.

Understanding the dynamics of the Pacific Rim economy is of the utmost importance if California and the rest of the United States want to stay competitive in the global economy. As a national leader and trend setter, California, we believe, is ahead of the rest of the United States in recognizing that the Pacific Rim economy is the future center of the emerging global marketplace. The San Diego-Tijuana region has emerged as a place where American, Mexican, Japanese, and South Korean capital and technology can assemble in a very productive manner; the region has one of the fastest growing economies in the world.

During the 1980s, a great deal of attention had been given to U.S. competitiveness in the global economy. One major issue in this debate is the loss of U.S. jobs due to the relocating of U.S. manufacturing operations off-shore. Although we do not attempt to enumerate all of the jobs lost to off-shore operations and compare this with all of the jobs created by activities such as those in San Diego, we will look at what types of jobs are

being created in the United States due to off-shore manufacturing activities.

As we move toward a single global marketplace, the role of the state as regulator is being re-defined, and, as is the case in Europe in 1992, the role of national borders is becoming less important. We believe that the distinction between doing business in developed and developing countries is also being re-defined. Telecommunications and the internationalization of production processes have given rise to a new way of organizing and managing companies and investment decisions. The case of the San Diego-Tijuana region is a microcosm of this larger, global restructuring. Although determining the economic impact that Tijuana's maquiladoras have on San Diego's economy is but a small part of this process, it does add to our knowledge of how the process works.

We will determine what economic impacts (e.g., employment, income, and output) the maquiladora industries have in San Diego by using a regional econometric forecasting model and data collected from local agencies in San Diego, specifically data from the San Diego Economic Development Corporation and the Otay Mesa Chamber of Commerce.

In Chapter 2, we discuss various economic models used to measure regional growth and the impacts of

exogenous factors on the region's economy and the REMI model that we employ for our forecasting analysis. In Chapter 3, we describe the San Diego metropolitan economy and the economy's structural changes that have taken place between 1969 and 1985. In Chapter 4, we look at the San Diego-Tijuana metropolitan economy and look at the growth of maquiladoras in Tijuana and related industry in San Diego. In Chapter 5, we provide a detailed analysis of the REMI forecast and economic impact analysis. In Chapter 6, we summarize the results of the economic forecast and draw conclusions about the impact of the maquiladora industries in San Diego.

Chapter 2

Alternative Economic Models, Multipliers, and Regional Purchase Coefficients

In the past two decades, regional economic models have evolved as one of the key tools used in policy analysis. Regional economic models "are used as predictions where the planner wants some idea of the size and shape of the future in order that his current decision can be responsive to the future" environment (Sonenblum, as quoted by Glickman, 1977, p. 14). A major use of regional economic models is to identify important sectors within an economy that have linkages with or impacts on other sectors; it is in this sense that we employ "impact" or "multiplier" analysis (Glickman, 1977). Three types of models are most often used for impact analysis: input-output, econometric, and economic base. All three are discussed below and their relevance to this research is discussed in the next chapter.

Economic Base Models

The economic base model can be characterized as a highly simplified general equilibrium model of a local economy. The assumptions are simple and the data requirements are minimal. The model assumes that the economy is initially in equilibrium and describes a new equilibrium position after the exogenous change has been

transmitted through the system. Prices, wages, and technology are assumed constant, supply is perfectly elastic, and no changes are allowed to occur in the distribution of income or resources (Pleeter, 1980).

Economic base models dichotomize economic activity in a region into export and local service industries (Glickman refers to them as "basic and "service" industries, respectfully). Economic base models view the local economy as a consumer and a seller. Industries and establishments within the local economy that cause funds to come in are considered to be export industries or sellers. These are firms that sell their products to businesses and households outside the boundaries of the local economy. We also consider tourism facilities and federal and state government to be part of the export industry because they are responsible for money inflows (Pleeter, 1980). Local service industries, by contrast, sell their outputs only within the local economy; therefore, the local economy does not grow, because funds are just being transferred between people within the local economy.

Without new injections of funds to the local economy, the economy will be stagnant, since local service industries can only respond to changes in local economic conditions. External changes that result in an increase in export activity cause increases in payroll

and employment in the export industries, which are then transmitted to the local service sector. Further, the inflow of money causes activity in local services to change by a multiple of the original stimulus as the new influx of funds is spent and re-spent in the local economy. Recirculation continues until the leakages from the system, like imports, savings, and taxes, exhaust the amount of the initial influx. Similar, though opposite, effects occur in the case of a decrease in export activity (Pleeter, 1980).

Input-Output Model

Input-output models provide a detailed account of the economic transactions that take place within an economy and illustrate how an impact originating in one sector is transmitted throughout the entire economy (Pleeter, 1980). The basic input-output model is generally constructed from observed economic data for a specific geographic region (nation, state, county, etc.). Within this specific geographic region, we are concerned about the activity of a group of industries that both produce goods (outputs) and consume goods from other industries (inputs) in the process of producing each industry's own output (Miller and Blair, 1985). This basic information from which an input-output model is developed is contained in an interindustry transaction

table. The rows of an input-output table describe the distribution of a producer's output throughout the economy. The columns describe the composition of inputs required or purchased by a particular industry to produce its output (Miller and Blair, 1985).

In essence, the input-output model is a snapshot of the economy, which gives the current "recipe" for producing all goods. Each industry in the economy is dependent upon every other industry; firms either sell their goods as an intermediate good to another firm or as a final good to consumers. Because input-output models are a snapshot of the economy at one specific time, assumptions with regard to production functions and supply are very specific. Production functions for each industry are assumed linear and homogenous so that economies and diseconomies of scale are disallowed and inputs must be used in fixed proportions. Prices and wages are assumed constant and no supply constraints exist (Pleeter, 1980).

Econometric Models

More recently econometric models have become the most commonly used method of economic analysis. The ability to make forecasts given past trends or relationships between variables has become a very powerful tool in impact analysis. Econometric models are

multiple-equation systems that attempt to describe the structure of a local economy and forecast aggregate variables, such as income, employment, and output. Econometricians usually employ time-series data (observations of the same economic variables on a regular temporal basis) in constructing a model (Glickman, 1977). The time-series data are used to estimate the hypothesized relationships by means of regression analysis.

There is no single theory of regional growth that is implicit in the development of econometric models. Rather, models builders generally incorporate variables and specifications that are relevant to the region being analyzed. The more sophisticated econometric models consider both internal and external sources of growth or impacts within the regional economy. Prices and wages for the region are determined within the system of equations postulated, and thus factor movements, in a neoclassical framework, can also be a consequence of exogenous shocks to the system. One factor emphasized in these models is labor supply, and equations explaining labor force and migration are critical elements. Consumption, government, and investment are specified by source (e.g., household, state and local, etc.) and thus considerable detail is provided (Pleeter, 1980).

Like the input-output model, the more complex or simultaneous models stress the interdependence of the economic variables within the regional economy; that is, each endogenous variable is determined, at least partially, by other endogenous variables. The interdependence of the variables allows the analyst to observe or forecast how a shock in one sector transmits or ripples through the rest of the economy, sometimes by incorporating an input-output model into the regression model. These more complex models are generally used for longer-run estimations of the economy's movement. They can incorporate aspects of changed structure, such as productivity change, demographic composition, and industrial composition, and thus provide sources for growth that are absent in other models. Because econometric models use regression principles based upon past relationships, they attempt to verify, empirically, the theory upon which they are based (Pleeter, 1980).

Multipliers

The notion of multipliers rests upon the difference between the initial effect of an exogenous (final demand) change and the total effects of that change. The total effects can be defined in either of two ways -- as the direct and indirect effects (which means that they would be found through elements in the Leontief inverse of a

model that is open with respect to households) or as direct, indirect, and induced effects (which means that they would be found through elements of the Leontief inverse of a model that is closed with respect to households). The multipliers that are found by using the direct and indirect effects are also known as simple multipliers. When direct, indirect, and induced effects are used, they are called total multipliers (Miller and Blair, 1985).

The three most frequently used multipliers are those that estimate the effects of exogenous changes on (1) outputs of the sectors in the economy, (2) income earned by households because of the new outputs, and (3) employment (in physical terms) that is expected to be generated because of the new outputs (Miller and Blair, 1985).

RIMS II

Effective planning for public- and private-sector projects and programs at the state and local area level requires systematic analysis of the economic impacts of the projects and programs on affected regions. Systematic analysis of economic impacts, in turn, must take into account interindustry relationships within regions because those relationships in large part determine regional responses to project and program

changes. Thus, regional input-output multipliers, which account for interindustry relationships within regions, are useful tools for regional economic impact analysis (Beemiller et al., 1986).

RIMS II is based on an input-output accounting framework. A typical input-output table in RIMS II derives mainly from two data sources: (1) the Bureau of Economic Analysis' (BEA) national input-output table, which shows the input and output structure for more than 500 U.S. industries, and (2) BEA's four-digit Standard Industrialization Classification (SIC) county wage-and-salary data, which can be used to adjust the national input-output table to show a region's industrial structure and trading patterns (Beemiller, et al., 1986).

RIMS II can be used to estimate the impacts of project and program expenditures by industry on regional output (gross receipts or sales), earnings (the sum of wages and salaries, proprietors' income, and other labor income, less employer contributions to private pension and welfare funds), and employment (Beemiller, et al., 1986).

Regional Purchase Coefficient (RPC) Estimation

The regional purchase coefficient (RPC) has been defined as the proportion of a good or service used to fulfill intermediate and/or final demands in a region

that is supplied by the region to itself rather than being imported (Stevens, et al., 1980). The construction of a regional input-output model without the use of survey data presents the analyst with the difficult problem of estimating "regional" coefficients. Stevens and Trainer suggest that the most efficient, and potentially the most accurate, non-survey approach is to use the national input-output technology in the most detailed form available, along with a set of regional purchase coefficients (RPCs) specific to the region in question (Stevens, et al., 1980).

The REMI Model

The regional econometric forecasting model in this study is the San Diego Forecasting and Simulation Model SDFS-53 (referred to, hereafter, as REMI) produced by Treyz at Regional Economic Models, Inc. (REMI). REMI is a regional macroeconometric model for forecasting and simulating the aggregate economic behavior of sub-national economies, usually states, for which the vendors provide as a part of the package specific regional data the users request. Analysts can use the program for economic-base or input-output modeling. They can conduct an extremely detailed analysis of regional impacts of government policies or impacts of anticipated changes in

economic variables by changing any of the policy or translator variables (Sivitanidou and Polenske, 1988).

REMI combines features from the various modeling techniques discussed above and can be used to make economic forecasts and to simulate alternative policies or strategies. Its predictions and simulations are based on the interaction of 2000 equations, which include 53 industrial sectors (including three government sectors and a farming sector) and 94 occupations. A very large number of economic policy changes can be analyzed through the use of policy and/or special "translator" variables. In all, 802 policy and 58 translator variables are available for use singly or in combination. The San Diego version of REMI contains time-series data for San Diego County beginning in 1965 and ending in 1985. Also imbedded in REMI is a regionalized input-output table using adjusted technical coefficients based on the 1977 national input-output table and a 1995 projected input-output table produced by the Bureau of Labor Statistics (the 1977 national input-output table is the latest one available based upon census data).

For policy simulations, the analyst uses two models: an input-output model and a fiscal-simulation (FS) macroeconometric model. Depending on the impact to be simulated, the user can suppress one or more of six responses: wage, labor intensity, export share, regional

purchase coefficient, population, or wage responses to the consumer price index (Sivitanidou and Polenske, 1988).

Chapter 3

The San Diego Metropolitan Economy

In this chapter, we look at how the San Diego Metropolitan economy has changed over time. In analyzing the structure of San Diego's economy, we focus on employment, output, and income. As a method for analysis, we disaggregate San Diego's economy into nine general industries in the private economy: (1) manufacturing (durable and nondurable manufacturing), (2) finance, insurance and real estate (F.I.R.E.), (3) services, (4) retail trade, (5) transportation and public utilities, (6) construction, (7) wholesale trade, (8) agriculture-forestry-fishing, and (9) mining. We do not include the government sector in our analysis because we want to look at how the major industrial sectors are affected by the maquiladora activity. The military is a very large part of San Diego's government employment, more so than most cities, and would show up as one of the largest employment sectors. Rather than continually explain that the government sector is large due to the large military employment, we simply delete it from the analysis; deleting the government sector from our analysis will not prevent us from our stated task. The nine-sector analysis focuses on private sector economic activity and will serve as the springboard for our maquiladora-related impact analysis.

An Overview of Economic Growth

In our historical nine-sector analysis, we look at a 16-year period between 1969 and 1985. We stop at 1985 because it is at this time that the substantial growth in Tijuana's maquiladora industries begins. Our impact analysis takes place between 1985 and the year 2000 (this part of the analysis has its own detailed chapter).

Over the period of 1969-1985, San Diego's economy and population grew at an extremely fast rate. Table 1 shows that total employment grew about 3.8 percent a year, gross regional product (GRP) expanded about 4.4 percent a year, population increased about 2.9 percent a year and personal income climbed an amazing 11.6 percent a year. Graph 1 shows a bi-annual growth rate of GRP, personal income, population, and employment. It is interesting to note that GRP and employment are fairly correlated, moving in tandem over the 16-year period. To understand better the dynamics and structure of this rapidly growing metropolitan economy, we look at employment, output, and income by sector and see how each sector relates to the economy as a whole.

Table 1

Bi-Annual Percentage Growth Rates of GRP, Personal Income, Total Employment, and Population

Item	1971	1973	1975	1977	1979	1981	1983	1985
GRP	4.7	12.5	6.3	11.9	15.3	1.2	5.7	16.2
Income	18.1	23.3	25.6	7.7	32.7	22.8	16.4	22.4
Employment	0.3	8.8	6.4	11.0	14.4	5.3	4.1	13.2
Population	3.8	7.7	7.8	6.1	6.5	5.3	4.8	5.5

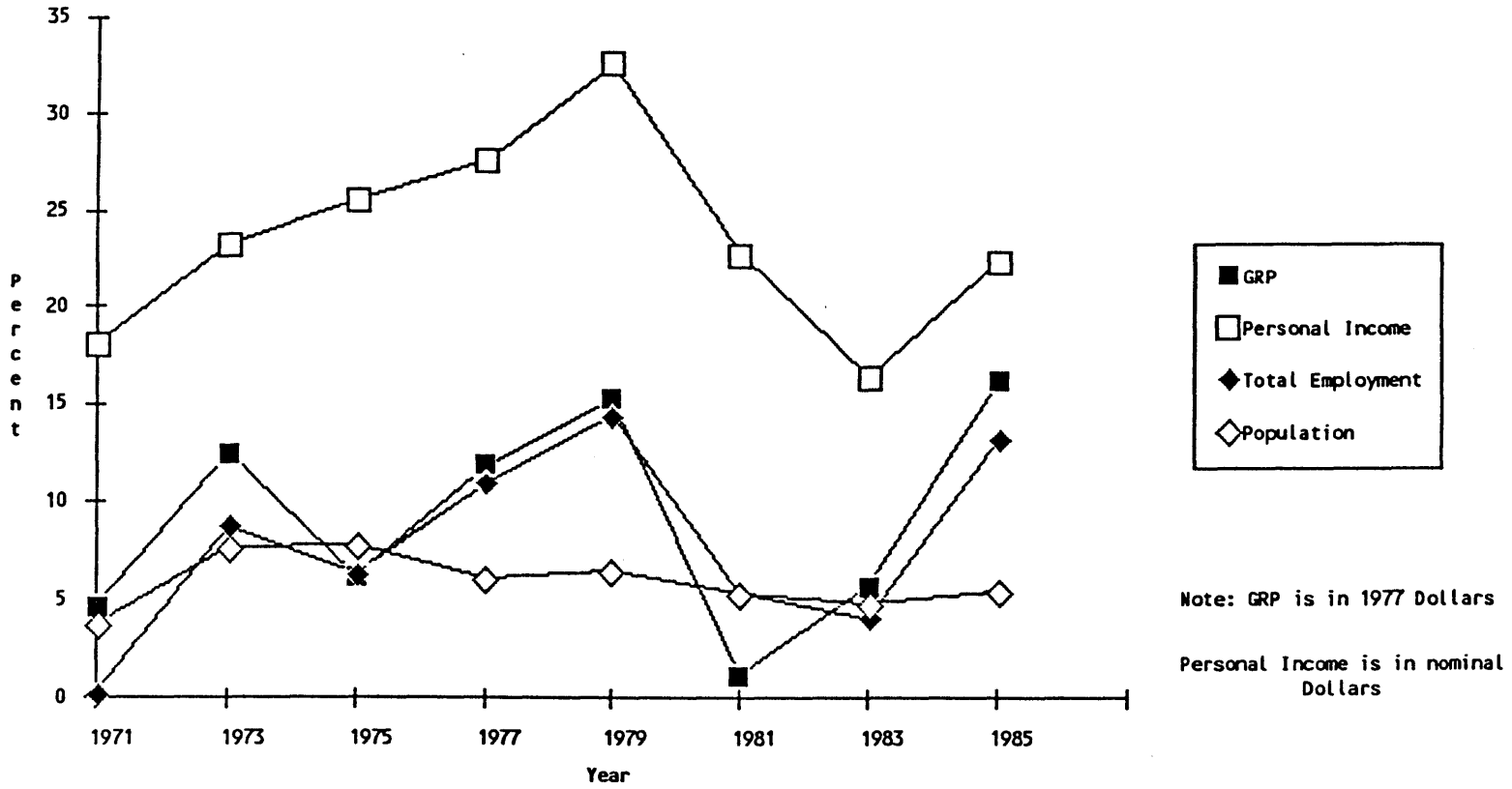
Note: GRP is measured in 1977 dollars.
Income is measured in nominal dollars.

Source: Author's calculations using data from REMI.

Employment

Table 2 shows the distribution of employment for the nine sectors. The service sector employs the largest number of workers, and the retail trade, manufacturing, F.I.R.E., and construction sectors round out the top five sectors, respectively. The two least important sectors with respect to employment are the agriculture-fishing-forestry and mining sectors. Over the 16-year period, every sector gained more workers every year with the exception of the construction sector, which is more susceptible to cyclical exogenous changes in the macro

Graph 1. Bi-Annual Growth Rates for GMP, Personal Income, Total Employment, and Population



Note: GRP is in 1977 Dollars

Personal Income is in nominal Dollars

Source: Author's calculations using data from REMI.

Table 2. Total Employment (thousands of people)

Sector	1969	1971	1973	1975	1977	1979	1981	1983	1985
Manufacturing	70.3	63.8	72.1	73.4	78.9	103.5	113.3	111.6	127.1
F.I.R.E.	30.0	36.1	44.8	46.2	57.5	70.1	74.5	83.2	98.8
Services	102.5	116.5	133.4	148.3	171.1	206.4	225.2	248.5	295.5
Retail Trade	82.3	89.3	100.3	109.6	123.9	144.8	149.3	157.7	177.3
T.P.U.	20.0	21.8	23.7	24.2	26.2	30.7	32.6	33.6	36.1
Construction	25.2	27.3	32.8	29.8	41.7	52.3	45.3	44.3	61.6
Wholesale Trade	15.1	14.9	17.5	18.5	22.9	26.8	28.9	33.2	38.1
A.F.F.	4.8	5.3	6.8	7.7	8.5	10.0	11.3	12.6	13.8
Mining	0.7	0.7	0.7	0.8	1.1	1.2	1.3	1.7	1.9

Note: F.I.R.E. = Finance, Insurance, and Real Estate
T.P.U. = Transportation and Public Utilities
A.F.F. = Agriculture, Fishing, and Forestry

Source: Author's calculations using data from REMI.

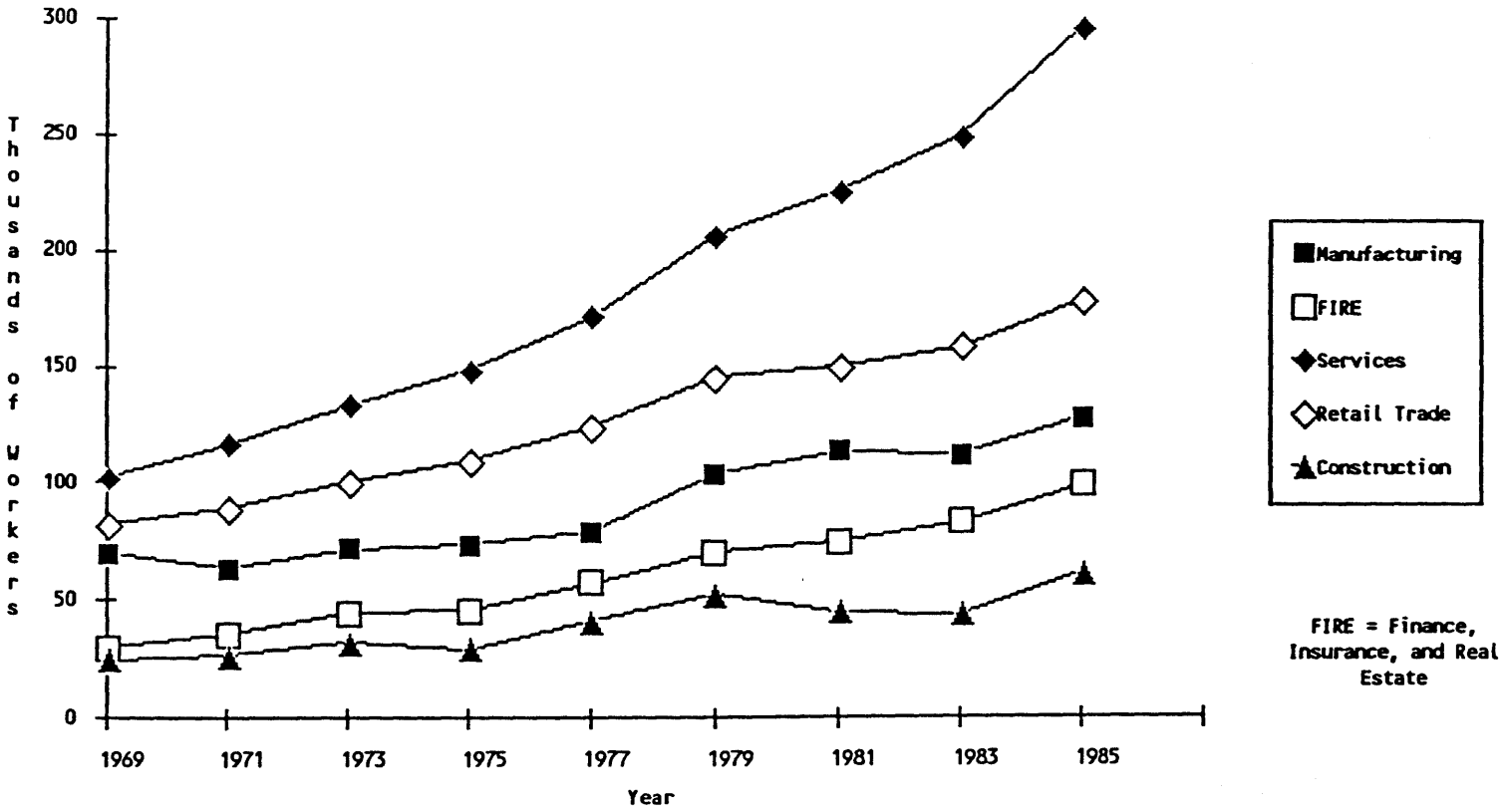
economy. Among the sectors with the highest increase of employment are services, retail trade, F.I.R.E., manufacturing, and construction. As shown in Graph 2, these five sectors added employees over the 16-year period of approximately 193,000, 95,000, 68,800, 56,800, and 36,400 respectively.

Graph 3 shows the top five sectors as a percentage of total employment between 1969 and 1985. We see that the service sector dominates as the leading sector of employment and continues to grow in importance, going from 16.2 percent in 1969 to 21 percent in 1977 and 25.6 percent in 1985. The retail trade, manufacturing, and construction sectors have maintained their positions in a fairly consistent manner over the 16-year period--about 15 percent, 11 percent, and 5 percent, respectively. The F.I.R.E. sector has steadily increased its position from 4.6 percent in 1969, to 7.1 percent in 1977, and to 8.6 percent in 1985.

Output

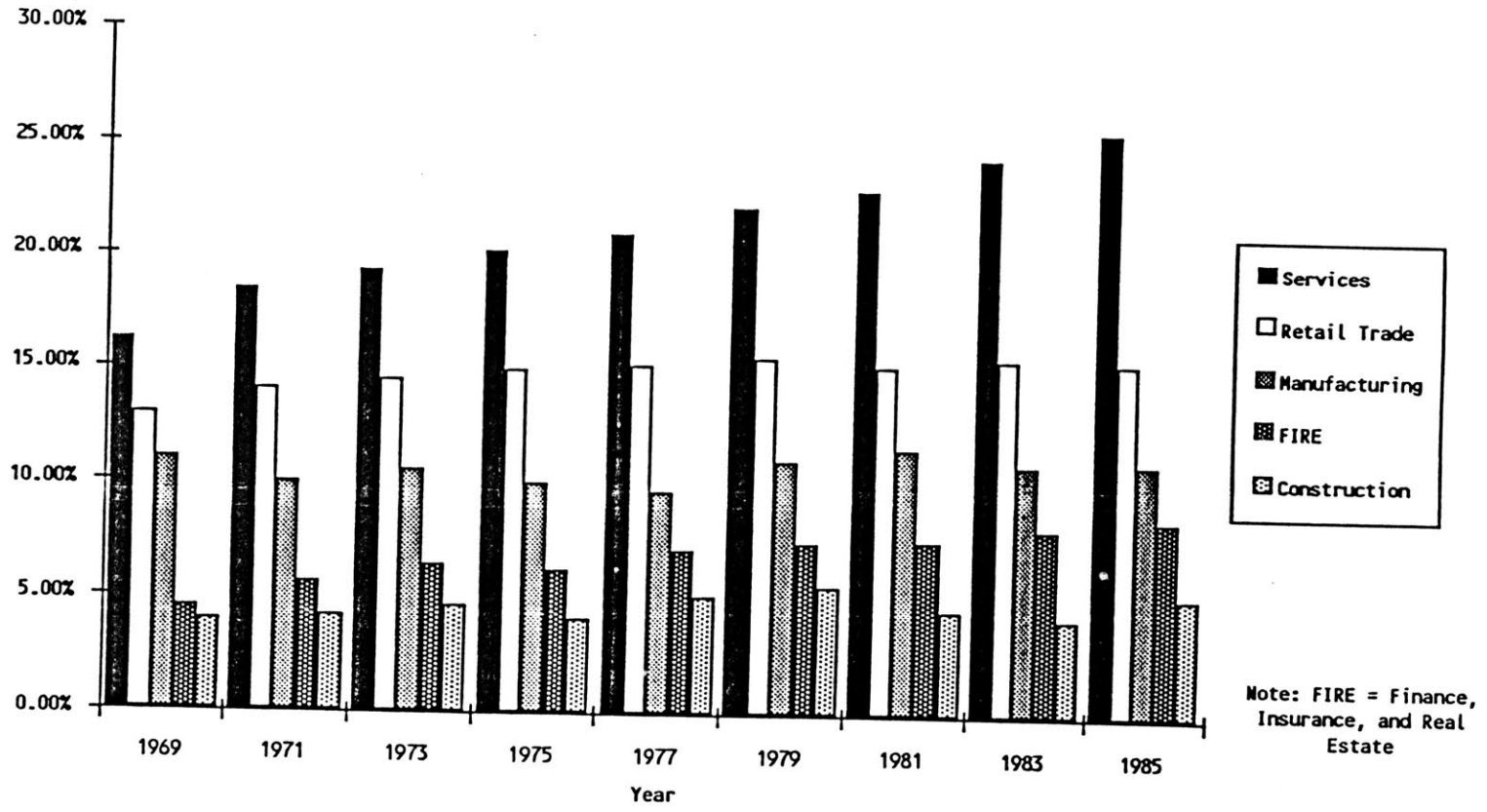
Although employment within a sector is one way to gage the importance of a sector, output within a sector is another; therefore, we need to compare and contrast employment versus output by sector. For example, in 1985, the manufacturing sector accounted for 11 percent of total employment but was responsible for about 32

Graph 2. Growth in Employment: Top Five Sectors



Source: Author's calculations using data from REMI.

Graph 3. Top Five Sectors as a Percent of Total Employment



Source: Author's calculations using data from REMI.

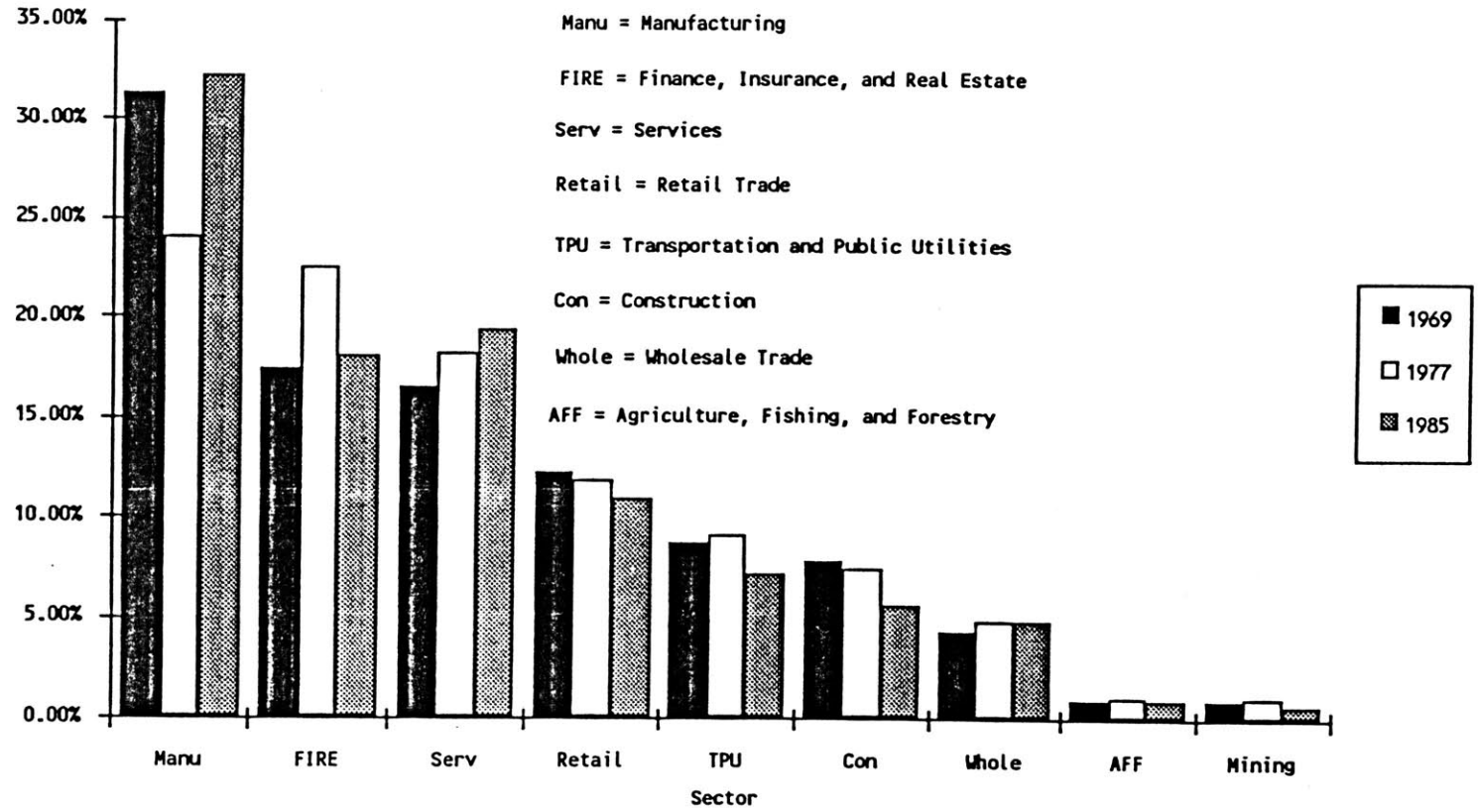
percent of total output. Therefore, any changes in employment or output in one sector need to be put into perspective with the larger economy.

Total output of the nine sectors in 1969 was 11.5 billion dollars, growing to 18.7 billion dollars in 1977 and 30.4 billion dollars in 1985, a 164.3 percent increase over the sixteen-year period, or 6.3 percent a year.[1] As shown in Graph 4, the manufacturing, services, and F.I.R.E. sectors make the largest contributions to output with 32 percent, 19 percent, and 18 percent in 1985, respectively, accounting for about 70 percent of total output.

Theoretically, a person's wage should be commensurate with his or her level of productivity; therefore, gains in productivity should increase people's purchasing power. Productivity represents the dollar value of output per employee. The sector with the highest productivity level is the mining sector, but since its total output and employment are too small to be significant, we can disregard this sector in the analysis. We obviously want to focus our analysis on sectors in the economy that significantly contribute to both employment and output. Graph 5 shows the productivity levels of employees by sector for 1969, 1977, and 1985. As we can see, the manufacturing,

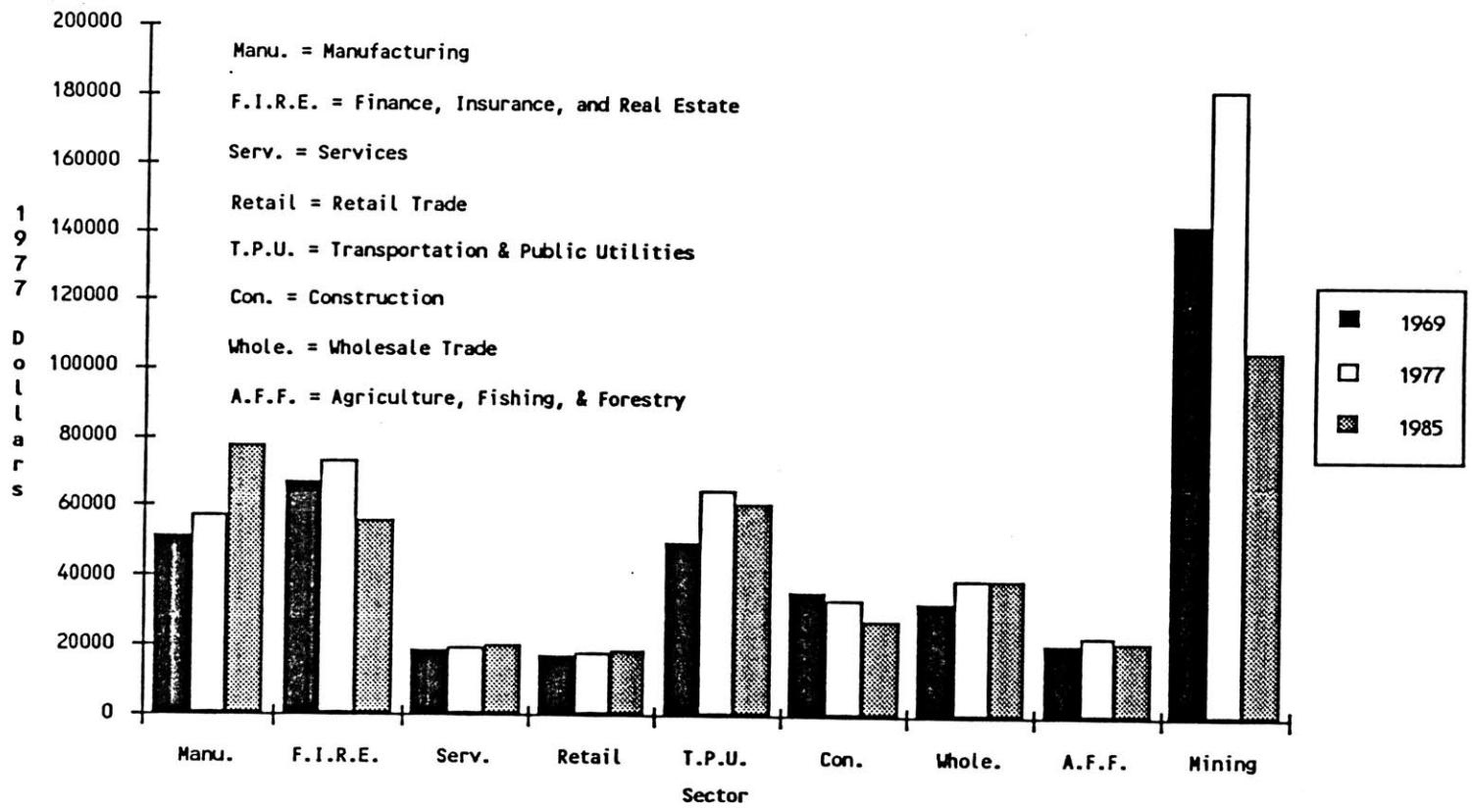
[1]All output is in billions of 1977 dollars.

Graph 4. Sector Output as a Percent of Total



Source: Author's calculations using data from REMI.

Graph 5. Output per worker by Sector: 1969, 1977, and 1985



Source: Author's calculations using data from REMI.

F.I.R.E., and transportation and public utilities sectors have the highest productivity levels during the 16-year period. An interesting and important note is the steadily increasing productivity of the manufacturing sector. In fact, in 1985, the manufacturing sector is the only sector with significant gains in productivity. This is important because we will later focus on the manufacturing sector when we discuss the impact of Tijuana's maquiladora industries on the San Diego economy.

Advances in productivity can stem from a variety of factors, including changes in technological innovation (both process and product innovation), improved work force skills through either training or experience, and investment in the capital stock of the economy. Productivity improvement is essential for a rapidly expanding economy such as San Diego's. If people's purchasing power does not increase as productivity increases--supply growing faster than demand in the short run--recessionary pressure could slow investment, thus slowing the economy's growth in the long run.

Income

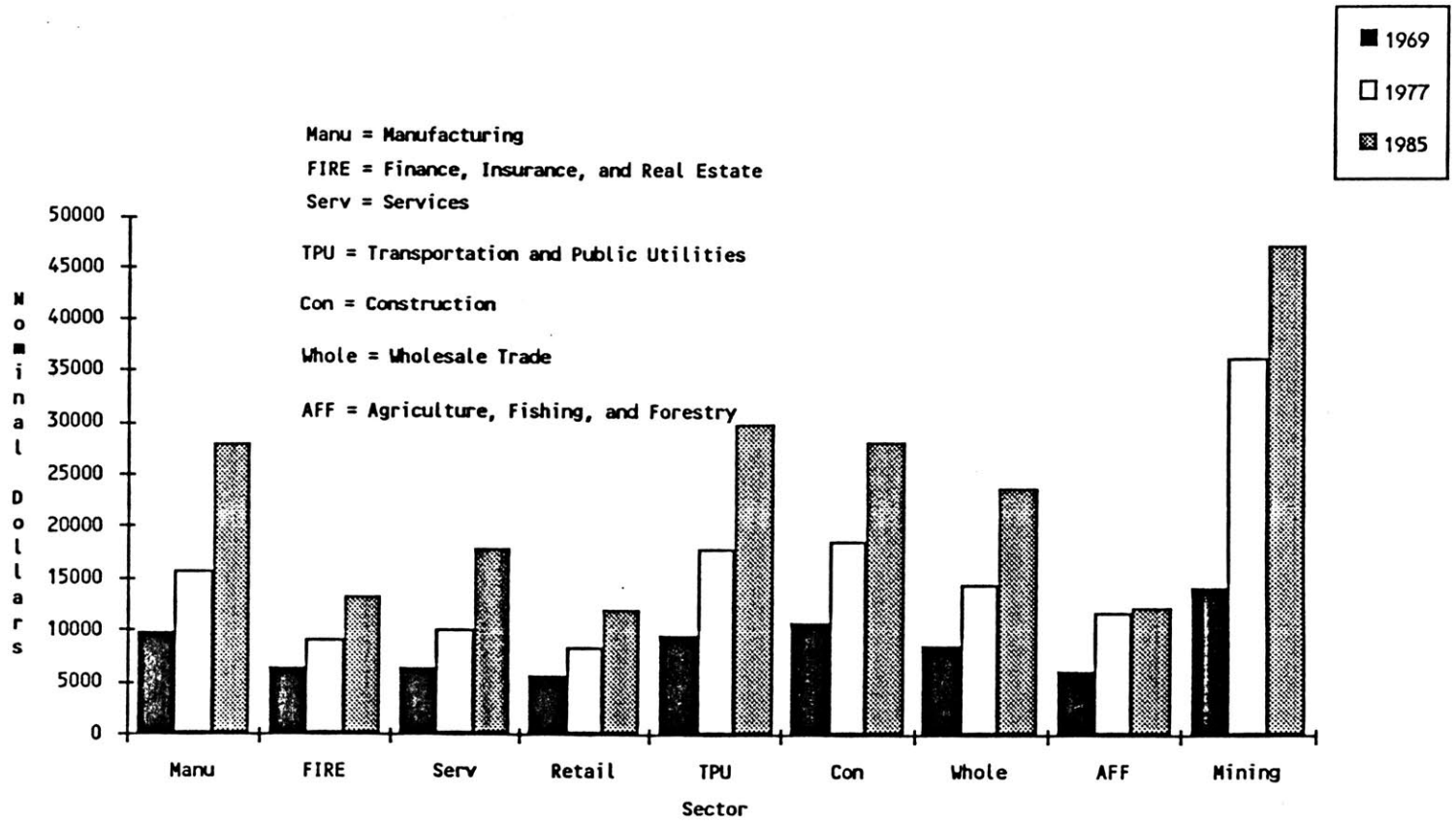
By looking at the total output, productivity, and employment of a sector, we can form a more accurate picture about the economic structure of San Diego.

Another factor that helps us understand the importance of a sector is the income that it generates, and, in turn, the income earned by its employees. As mentioned above, income is directly related to the productivity and output generated within a sector. The more productive a worker is, the more income or higher the wage should be for that worker.

If we look at Graph 6, we see the breakdown of the average income per worker by sector for 1969, 1977, and 1985. If we focus on the significant sectors (ignoring the mining sector that has an unusually high average income per worker), we see that the transportation and public utilities, construction, manufacturing, and wholesale trade sectors have the highest average income per worker, respectively. If we compare the average income per worker to the output per worker, or productivity, shown in Graph 5, we see that the manufacturing, transportation and public utilities, wholesale trade, and construction sectors are in the top five significant sectors. Surprisingly, the F.I.R.E. sector is a relatively productive sector--third behind manufacturing and transportation and public utilities--yet it is not in the top five significant sectors with respect to average income per worker.

We think that when looking at income generated within a sector, it is more important to look at average

Graph 6. Average Income Per Worker



Source: Author's calculations using data from REMI.

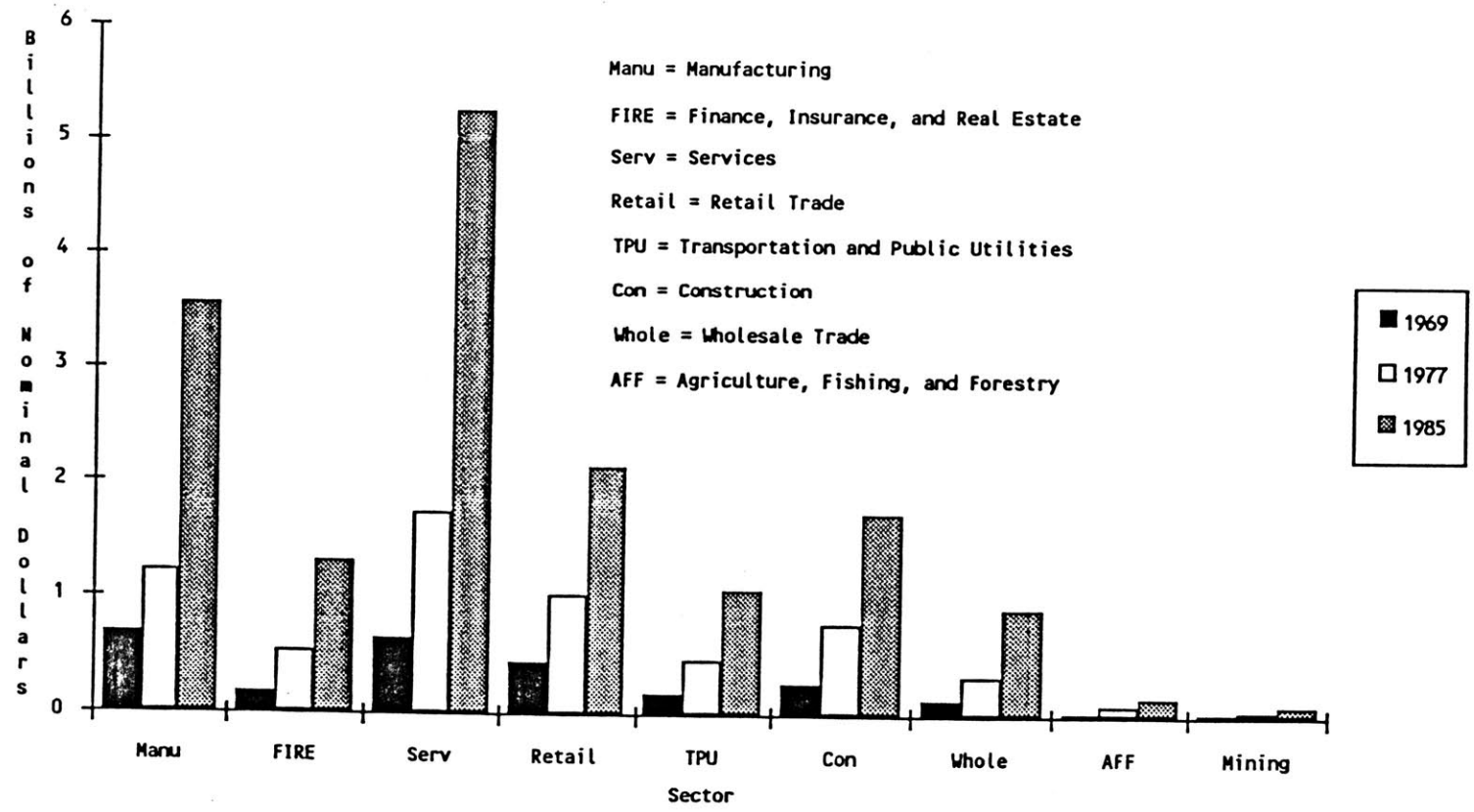
income per worker because this translates to the purchasing power for a given worker. Often, the mass media just reports on job creation and unemployment rates. Over the past decade, the focus of the Reagan administration was on job creation. Yet, the types of jobs being created have not necessarily been high-paying jobs, whereas the jobs being lost have been (Harrison, 1988).

In illustrating the importance of income per worker versus employment or income per sector, we can look to Graph 7 which shows labor and proprietor's income per sector (this is the same income used to calculate average income per worker). We can see that the service sector, by far, creates the most labor income. In 1985, the service sector's labor income was 5.27 billion dollars compared to the combined labor income for the F.I.R.E., retail trade, and transportation and public utilities sectors of 4.6 billion dollars.[2] However, if we look back to the average income per worker, the service sector falls well below the transportation and public utilities, construction, manufacturing, and wholesale trade sectors, thus indicating that most service sector jobs are not high paying or very productive.

---

[2]Labor and proprietor's income is in billions of nominal dollars.

Graph 7. Labor and Proprietor's Income: 1969, 1977, and 1985



Source: Author's calculations using data from REMI.

We need to keep our evaluation indicators in perspective when trying to understand the importance of a sector within the larger economy, especially when we are analyzing the impact of an exogenous activity on the structure of the economy. In trying to decide which indicators to use in an impact analysis, we must refer to the question or questions initially being asked and then devise an appropriate approach to answer these questions.

In our impact analysis of the maquiladora industries on San Diego's economy, just looking at how many jobs are being created or lost is not enough. We want to know what types of jobs are affected and how these jobs influence the whole economy. Do these jobs contribute to increasing San Diego's productivity or does it just add another low-paying, low-productive job? If San Diego becomes too dependent on a particular sector, say services, does the economy face problems in the future when it faces competition from other regional economies that are more productive? It is in this regard that the types of indicators we use to analyze an impact on the economy become more or less relevant to our analysis. We will come back to the relevance of particular indicators when we analyze the impact of Tijuana's maquiladora industries on the San Diego economy.

Chapter 4

San Diego and Tijuana:

A Transnational Metropolitan Economy

In this chapter we look at the relationship between San Diego and Tijuana and the symbiotic relationship that exists between the two cities. We look in detail at the growing maquiladora industries in Tijuana, discuss why the San Diego-Tijuana metropolitan region is growing in popularity with respect to other maquiladora regions, and look at San Diego's role as a supplier of inputs to Tijuana's maquiladoras.

An Overview of Tijuana

According to the International Demographic Data Center of the U.S. Bureau of Census, in its official census of 1980, the Mexican government estimated Tijuana's population to be about one-half million. However, it is widely accepted that any official estimate of Tijuana's population will be on the low side. In a September 1987 survey of Mexico, The Economist estimated that Tijuana's population was somewhere between 1.2 and 1.5 million. Max Schetter of the Greater San Diego Chamber of Commerce estimates that by 1995, there will probably be as many people in Tijuana as in the County of San Diego--about two and one-half million people on each

side of the border, or five million in the total metropolitan area.

The sharing of production between the two countries has led to growth in trade, not only in finished products, but also in intermediate goods going in both directions. This changes the traditional concepts of imports and exports because both are part of the same process (Woodlands Conference, December 1989). The industrial integration that exists between San Diego and Tijuana has taken place primarily through private initiative. The governmental arrangements that have taken place on both sides of the border have made the San Diego-Tijuana region desirable for location or re-location of private industry. On the Tijuana side, the Border Industrialization Program established in 1965 allows certain industries--maquiladoras--to import inputs so long as the final product is then exported.

On the San Diego side, the U.S. government classifies the maquiladora-produced goods as items 806.30 and 807.00 under the provisions of the Tariff Schedules of the United States. Items 806.30 and 807.00 are assessed for U.S. Customs duties on the basis of the value that is added in Mexico (Maquiladora Resource Guide, 1989). San Diego also has a free trade zone. Products shipped to a free trade zone do not require formal customs entry, and are not subject to the payment

of duty and excise taxes nor to quota restrictions. While in the free trade zone, the product may be processed, assembled, or manipulated and if the product is then reexported, no U.S. Customs duty or excise tax is ever paid. If the product enters the domestic market after leaving the free trade zone, U.S. Customs duty and/or excise taxes are payable on either the rate of the finished products or the imported parts, whichever is lower (Maquiladora Resource Guide, 1989).

The term "maquiladora" comes from the Spanish word "maquila," which in colonial Mexico was the charge that millers collected for processing grain. Today the term maquiladora is used as a generic term for those firms that process components imported into Mexico that are then reexported, usually back into the United States. Another term frequently associated with the maquiladoras is "twin plant," which refers to the existence of two factories, one on either side of the border, involved in complementary phases of production and assembly of a given product (Maquiladora Resource Guide, 1989).

One key factor linking San Diego to Tijuana is that San Diego supplies a considerable amount of the inputs to Tijuana's maquiladoras. Tijuana has no local content regulation, though maquiladoras are continually urged by the Mexican government to purchase local inputs. Apart from direct labor, however, inputs to maquiladora

products, whether finished or semi-finished goods, are only about 1.5 percent Mexican (Maquiladora Resource Guide, 1989).

The Mexican government's drive to stimulate the production of inputs for the maquiladora industries has led to a new round of investment in what are called "in-bond" supply companies. In Tijuana, many of the same foreign companies that operate maquiladoras are now establishing in-bond supply operations; this practice is particularly noticeable among large Japanese firms (Maquiladora Resource Guide, 1989). In-bond companies manufacture component products required in other maquiladora assembly processes. Many times the in-bond company is established by the same parent company of the foreign subsidiary or its supplier. Under such arrangements, the foreign parent company provides the in-bond company with the necessary technology and financial support to become an efficient supplier. Thus, the demand for qualified suppliers within Mexico has created a whole new round of investment in the border region (Maquiladora Resource Guide, 1989).

The Growth and Composition of Tijuana's Maquiladoras

The staff at the San Diego Economic Development Corporation estimate that today, Tijuana has between 500 and 520 maquiladoras in operation. As of June 1988, 413

Tijuana maquiladoras had registered and received authorization from Mexico´s Secretaria de Comercio y Fomento Industrial Delegacion (SECOFI) to operate under the maquiladora program (San Diego Economic Development Corporation, 1989). Table 3 shows the number of maquiladora plants operating in Tijuana since 1986. There is every indication that this growth will continue. In a study conducted by San Diego State University, Department of Mexican American Studies, 61 percent of the maquiladoras in Tijuana indicated that they plan to invest in new facilities or expansion projects both in San Diego and Tijuana (Morales, 1989, as quoted by the San Diego Economic Development Corporation). As of June 1988, Tijuana´s 413 maquiladoras employed about 45,000 workers with the median firm employment size of about 45 employees and an average size of 109 employees--only 3 percent employ more than 500 (San Diego Economic development Corporation, 1989). We assume that the firm sizes have remained the same since June 1988, which would mean that the 107 or so new maquiladora firms added about another 20,000 workers.

Table 3

Number of Maquiladoras Operating in Tijuana

Approval Date	# of Firms	% Total
Prior to 1986	212	41 %
January to June 1986	31	
July to December 1986	40	59 %
January to June 1987	35	
July to December 1987	45	
January to June 1988	50	
July 1988 to January 1990[3]	107	
Total	520	100 %

SOURCE: Subdelegacion de Fomento Industrial (SECOFI), Tijuana, B.C., October 1988, as reported by the San Diego Economic Corporation in a report entitled "Maquiladora Industry: The Economic Impact on San Diego's Economy," June 1989.

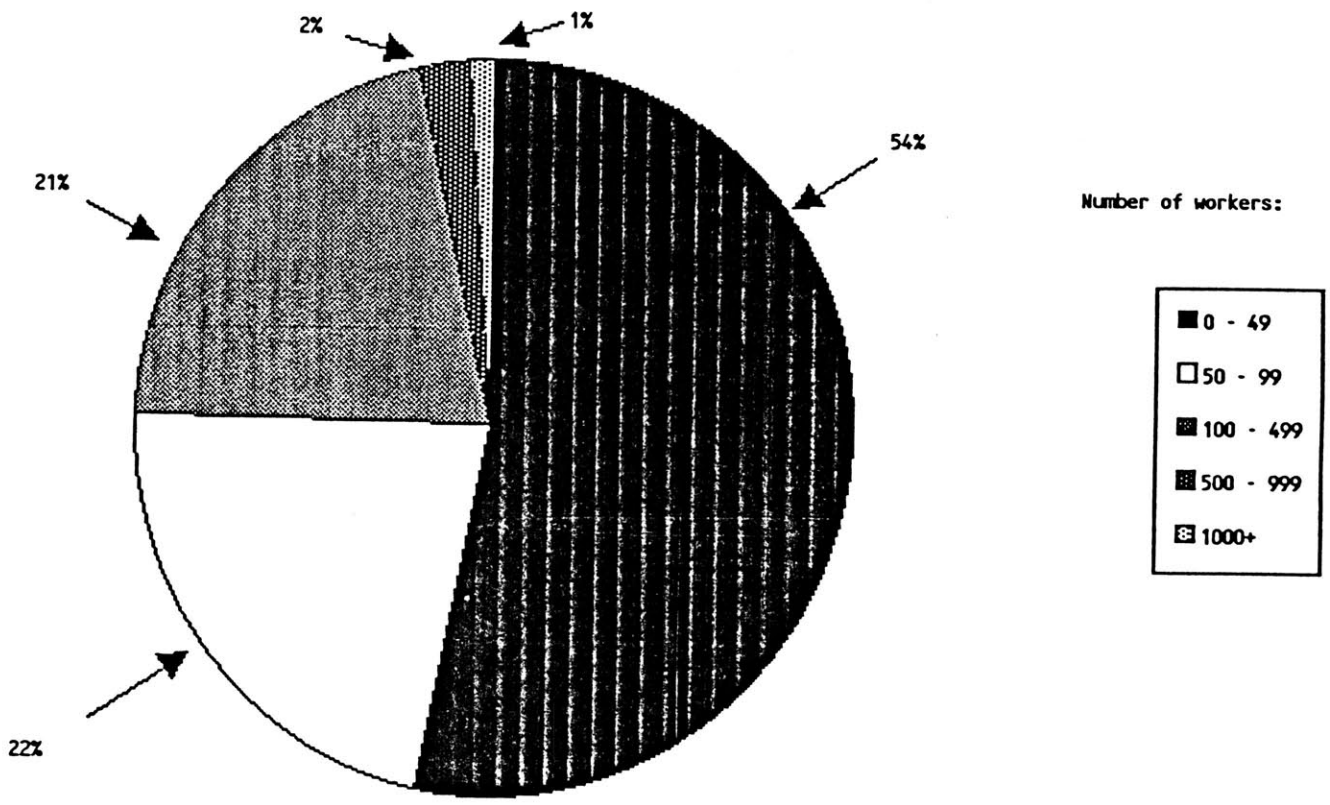
For analytical purposes, we have disaggregated the maquiladoras into eight industrial classifications with the relevant two-digit Standard Industrial Classification codes in parentheses: Electronics and Electrical Products

[3]The number of maquiladoras established between July 1988 and January 1990 are estimates as per an interview with the staff at the San Diego Economic Development Corporation in January, 1990.

(52-55), Wood and Paper Products (30-32), Textiles, Apparel and Leather (26-28), Plastic Products (42), Metal and Steel Products (46-50), Chemical, Rubber, Synthetic and Glass Products (33-45), Auto Parts and Products (56-58), and Other (16, 19, 51, 59, 60).

Graph 8 shows the size distribution of Tijuana's maquiladoras. About 54 percent of the firms employ 49 workers or less, 22 percent employ between 50 and 99, 21 percent employ between 100 and 499, 2 percent employ between 500 and 999, and 1 percent employs over 1,000 workers. The relatively small size of Tijuana's maquiladoras is very different from the very large maquiladora operations in the El Paso-Ciudad Juarez maquiladora region in which the average firm employs about 4,800 workers (United States International Trade Commission, 1986). The emerging need for flexibility in the production process (e.g., just-in-time inventory, "flexible specialization," and market niche specialization) makes small firm size a necessity, something that large infrastructure and capital overhead cannot handle. This style of production structure and management is the dominant form in California, especially in the electronics and computer industries which is the dominant type of maquiladora in Tijuana.

Graph 8. Distribution of Maquiladoras by Number of Employees



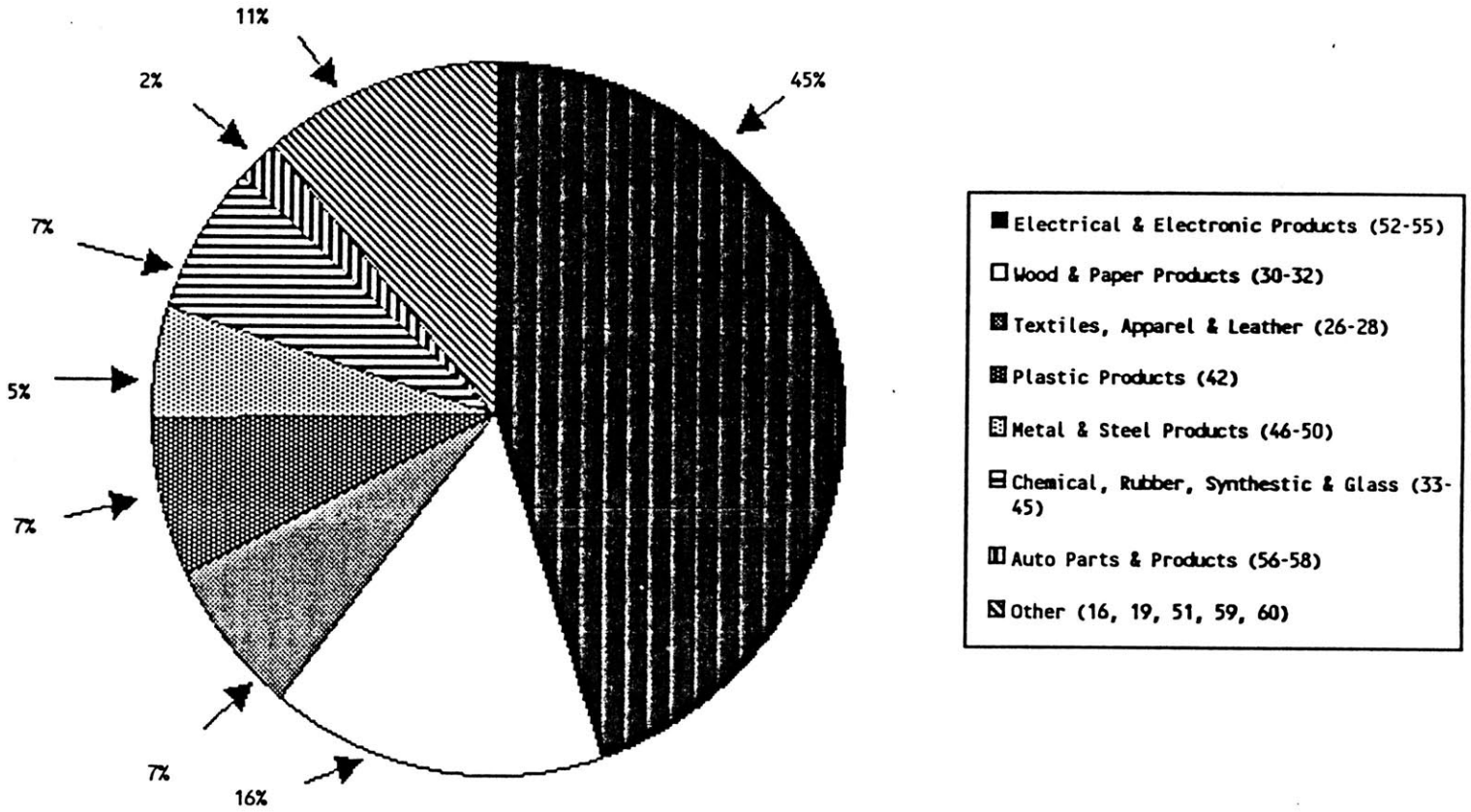
Source: San Diego Economic Development Corporation.

Graph 9 shows maquiladora employment broken down by industry. The electrical and electronic products firms employ about 45 percent of maquiladora workers, wood and paper products about 16 percent, textiles, apparel and leather about 7 percent, plastics products about 7 percent, metal and steel products about 5 percent, chemical, rubber, synthetic and glass products about 7 percent, auto parts and products about 2 percent, and the other various firms about 11 percent.

Graph 10 shows the industrial distribution of Tijuana's maquiladoras as a percentage of the number of firms. About 26 percent of the firms produce electrical and electronic products, 20 percent produce wood and paper products, 14 percent produce textiles, apparel and leather goods, 13 percent produce metal and steel products, 8 percent produce plastic products, 7 percent produce chemical, rubber, synthetic and glass products, 4 percent produce auto parts and products, and the remaining 8 percent produce other goods.

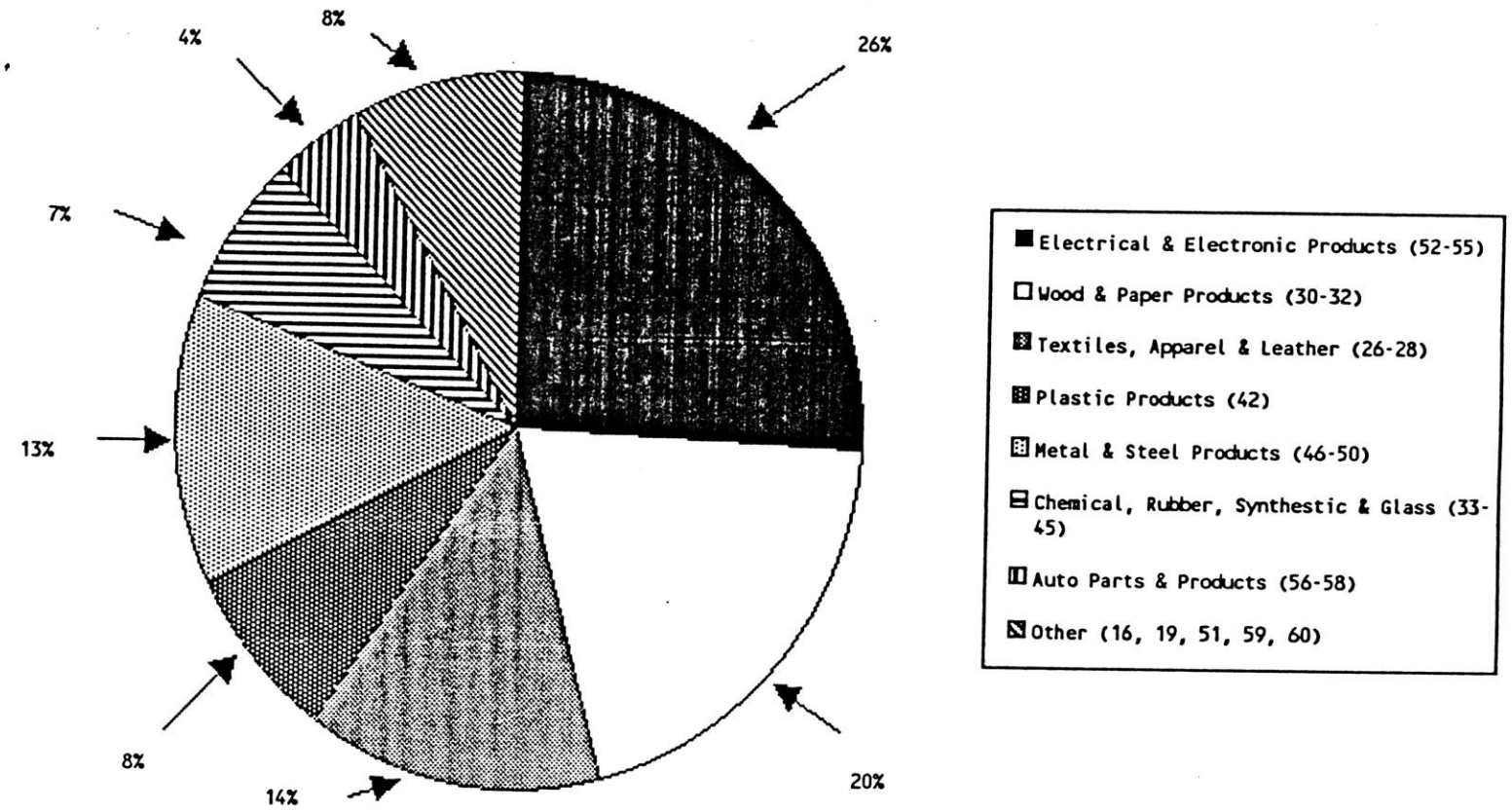
Because the significant emergence of the maquiladoras in Tijuana is a relatively new phenomena (e.g., 60 percent growth in the number of maquiladoras since 1985), many of their attributes reflect new ways of organizing and managing production facilities. This is very different from the large, mass-production facilities

Graph 9. Industrial Distribution of Maquiladoras as a Percent of Total Employment



Source: San Diego Economic Development Corporation.

Graph 10. Industrial Distribution of Maquiladoras as a Percent of Total Firms



Source: San Diego Economic Development Corporation.

of the El Paso-Ciudad Juarez maquiladora region, which reflects the structure and style of production that was evident during the late 1960s and early 1970s--precisely when Ciudad Juarez began to grow as a maquiladora city.

San Diego as Supplier of Inputs to the Maquiladoras

Based on data from the Mexican Director of Statistics, as quoted by the San Diego Economic development Corporation, between 1985 and 1987 the amount of component parts and materials imported by Tijuana maquiladora plants increased by 70 percent. In 1987, the dollar value exceeded $900 million (see Table 4). The amount imported by Tijuana maquiladoras is expected to be even higher in 1988--the third quarter already shows a 55 percent increase over the same time period in 1987.

Table 4

Tijuana Maquiladora Industry

Imports and Exports

1985-1988

	Imports ($M)	Percent Increase	Exports ($M)	Percent Increase
1985	530.7		682.1	
1986	628.7	18	801.1	17
1987	901.1	43	1093.1	36
1988	873.3	55[4]	1066.7	56[5]

SOURCE: Datos de la Direccion General de Estadistica, I.N.E.G.I., S.P.P. (Mexican Director of Statistics), December 1988, as reported by the San Diego Economic Development Corporation in a report entitled, "Maquiladora Industry: The Economic Impact on San Diego's Economy," June 1989.

As a port of entry, Tijuana ranks second--behind Ciudad Juarez--among border cities. The San Diego Economic Development Corporation estimates that between 1985 and 1987, the total value of goods imported by Tijuana maquiladoras has been increasing at a faster rate

[4]Percent increase is from 3rd quarter 1987 to 3rd quarter 1988.

[5]Percent increase is from 3rd quarter 1987 to 3rd quarter 1988.

than Ciudad Juarez--64.4 percent compared to 22.5 percent.

Although we do not know exactly how much of Tijuana's imports come from San Diego, a recent survey of maquiladoras conducted by San Diego State University indicated that, on average, approximately 24 percent of materials sourced for Tijuana maquiladoras was from San Diego. Using a weighted average, based on employment size,[6] the percent sourced from San Diego drops to 9 percent. That large of a drop indicates that the percent of total imports going to the larger maquiladoras (relative to employment) is less than that of the smaller ones. Information about the volume or dollar value of materials sourced from San Diego, is not known. Although, the larger maquiladoras source a smaller percentage of their materials from San Diego, the dollar value may exceed that of the smaller maquiladoras because the larger firms purchase larger volumes of inputs (San Diego Economic Development Corporation, June 1989). It is our attempt to estimate the value of maquiladora imports from San Diego in an effort to analyze the impact they have on the San Diego economy.

---

[6]The weighted average was calculated as follows: For each maquiladora, the percent sourced from San Diego was multiplied by its number of employees. The sum of those values was then divided by the total number of employees producing a weighted average based on employment size.

Although the focus of our analysis is on the economic impacts that result in San Diego because San Diego supplies a large portion of the input demands by Tijuana's maquiladora industries, we must mention that a great deal of other activities are taking place due to the maquiladora activities in Tijuana. In November of 1989, the Otay Mesa Chamber of Commerce carried out a demographic survey of companies in Otay Mesa. At that time, 85 companies were located in Otay Mesa. Of these 85 companies, 25 have maquiladora operations in Tijuana and another 20 are directly related to the maquiladora industry (e.g., customhouse brokers, maquiladora holding company, and operators of the foreign trade zone); therefore, 53 percent of the companies in Otay Mesa are directly linked to Tijuana's maquiladora industries. Six companies not counted as directly linked to Tijuana's maquiladora industries are involved in real estate development and marketing. Given the growth of industrial space and development around the free trade zone and the relative absence of residential development in that region, we can assume that these six real estate development companies are indirectly linked to Tijuana's maquiladora industries. The jobs created due to these kinds of linkages to the maquiladoras are important, nevertheless our focus is on the impacts related to the

supplying of inputs to Tijuana´s maquiladora industries directly.

Chapter 5

Forecasting the Impact of Tijuana's Maquiladoras on San Diego

In this chapter, we get to the heart of our research in forecasting the growth of Tijuana's maquiladoras and analyzing the impact of this growth on San Diego's economy and, in this context, look at the quantitative linkages between the two cities. The first part of this analysis is the estimation of continued growth rates of both the number of maquiladoras in Tijuana, and the growth of imports by Tijuana's maquiladoras. The estimations are based on past trends in growth rates and the assumptions in the analysis are described in detail. The second part of the analysis involves a sensitivity analysis using the estimated growth in imports to Tijuana's maquiladoras from San Diego and looking at how the various industrial sectors in San Diego are affected. The impact analysis requires a degree of flexibility on our part. We will bound our analysis by using two growth rates in Tijuana's maquiladora activity and look at the impact in San Diego for both alternatives. By looking at two alternatives, we can compare the impacts in San Diego and determine how sensitive San Diego's economy is with respect to the exogenous activity in Tijuana.

Future Growth in Tijuana's Maquiladoras

Based on past growth rates of the number of maquiladoras in Tijuana and their dollar value of imports, we estimate the number of maquiladoras and their value of imports in the future. We see that there is a 19.7 percent average annual growth rate for the observed years between 1985 and 1989. Graph 11 shows three growth estimates; the first is based on the past growth rate of almost 20 percent annual growth, the next two are estimates that we think are more reasonable and fit more closely with what industry analysts think. Our first growth estimate varies from year to year but has an average annual growth rate of about 14 percent (hereafter referred to as the 14 percent growth estimates); the second is a simple 8 percent annual growth each year.

Table 6 shows the estimations for the number of maquiladoras in Tijuana each year between 1990 and the year 2000 by calculating a 19.6 percent growth each year over the ten-year period. These numbers are difficult to accept; sustaining a nearly 20 percent growth rate for the next ten years is highly unlikely. If we look at the estimated growth rate in maquiladoras in Table 6, we see that in the five-year period from 1990 to 1995, the number of maquiladoras almost triples from 622 to 1,530, and by the year 2000, the number will have grown to about 3,760. These growth estimates do not come anywhere close

to what industry analysts believe; they tell us that by 1995, there should be about 1,000 maquiladoras in Tijuana, not 1,500 (Rodriguez, 1987). Because these numbers are not reasonable, we will not use them in our forecast assessment, but rather our 8 and 14 percent estimates.

Table 6

Estimated Growth of the Number of Tijuana's Maquiladoras Based on the Past Growth Rate of 19.6%: 1990-2000

Year	Number of Maquiladoras
1990	622
1991	745
1992	892
1993	1068
1994	1278
1995	1530
1996	1831
1997	2192
1998	2623
1999	3140
2000	3759

SOURCE: Author's calculations based on past trends.

Although the number of maquiladoras in Tijuana have been growing at about 20 percent, we will look at what we could expect if Tijuana's maquiladora growth rate was about 8 percent and 14 percent. Table 7 shows the estimated number of maquiladoras each year between 1985 and the year 2000 using our 8 percent and 14 percent growth estimates. Graph 11 shows the three growth rates together. The number of maquiladoras for 1985 through 1989 are actual numbers and the number of maquiladoras for 1990 through the year 2000 are estimates. Using the 8 percent growth estimate we see that in 1996, there will be 891 maquiladoras and about 1,212 in the year 2000. Looking at the 14 percent estimate, we see that in 1996, there will be 1010 maquiladoras and about 1,331 in the year 2000. These numbers bound what industry analysts expect--about 1000 maquiladoras in Tijuana by 1996. We believe that by bounding our analysis between two growth rates (e.g., an annual average growth rate of 8 percent and 14 percent), we get a better understanding of how sensitive the San Diego economy is to various growth stimulus originating in Tijuana.

Table 7

Estimated Number of Maquiladoras

Using 8 and 14 Percent Growth Rates

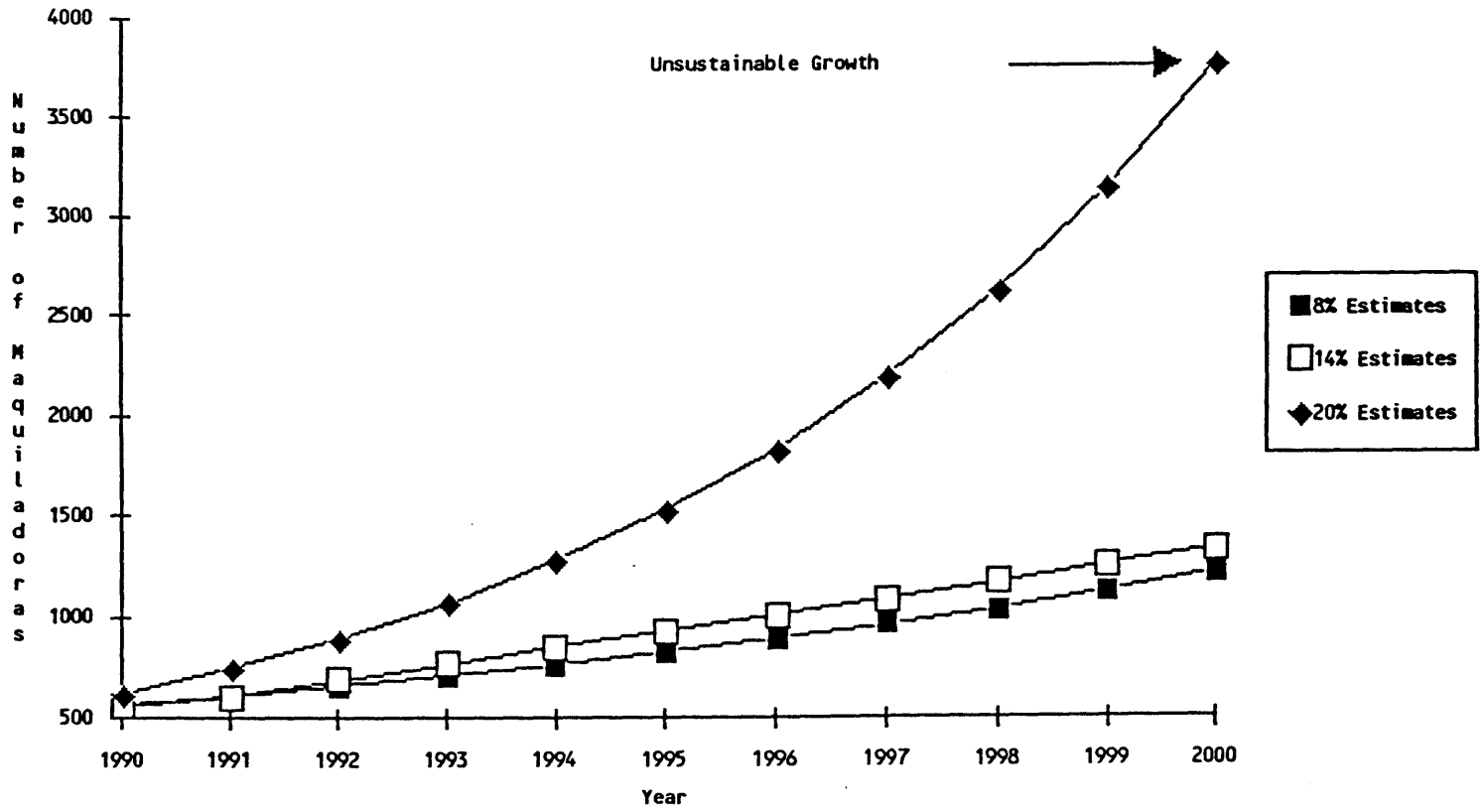
Year	Number of Maquiladoras	
	8%	14%
1990	562	570
1991	607	610
1992	655	690
1993	707	770
1994	764	850
1995	825	930
1996	891	1010
1997	962	1091
1998	1039	1171
1999	1123	1251
2000	1212	1331

SOURCE: Author's calculations based on past trends.

Growth of Maquiladora Imports and San Diego's Supply

We now turn to how much we can expect Tijuana's maquiladoras to import from San Diego. This is the crucial point for our research because it is the stimulus for our impact analysis. As we mentioned in Chapter 5, we have no knowledge of the actual dollar values of imports to Tijuana's maquiladoras coming directly from San Diego; therefore, we are forced to impute these

Graph 11. Growth Estimates in the Number of Maquiladoras



Source: Author's estimates using past trends.

values. We also mentioned in Chapter 4 that about 9 percent[7] of Tijuana's maquiladora imports come from San Diego. Therefore, we will assume that the amount of imports from San Diego will remain at 9 percent of total imports to Tijuana's maquiladoras through the year 2000, perhaps a conservative estimate. Furthermore, we will assume that the imports coming from San Diego are broken down in the same proportion as the industrial mix of Tijuana's maquiladoras (e.g., the Electronics sector makes up 26 percent of Tijuana's maquiladoras, therefore 26 percent of San Diego's imports to Tijuana are from San Diego's electronics sector, and so forth).

In estimating future imports to Tijuana's maquiladoras, we go through the same process as we did when estimating the number of maquiladoras in Tijuana through the year 2000. If we assume that the growth rate remained as it had between 1985 and 1988--a 27.4 percent average annual growth rate--we run into the same unreasonable result as we did when using this same method for estimating the number of maquiladoras. The problems are that a 27.4 percent annual growth rate is not reasonably sustainable over a ten-year period, and after

---

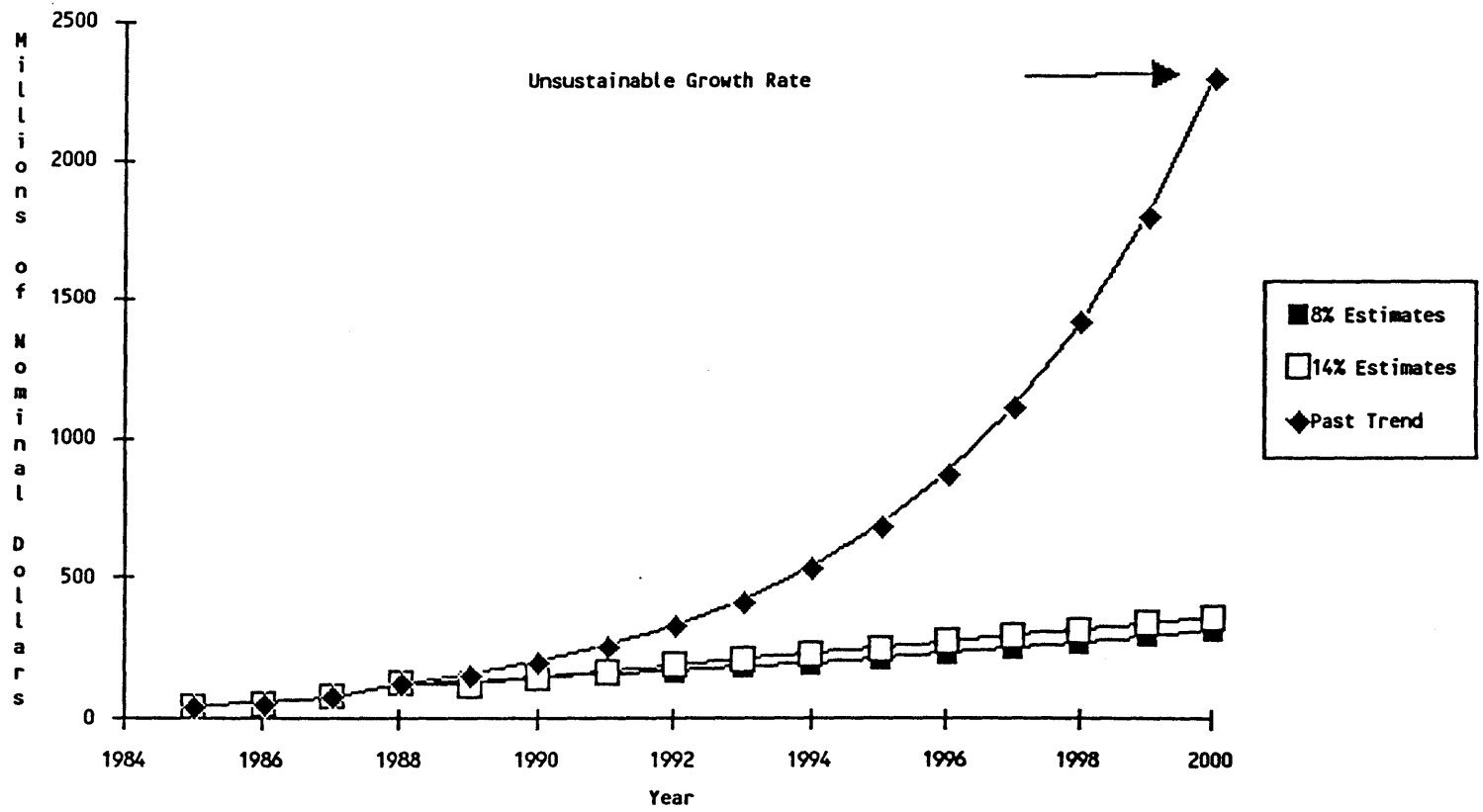
[7]The survey conducted by San Diego State University found that 24 percent of materials sourced for Tijuana's maquiladoras was from San Diego. The San Diego Economic Development Corporation re-calculated these figures taking into account the relative size of the maquiladora and came up with a weighted average of 9 percent.

five years, the import values coming from San Diego really blow up, e.g., going from 204 million dollars in 1990 to 1.5 billion dollars in 1998 and 2.3 billion dollars in the year 2000 (see Appendix A for calculations). Therefore, we will not use these estimations.

Instead, we have chosen two sets of data based on our conversations with industry experts and their estimations of how many maquiladoras will be in operations in the near future. These two data sets are compared to a baseline forecast for the San Diego economy from the year 1988 to the year 2000. The first growth alternative is an average annual growth rate of 8 percent in the amount of imports to Tijuana's maquiladoras. The second growth alternative estimates varied growth rates--faster in the beginning and slower in the end--averaging about 14 percent growth between 1985 and the year 2000 (hereafter referred to as the 14 percent growth estimates). Graph 12 shows the three growth alternatives, and Graph 13 focuses on the two alternatives that we use (i.e., the 8 and 14 percent growth alternatives).

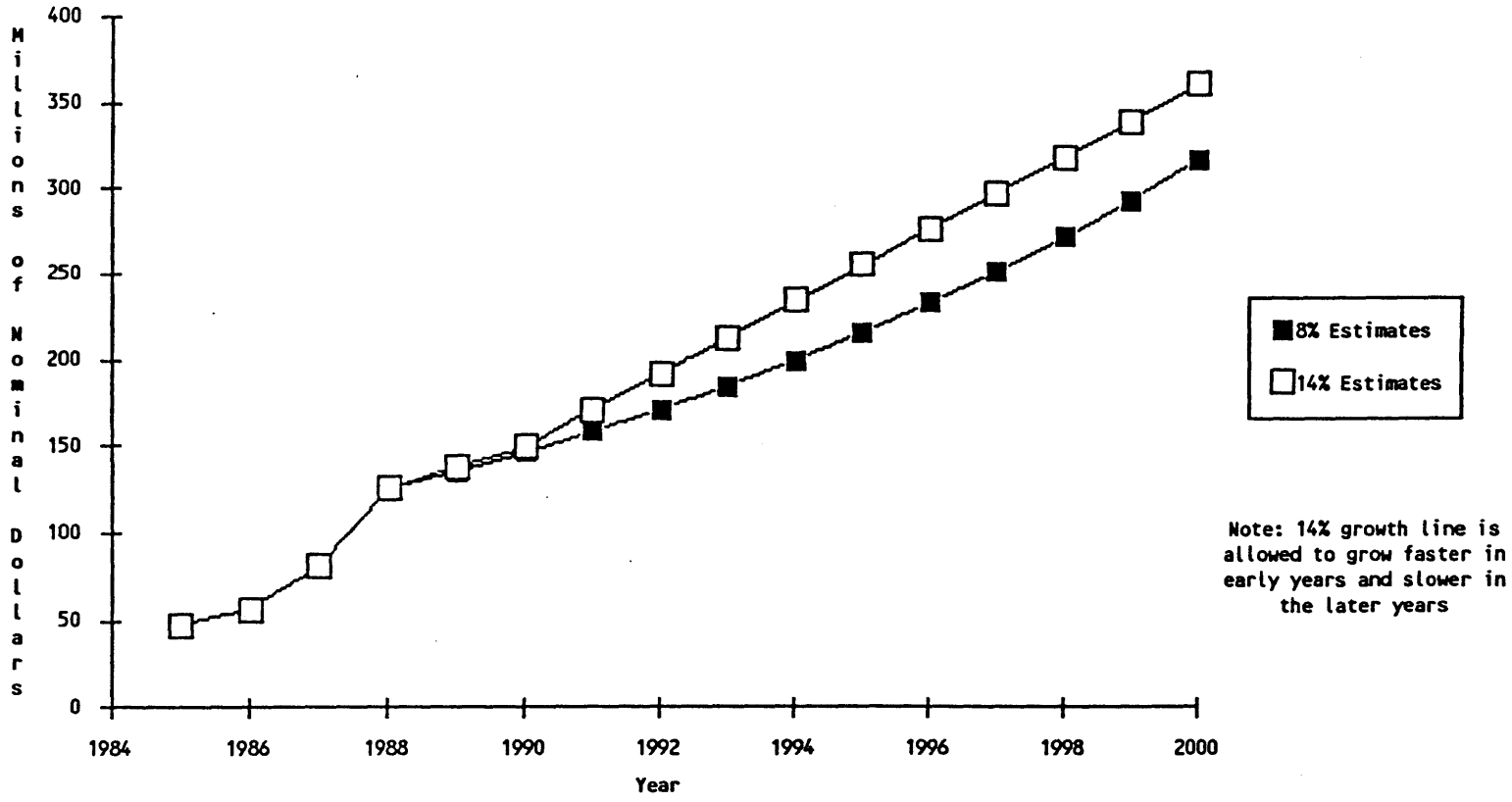
Each of our growth alternatives are compared to the baseline forecast and to each other in an effort to see how different or similar the impacts will be under the two. We disaggregated our estimated growth values by

Graph 12. Growth Estimates in San Diego's Supply of Imports to Tijuana's Maquiladoras



Source: Author's estimations.

Graph 13. Growth Rates Used in the Forecast Simulations



Note: 14% growth line is allowed to grow faster in early years and slower in the later years

Source: Author's estimations.

standard industrial classification (SIC) code in a manner that is consistent with REMI's sectoral classification (Appendix B and C have a detailed breakdown of each sectors imputed value of output for each year from 1986 to the year 2000).

Forecasting the Maquiladoras' Impacts on San Diego

We now employ REMI to analyze the impact of the demand for inputs going to Tijuana's maquiladoras as supplied by San Diego's various industrial sectors. Within REMI, we make use of a policy variable that represents increased sales to regions outside of San Diego for various sectors in the San Diego economy. In increasing the demand for goods from various sectors, we assume that the regional purchase coefficients do not change given the exogenous demand stimulus. Therefore, the added demand for goods in San Diego increases with the same proportions of regional self supply in the production of that output.

The reason that we assume that the regional purchase coefficients do not change is that two growth alternatives with opposite effects are just as likely to occur. The first alternative as trade between Mexico and the United States grows and Japanese and Korean firms play a larger role in the maquiladora production activity, we can assume that more open and free trade

will occur. This should mean that locally produced inputs will come into competition with similar goods produced outside the region. If this increased free trade and competition occurs, the regional purchase coefficient should go down because less of the inputs supplied to the maquiladoras will come from within the region. The second alternative would be that the increased border activity would create agglomeration effects and industries with close linkages will locate in the same region. If this is the case, we should expect that the regional purchase coefficients will go up because firms that supply inputs to the maquiladora industries will locate within the same region.

Because both of the scenarios are plausible and our limited resources do not allow us further research with respect to changing regional purchase coefficients, we assume, for this research, that the regional purchase coefficients stay constant for our 13-year forecast simulations.

The following analysis compares the difference between a control or "baseline" forecast and two simulations with different exogenous demand stimulus. The baseline forecast estimates what the San Diego economy would look like if there were no exogenous activity in Tijuana affecting the San Diego economy and no other major economic changes occur. The first

simulation estimates the economic impacts in San Diego caused by the activities in the Tijuana maquiladora industries using the 14 percent growth estimates of future demand by the maquiladoras; the second simulation estimates the economic impacts using the 8 percent annual growth estimates. Given the constraints of this report, we focus our analysis on the employment, output, and income effects of Tijuana's maquiladora activities in San Diego. The analysis compares only the differences between the baseline forecast and the two simulations rather than looking at the total numbers involved in the simulations.

Table 8 presents some outcomes of the forecast and simulations with respect to total employment, gross regional product, and personal income. The differences between the outcomes of the baseline and two simulations represent the impact of Tijuana's maquiladoras on the San Diego economy with respect to San Diego acting as a supplier of inputs to Tijuana's maquiladoras. The total employment generated between 1988 and the year 2000 using the 14 percent growth estimates is about 25,705 compared to 22,888 during the same period using the 8 percent annual growth estimates. The gross regional product increases by about 3.4 billion dollars over the 13-year period using the 14 percent growth estimates and by about 3 billion dollars using the 8 percent growth estimate.

Table 8. Summary of Differences Between the Control Forecast and the Simulations

Indicators	1988-1992	1993-1997	1998-2000	Annual Average	Total
Eight % Growth Simulation					
Total Employment	9560	8635	4693	1761	22888
Gross Regional Product	837.3	1216.7	952.1	231.2	3005.8
Personal Income	284	420	292	77	996
14% Growth Simulation					
Total Employment	9756	10419	5530	1977	25705
Gross Regional Product	829.3	1440	1101.6	259.3	3370.9
Personal Income	289	490	343	86	1122

Note: Gross Regional Product is in millions of nominal dollars
Personal Income is in millions of nominal dollars

Source: Author's estimation based on the REMI simulation data.

Personal income increases about 1.1 billion dollars using the 14 percent growth estimates and about 996 million dollars using the 8 percent annual growth estimates.

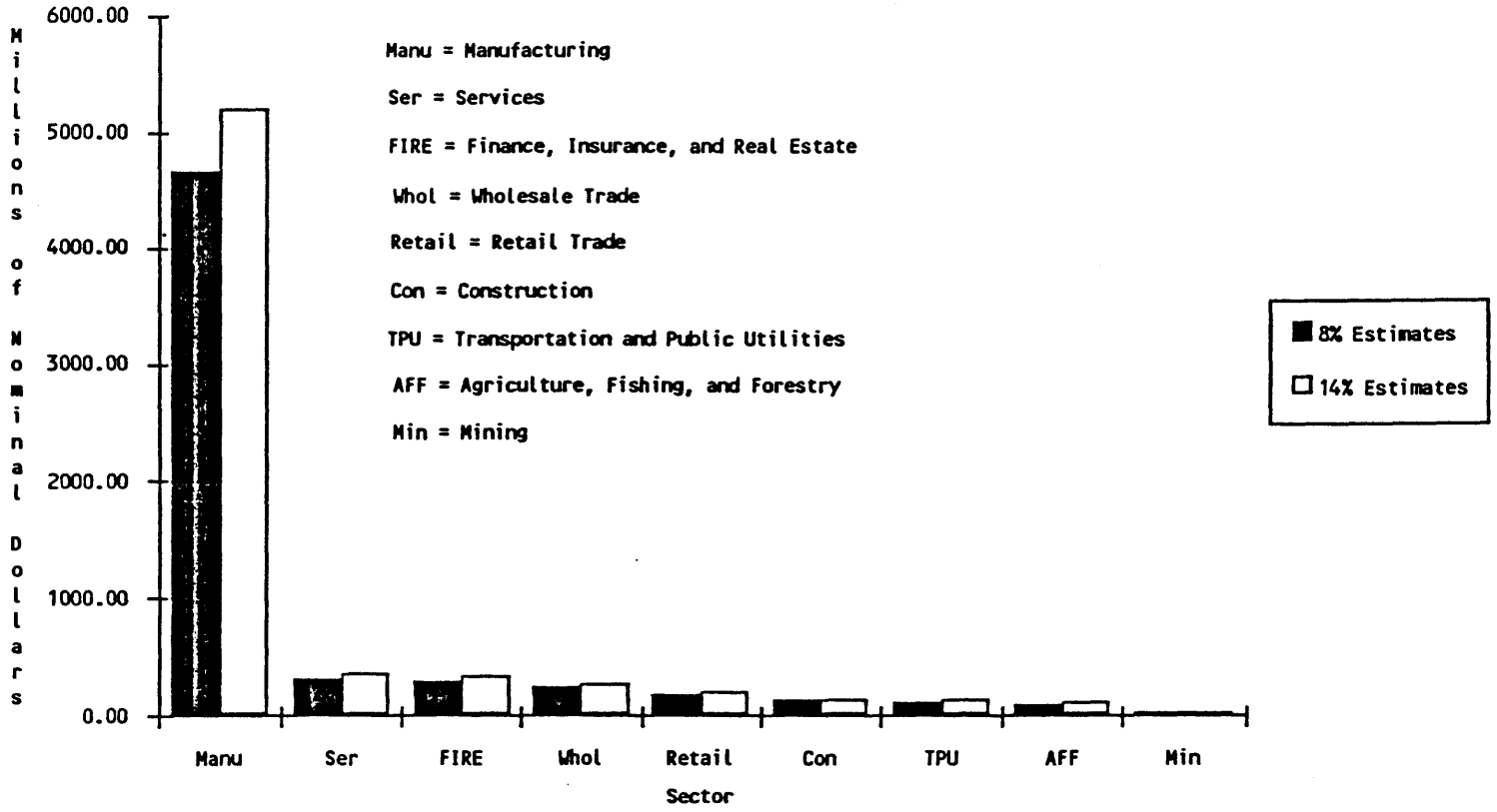
Graph 14 shows the total gains in output by sector, Graph 15 shows the total gains in employment by sector, and Graph 16 shows the total gains in labor and proprietor's income by sector. As we can see, the manufacturing sector is the major beneficiary of the increases in output, employment, and labor and proprietor's income generated by the activities in Tijuana's maquiladora industries (Appendices D, E, F, G, H, and I have detailed breakdowns of employment, output and income for each year by sector).

In total, our 14 percent growth simulation shows that total output increases by about 6.8 billion dollars, total employment increases by about 25,705, and labor and proprietor's income increases by about 1.3 billion dollars over the 13-year period. The 8 percent annual growth simulation shows that total output increases by about 6.1 billion dollars, total employment increases by about 22,888, and labor and proprietor's income increases by about 1.16 billion dollars for the 13-year period.[8]

---

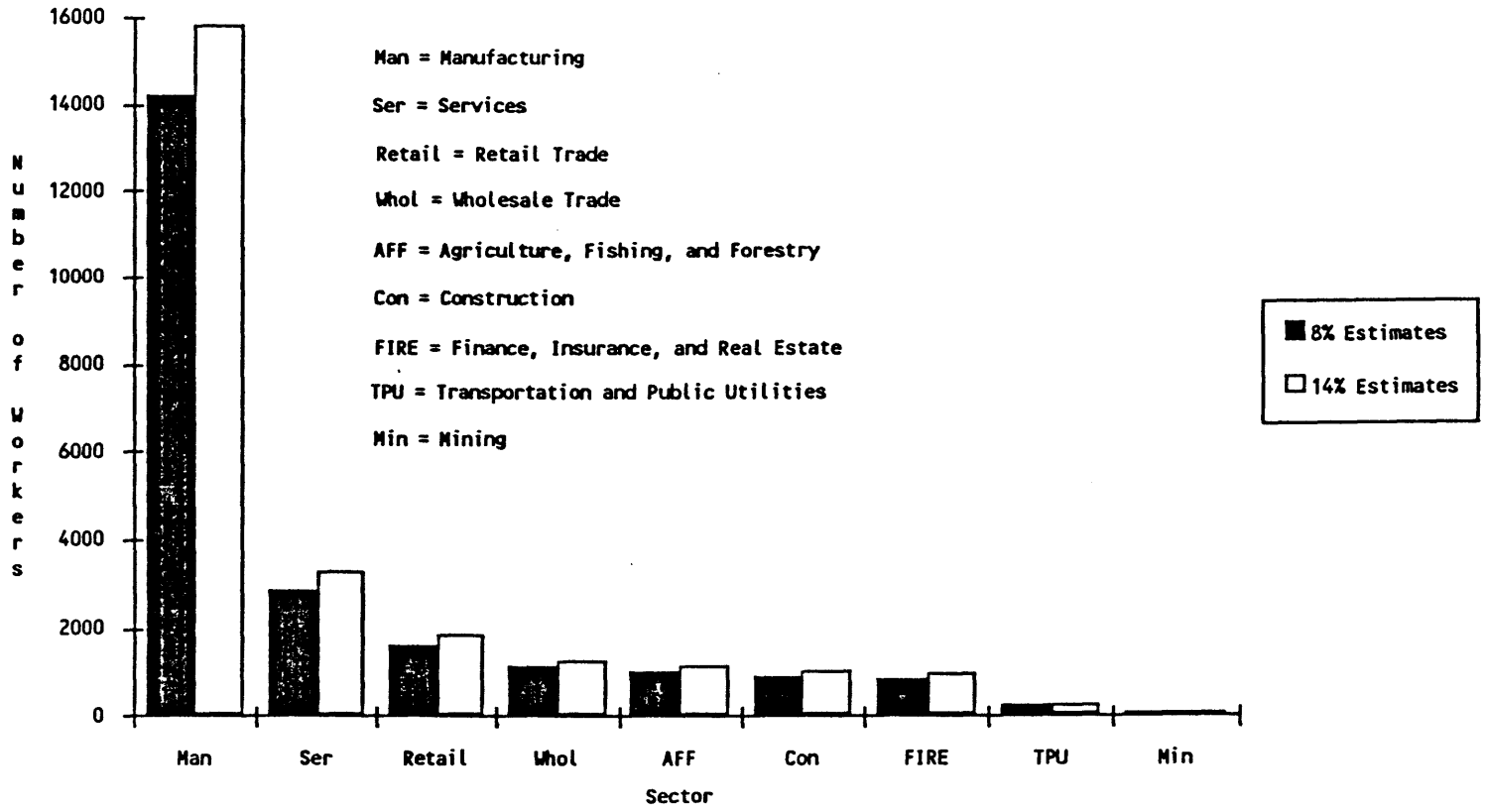
[8]In both simulations, output is measured in millions of 1977 dollars and labor and proprietor's income is measured in millions of nominal dollars.

Graph 14. Comparison of Output for the 8% and 14% Forecasts



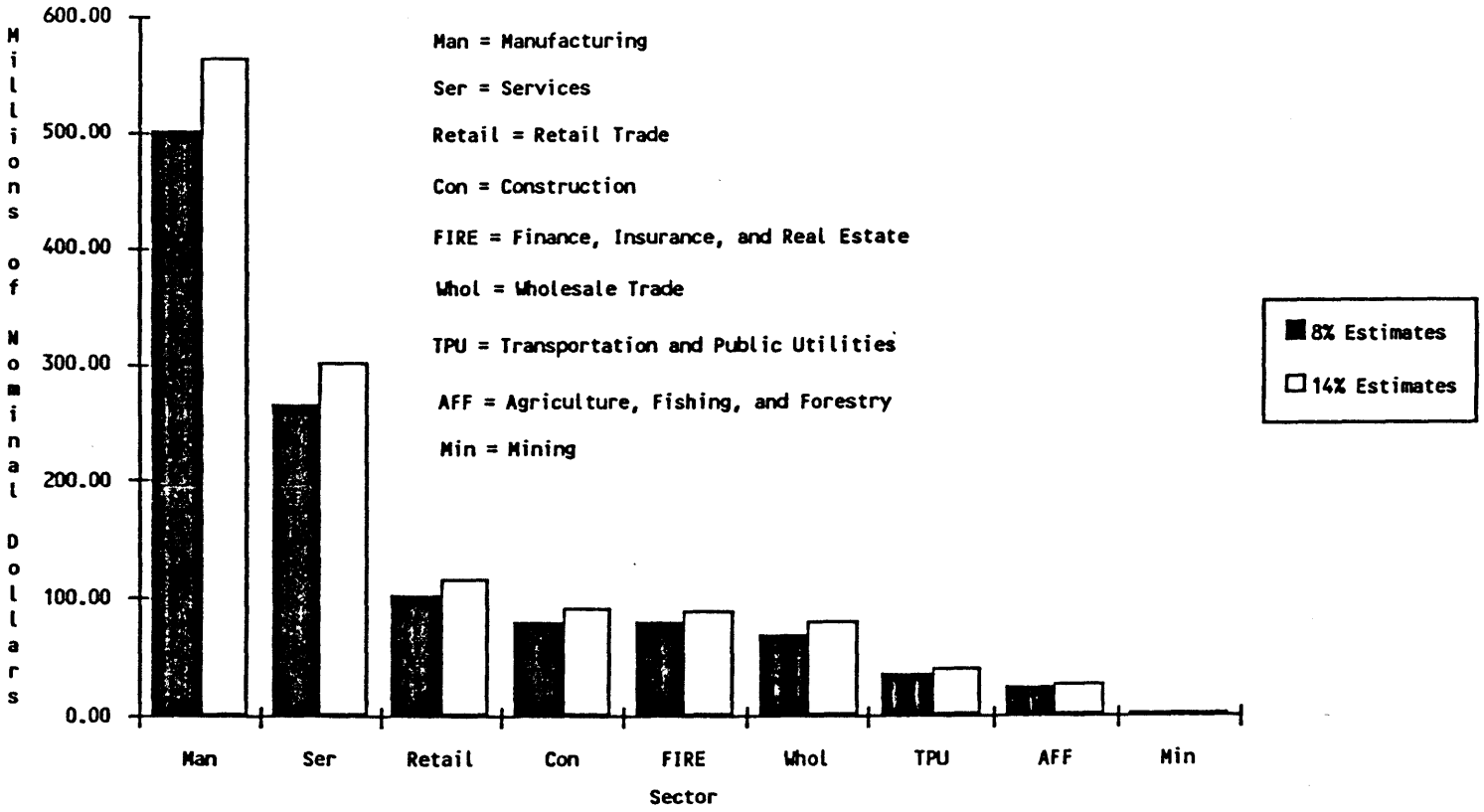
Source: Author's calculations using data from REMI.

Graph 15. Comparison of Employment for the 8% and 14% Forecasts



Source: Author's calculations using data from REMI.

Graph 16. Comparison of Labor and Proprietor's Income for the 8% and 14 % Forecasts



Source: Author's calculations using data from REMI.

Table 9 gives a year-by-year breakdown of the output, employment, and labor and proprietor's income impacts stimulated by our two simulations. The economic dynamics behind these impact indicators have implications that are as important as the numbers themselves. We want to know how much output, employment, and income is generated by each dollar of output going to Tijuana, the multiplier affect, and how these reverberations impact the economy as a whole.

The output multiplier in our analysis is about two, e.g., for every dollar of output going to Tijuana, there is two dollars of output being generated in the San Diego economy. On a national scale, we might expect about a three-to-one output multiplier from these activities; however, due to leakages outside of the San Diego region (e.g., the importation of non-San Diego-supplied inputs to the output generated), the output multiplier is lower.

If we look at employment generated from the output going to Tijuana, we see that in 1988, one job was created for every $66,000 of output. However, job creation goes down relative to the amount of output being generated--it takes more output to create one job. In 1995, it takes about $123,000 of output to create one job, and in the year 2000, it takes $200,000 of output for one job.

Table 9. Summary of Supply Impacts

	San Diego Supply To Tijuana		Output Generation		Employment Creation		Labor & Proprietor's Income	
Year	8% Est.	14% Est.	8% Est.	14% Est.	8% Est.	14% Est.	8% Est.	14% Est.
1988	125.70	125.70	265.06	255.24	1893	1893	52.76	52.76
1989	135.76	118.48	309.94	261.39	1905	1658	62.41	55.19
1990	146.62	149.64	345.41	352.97	1965	2009	70.97	71.49
1991	158.35	170.70	370.48	388.18	1939	2090	78.04	82.39
1992	171.02	191.76	400.79	428.33	1858	2106	82.85	91.29
1993	184.70	212.82	434.89	493.68	1794	2106	86.94	98.92
1994	199.48	233.88	443.42	539.15	1762	2119	91.88	107.04
1995	215.43	254.94	475.49	583.70	1719	2091	95.76	113.37
1996	232.67	276.00	525.60	604.38	1720	2105	103.63	123.80
1997	251.28	297.06	560.07	670.57	1640	1998	103.64	124.10
1998	271.38	318.12	591.75	687.25	1598	1924	107.25	127.93
1999	293.09	339.18	625.03	755.65	1559	1840	111.12	131.23
2000	316.54	360.24	726.18	786.83	1536	1766	117.69	136.66

Note: San Diego supply to Tijuana is in millions of nominal dollars.
Employment creation is in number of workers.
Output generation is in millions of nominal dollars.
Labor and proprietor's income is in millions of nominal dollars.

Source: Author's calculations using data from REMI.

Part of the reason for the decreasing employment per dollar of output is that San Diego's economy has a higher inflation rate relative to the rest of California and the United States and the increased activity between San Diego and Tijuana puts even more pressure on labor, capital, and factor costs in San Diego. As relative labor costs go up in San Diego, firms are forced to shift their labor-capital mix away from labor and towards capital equipment. Furthermore, most of the induced economic activity takes place in the manufacturing sector. As we discussed earlier in Chapter 3, the manufacturing sector is San Diego's most productive sector; the average annual output per worker in the manufacturing sector was about $80,000 in 1985 and was the only sector to have gains in productivity for that year. Therefore, increased labor and factor costs and gains in productivity in the manufacturing sector lead to decreased employment creation relative to gains in total output.

Looking at labor and proprietor's income, we would expect that 10 percent of the value of output goes to the proprietor as a return on his investment and between 30 and 35 percent goes to value added (labor). Given that most of the exogenously stimulated output is produced in the manufacturing sector, we would expect that the value added component of the output would be higher than other

sectors--about 35 percent. Therefore, we should see that labor and proprietor's income is about 40 to 45 percent of the value of output going to Tijuana. Again looking at Table 9, we see that in both forecast simulations, labor and proprietor's income does fluctuate between 42 and 45 percent throughout the 13-year period.

As we can see, the impact that Tijuana's maquiladora industries have on San Diego's economy is very significant. Given the relative stability in the impact given different growth alternatives, San Diego is likely to benefit greatly from the maquiladora activity even if there is significant slowing down in the increases of maquiladora activity in Tijuana, though this is very unlikely. San Diego's manufacturing sector is the real gainer with respect to supplying Tijuana's maquiladoras. The manufacturing sector is by far San Diego's most productive sector and, thus, we think that it is good that such a productive sector is gaining so many jobs; this is a change from the trend of new job creation in the services sector.

Chapter 6

Summary and Conclusions

In this thesis, we assessed the economic impacts of San Diego acting as a supplier of inputs to Tijuana's maquiladora industries. We showed that exports to Tijuana from San Diego's industrial sectors are expected to stimulate substantial increases in employment and output in San Diego's economy. We also showed that the types of jobs that are being created are, for the most part, very productive. The manufacturing sector is the biggest beneficiary of these activities gaining about 15,000 employees, adding about 5 billion dollars of output, and increasing its labor and proprietor's income by about 530 million dollars between 1988 and the year 2000.

In Chapter 2, we discussed various regional economic models and techniques for measuring the impact of exogenous stimulus on a regional economy. We also discussed REMI, the macroeconometric forecasting model that we used for our simulations. REMI allowed us to impute future values of demand by specific sectors (two-digit SIC code) and estimate changes in employment, output, and income for various sectors.

In an effort to put our forecasting results in perspective, we looked back at the structural changes that took place in the San Diego economy over the period

from 1969 to 1985. We saw that San Diego's economy grew at a very healthy pace. The gross regional product grew about 4.4 percent a year, employment grew about 3.8 percent a year, the population grew about 2.9 percent a year and labor and proprietor's income grew about 11.6 percent a year. The services sector is the dominant sector with respect to employment and the manufacturing sector, by far, produces the most output.

Just as San Diego's economy and population grew, we saw that Tijuana was also growing very rapidly over the same time period. By 1995, the San Diego-Tijuana metropolitan region will be home to more than five million people. According to maquiladora industry surveys, expansion in operations on both sides of the border are in the pipeline. Although we estimated 8 percent and 14 percent annual growth in imports from San Diego to Tijuana's maquiladoras over the next ten years, it is likely that the numbers will be somewhat higher. Nevertheless, our analysis shows the proportions of impact on San Diego's economy.

We concluded that the impact of Tijuana's maquiladoras affected the manufacturing sector, the most productive sector in San Diego. This raises questions that are worth considering for future research. Given that firms are able to split their production process between two locations separated by a national border, how

do we assess a firms productivity? In our analysis, we only looked at the output produced by firms in San Diego.

However, if a firm sends some of its goods to Tijuana for sub-assembly and it then brings it back to San Diego, that good is both an export and an import. The value added that takes place in Tijuana is strictly that of labor performing nonskilled, manual or semi-manual assembly at a very low wage. If these activities were to be carried out in San Diego, it would dramatically decrease overall worker productivity. Therefore, the question is, are San Diego's manufacturing firms that are involved with the maquiladoras in Tijuana more productive, or are they simply off-shoring the non-productive aspects of their production process?

Another area for future research is the economic impacts of the construction of new industrial space in Otay Mesa. These new use patterns for the area have dramatically increased the value of land, but the direct and indirect impacts of the actual construction are very important as well.

Because most manufacturing processes require a great deal of space, it is important that industrial space be reasonably priced. However, if land speculation bids up the price of land too much, the attractiveness of the area to maquiladora-related business will decrease; the

maquiladora-related activities are what have induced the speculation and land value increase in the first place.

Given that San Diego sits at the gateway to the Pacific Rim economy and Asian investment in Tijuana and San Diego will continue to increase because of the maquiladoras, we have to say that the maquiladoras are beneficial to San Diego's economy. The manufacturing sector is producing tradable goods that help the U.S. trade balance, domestic and foreign investments are making a once non-productive region in San Diego a very productive region, and the jobs being created are very productive.

Appendix A

Growth in Imports Supplied by San Diego Based on a 19.6% Growth Rate

Year	Supplied by San Diego
1985	47.763
1986	56.583
1987	81.099
1988	125.703
1989	160.146
1990	204.026
1991	259.929
1992	331.149
1993	421.884
1994	537.480
1995	684.749
1996	872.371
1997	1111.400
1998	1415.924
1999	1803.887
2000	2298.152

Source: Author's calculations using past trends.

Note: Supply values are in millions of nominal dollars.

Appendix B. Eight Percent Growth Estimates Broken Down by Industrial Mix

SIC Code	REMI Code	Firms	As % of Firms	Imports to Tijuana's Maquiladoras From San Diego (Millions of nominal dollars)														
				1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
30	601	74	17.92	10.138	14.531	22.523	24.325	26.271	28.373	30.642	33.094	35.741	38.601	41.689	45.024	48.626	52.516	56.717
48	602	7	1.69	0.959	1.375	2.131	2.301	2.485	2.684	2.899	3.130	3.381	3.651	3.944	4.259	4.600	4.968	5.365
43	603	14	3.39	1.918	2.749	4.261	4.602	4.970	5.368	5.797	6.261	6.762	7.303	7.887	8.518	9.199	9.935	10.730
44	603	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	603	2	0.48	0.274	0.393	0.609	0.657	0.710	0.767	0.828	0.894	0.966	1.043	1.127	1.217	1.314	1.419	1.533
				2.192	3.142	4.870	5.259	5.680	6.135	6.625	7.155	7.728	8.346	9.014	9.735	10.514	11.355	12.263
46	605	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	605	6	1.45	0.822	1.178	1.826	1.972	2.130	2.300	2.485	2.683	2.898	3.130	3.380	3.651	3.943	4.258	4.599
50	605	38	9.20	5.206	7.462	11.566	12.491	13.490	14.570	15.735	16.994	18.354	19.822	21.408	23.120	24.970	26.967	29.125
				6.028	8.640	13.392	14.463	15.621	16.870	18.220	19.677	21.252	22.952	24.788	26.771	28.912	31.226	33.724
47	606	2	0.48	0.274	0.393	0.609	0.657	0.710	0.767	0.828	0.894	0.966	1.043	1.127	1.217	1.314	1.419	1.533
51	606	6	1.45	0.822	1.178	1.826	1.972	2.130	2.300	2.485	2.683	2.898	3.130	3.380	3.651	3.943	4.258	4.599
				1.096	1.571	2.435	2.630	2.840	3.067	3.313	3.578	3.864	4.173	4.507	4.867	5.257	5.677	6.132
52	607	1	0.24	0.137	0.196	0.304	0.329	0.355	0.383	0.414	0.447	0.483	0.522	0.563	0.608	0.657	0.710	0.766
53	607	3	0.73	0.411	0.589	0.913	0.986	1.065	1.150	1.242	1.342	1.449	1.565	1.690	1.825	1.971	2.129	2.299
54	607	99	23.97	13.563	19.440	30.132	32.543	35.146	37.958	40.995	44.274	47.816	51.641	55.772	60.234	65.053	70.257	75.878
55	607	6	1.45	0.822	1.178	1.826	1.972	2.130	2.300	2.485	2.683	2.898	3.130	3.380	3.651	3.943	4.258	4.599
				14.934	21.404	33.176	35.830	38.696	41.792	45.136	48.746	52.646	56.858	61.406	66.319	71.624	77.354	83.543
56	608	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
57	609	14	3.39	1.918	2.749	4.261	4.602	4.970	5.368	5.797	6.261	6.762	7.303	7.887	8.518	9.199	9.935	10.730
58	609	3	0.73	0.411	0.589	0.913	0.986	1.065	1.150	1.242	1.342	1.449	1.565	1.690	1.825	1.971	2.129	2.299
				2.329	3.338	5.174	5.588	6.035	6.518	7.039	7.603	8.211	8.868	9.577	10.343	11.171	12.064	13.030
59	611	21	5.08	2.877	4.124	6.392	6.903	7.455	8.052	8.696	9.391	10.143	10.954	11.831	12.777	13.799	14.903	16.095
16	612	5	1.21	0.685	0.981	1.521	1.643	1.774	1.916	2.069	2.235	2.414	2.607	2.815	3.041	3.284	3.546	3.830
26	614	11	2.66	1.507	2.160	3.348	3.616	3.905	4.218	4.555	4.919	5.313	5.738	6.197	6.693	7.228	7.806	8.431

Appendix B. Eight Percent Growth Estimates Broken Down by Industrial Mix
(continued)

SIC Code	REMI Code	Firms	As % of Firms	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
27	615	35	8.47	4.795	6.873	10.653	11.505	12.425	13.419	14.493	15.652	16.905	18.257	19.718	21.295	22.999	24.838	26.826
31	616	4	0.97	0.548	0.785	1.217	1.315	1.420	1.534	1.656	1.789	1.932	2.087	2.253	2.434	2.628	2.839	3.066
32	617	3	0.73	0.411	0.589	0.913	0.986	1.065	1.150	1.242	1.342	1.449	1.565	1.690	1.825	1.971	2.129	2.299
35	618	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
36	618	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	618	9	2.18	1.233	1.767	2.739	2.958	3.195	3.451	3.727	4.025	4.347	4.695	5.070	5.476	5.914	6.387	6.898
38	618	1	0.24	0.137	0.196	0.304	0.329	0.355	0.383	0.414	0.447	0.483	0.522	0.563	0.608	0.657	0.710	0.766
39	618	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	618	1	0.24	0.137	0.196	0.304	0.329	0.355	0.383	0.414	0.447	0.483	0.522	0.563	0.608	0.657	0.710	0.766
				1.507	2.160	3.348	3.616	3.905	4.218	4.555	4.919	5.313	5.738	6.197	6.693	7.228	7.806	8.431
33	619	1	0.24	0.137	0.196	0.304	0.329	0.355	0.383	0.414	0.447	0.483	0.522	0.563	0.608	0.657	0.710	0.766
34	619	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.137	0.196	0.304	0.329	0.355	0.383	0.414	0.447	0.483	0.522	0.563	0.608	0.657	0.710	0.766
41	620	2	0.48	0.274	0.393	0.609	0.657	0.710	0.767	0.828	0.894	0.966	1.043	1.127	1.217	1.314	1.419	1.533
42	620	31	7.51	4.247	6.087	9.435	10.190	11.005	11.886	12.837	13.864	14.973	16.171	17.464	18.861	20.370	22.000	23.760
				4.521	6.480	10.044	10.848	11.715	12.653	13.665	14.758	15.939	17.214	18.591	20.078	21.684	23.419	25.293
28	621	13	3.15	1.781	2.553	3.957	4.273	4.615	4.984	5.383	5.814	6.279	6.781	7.324	7.910	8.542	9.226	9.964
60	623	1	0.24	0.137	0.196	0.304	0.329	0.355	0.383	0.414	0.447	0.483	0.522	0.563	0.608	0.657	0.710	0.766

Source: Subdelegacion de Fomento Industrial (SECOFI), Tijuana, B.C., October 1988; as reported by the San Diego Economic Development Corporation in a report entitled, "Maquiladora Industry: The Economic Impact on San Diego's Economy," June 1989. The imputed values have been calculated by the author.

Appendix C. 14% Growth Estimates Broken Down by Industrial Mix

SIC	REMI		As % of	Imports to Tijuana's Maquiladoras from San Diego (Millions of nominal dollars)														
Code	Code	Firms	Firms	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
30	601	74	17.92	10.138	14.531	22.523	21.229	26.811	30.585	34.358	38.132	41.905	45.679	49.452	53.226	56.999	60.773	64.546
48	602	7	1.69	0.959	1.375	2.131	2.008	2.536	2.893	3.250	3.607	3.964	4.321	4.678	5.035	5.392	5.749	6.106
43	603	14	3.39	1.918	2.749	4.261	4.016	5.072	5.786	6.500	7.214	7.928	8.642	9.356	10.070	10.784	11.498	12.211
44	603	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	603	2	0.48	0.274	0.393	0.609	0.574	0.725	0.827	0.929	1.031	1.133	1.235	1.337	1.439	1.541	1.643	1.744
				2.192	3.142	4.870	4.590	5.797	6.613	7.429	8.245	9.061	9.876	10.692	11.508	12.324	13.140	13.956
46	605	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	605	6	1.45	0.822	1.178	1.826	1.721	2.174	2.480	2.786	3.092	3.398	3.704	4.010	4.316	4.622	4.928	5.233
50	605	38	9.20	5.206	7.462	11.566	10.901	13.768	15.706	17.643	19.581	21.519	23.457	25.394	27.332	29.270	31.208	33.145
				6.028	8.640	13.392	12.623	15.942	18.186	20.429	22.673	24.917	27.160	29.404	31.648	33.891	36.135	38.379
47	606	2	0.48	0.274	0.393	0.609	0.574	0.725	0.827	0.929	1.031	1.133	1.224	1.337	1.439	1.541	1.643	1.744
51	606	6	1.45	0.822	1.178	1.826	1.721	2.174	2.480	2.786	3.092	3.398	3.703	4.010	4.316	4.622	4.928	5.233
				1.096	1.571	2.435	2.295	2.899	3.306	3.714	4.122	4.530	4.927	5.346	5.754	6.162	6.570	6.978
52	607	1	0.24	0.137	0.196	0.304	0.287	0.362	0.413	0.464	0.515	0.566	0.617	0.668	0.719	0.770	0.821	0.872
53	607	3	0.73	0.411	0.589	0.913	0.861	1.087	1.240	1.393	1.546	1.699	1.852	2.005	2.158	2.311	2.464	2.617
54	607	99	23.97	13.563	19.440	30.132	28.401	35.869	40.917	45.966	51.014	56.062	61.111	66.159	71.207	76.256	81.304	86.352
55	607	6	1.45	0.822	1.178	1.826	1.721	2.174	2.480	2.786	3.092	3.398	3.704	4.010	4.316	4.622	4.928	5.233
				14.934	21.404	33.176	31.270	39.492	45.051	50.609	56.167	61.725	67.283	72.842	78.400	83.958	89.516	95.075
56	608	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
57	609	14	3.39	1.918	2.749	4.261	4.016	5.072	5.786	6.500	7.214	7.928	8.642	9.356	10.070	10.784	11.498	12.211
58	609	3	0.73	0.411	0.589	0.913	0.861	1.087	1.240	1.393	1.546	1.699	1.852	2.005	2.158	2.311	2.464	2.617
				2.329	3.338	5.174	4.877	6.159	7.026	7.893	8.760	9.627	10.494	11.361	12.227	13.094	13.961	14.828
59	611	21	5.08	2.877	4.124	6.392	6.024	7.609	8.679	9.750	10.821	11.892	12.963	14.034	15.105	16.175	17.246	18.317
16	612	5	1.21	0.685	0.981	1.521	1.434	1.811	2.065	2.320	2.575	2.830	3.085	3.340	3.594	3.849	4.104	4.359

Appendix C. 14% Growth Estimates Broken Down by Industrial Mix
(continued)

SIC	REMI		As % of	Imports to Tijuana's Maquiladoras from San Diego (Millions of nominal dollars)														
Code	Code	Firms	Firms	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
26	614	11	2.66	1.507	2.160	3.348	3.156	3.985	4.546	5.107	5.668	6.229	6.790	7.351	7.912	8.473	9.034	9.595
27	615	35	8.47	4.795	6.873	10.653	10.041	12.681	14.466	16.251	18.035	19.820	21.605	23.389	25.174	26.959	28.744	30.529
31	616	4	0.97	0.548	0.785	1.217	1.148	1.449	1.653	1.857	2.061	2.265	2.469	2.673	2.877	3.081	3.285	3.489
32	617	3	0.73	0.411	0.589	0.913	0.861	1.087	1.240	1.393	1.546	1.699	1.852	2.005	2.158	2.311	2.464	2.617
35	618	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
36	618	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	618	9	2.18	1.233	1.767	2.739	2.582	3.261	3.720	4.179	4.638	5.097	6.014	6.014	6.473	6.932	7.391	7.850
38	618	1	0.24	0.137	0.196	0.304	0.287	0.362	0.413	0.464	0.515	0.566	0.668	0.668	0.719	0.770	0.821	0.872
39	618	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	618	1	0.24	0.137	0.196	0.304	0.287	0.362	0.413	0.464	0.515	0.566	0.668	0.668	0.719	0.770	0.821	0.872
				1.507	2.160	3.348	3.156	3.985	4.546	5.107	5.668	6.229	6.790	7.351	7.912	8.473	9.034	9.595
33	669	1	0.24	0.137	0.196	0.304	0.287	0.362	0.413	0.464	0.515	0.566	0.617	0.668	0.719	0.770	0.821	0.872
34	669	0	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
				0.137	0.196	0.304	0.287	0.362	0.413	0.464	0.515	0.566	0.617	0.668	0.719	0.770	0.821	0.872
41	620	2	0.48	0.274	0.393	0.609	0.574	0.725	0.827	0.929	1.031	1.133	1.235	1.337	1.439	1.541	1.643	1.744
42	620	31	7.51	4.247	6.087	9.435	8.893	11.232	12.813	14.393	15.974	17.555	19.136	20.716	22.297	23.878	25.459	27.040
				4.521	6.480	10.044	9.467	11.956	13.639	15.322	17.005	18.687	20.370	22.053	23.736	25.419	27.101	28.784
28	621	13	3.15	1.781	2.553	3.957	3.729	4.710	5.373	6.036	6.699	7.362	8.025	8.688	9.350	10.013	10.676	11.339
60	623	1	0.24	0.137	0.196	0.304	0.287	0.362	0.413	0.464	0.515	0.566	0.617	0.668	0.719	0.770	0.821	0.872

Source: Subdelegacion de Fomento Industrial (SECOFI), Tijuana, B.C., October 1988; as reported by the San Diego Economic Development Corporation in a report entitled, "Maquiladora Industry: The Economic Impact on San Diego's Economy," June 1989. Imputed values have been calculated by the author.

Appendix D. Difference Between Baseline and 8% Forecast Simulations: Output (millions of nominal dollars)

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing	205.55	239.63	261.43	279.51	302.67	329.56	337.02	362.88	397.72	429.98	456.09	484.10	563.64	4649.77
Mining	0.92	1.12	1.25	1.37	1.48	1.60	1.64	1.76	1.84	1.96	2.09	2.28	2.64	21.95
Construction	4.97	6.08	7.29	8.05	8.85	9.72	9.92	10.49	11.87	11.91	12.60	12.93	14.70	129.38
TPU	5.64	6.54	7.66	8.12	8.59	9.10	9.14	9.59	10.58	10.93	11.42	11.98	13.62	122.91
FIRE	12.15	14.57	17.82	19.39	20.98	22.39	22.43	23.48	28.20	27.44	28.15	28.83	33.54	299.36
Retail Trade	7.02	8.49	10.46	11.52	12.54	13.49	13.65	14.41	16.24	16.51	17.24	17.76	19.92	179.24
Wholesale Trade	9.32	11.01	12.94	14.14	15.50	17.06	17.55	19.05	21.25	22.74	24.17	25.92	30.48	241.11
Services	14.20	16.62	20.03	21.49	22.95	24.35	24.40	25.59	28.80	29.06	30.14	31.11	36.24	324.97
AFF	5.29	5.89	6.53	6.90	7.22	7.63	7.67	8.26	9.11	9.56	9.84	10.12	11.40	105.41
Total	265.06	309.94	345.41	370.48	400.79	434.89	443.42	475.49	525.60	560.07	591.75	625.03	726.18	6074.09

Note: FIRE = Finance, Insurance, and Real Estate
TPU = Transportation and Public Utilities
AFF = Agriculture, Fishing, and Forestry

Source: Author's calculations using data from REMI.

Appendix E. Difference Between Baseline and 8% Forecast Simulations: Employment (number of people)

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing	1152	1142	1156	1136	1095	1079	1078	1075	1073	1062	1055	1050	1051	14204
Mining	3	3	3	3	2	2	2	2	2	2	2	2	2	30
Construction	68	74	79	82	81	79	77	73	73	65	62	59	56	928
TPU	28	28	28	26	23	20	18	16	14	11	9	7	6	234
FIRE	82	85	89	89	83	75	68	61	62	52	47	42	37	872
Retail Trade	137	143	157	155	149	139	132	124	125	108	100	90	82	1641
Wholesale Trade	83	86	90	90	89	87	87	86	88	85	84	84	84	1123
Services	254	258	278	275	258	238	224	207	207	181	167	155	150	2852
AFF	86	86	85	83	78	75	76	75	76	74	72	70	68	1004
Total	1893	1905	1965	1939	1858	1794	1762	1719	1720	1640	1598	1559	1536	22888

Note: FIRE = Finance, Insurance and Real Estate
TPU = Transportation and Public Utilities
AFF = Agriculture, Fishing, and Forestry

Source: Author's calculations using data from REMI.

Appendix F. Difference Between Baseline and 8% Forecast Simulations:
Labor and Proprietor's Income (millions of nominal dollars)

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing	29.47	31.97	33.83	35.34	35.97	36.99	38.59	40.02	41.94	42.33	43.50	45.12	47.68	502.75
Mining	0.11	0.14	0.16	0.17	0.19	0.20	0.22	0.23	0.24	0.23	0.24	0.25	0.26	2.64
Construction	3.13	4.14	4.81	5.56	6.03	6.32	6.63	6.69	7.53	7.17	7.38	7.46	7.72	80.57
TPU	1.47	1.92	2.31	2.55	2.74	2.86	3.00	3.10	3.25	3.17	3.19	3.23	3.29	36.08
FIRE	2.24	3.26	4.09	4.96	5.59	6.00	6.42	6.66	7.79	7.68	8.06	8.38	8.96	80.09
Retail Trade	3.38	4.56	5.74	6.59	7.31	7.86	8.42	8.87	9.67	9.60	9.87	10.18	10.59	102.64
Wholesale Trade	2.75	3.38	3.95	4.42	4.85	5.19	5.57	5.92	6.43	6.50	6.76	7.14	7.71	70.57
Services	8.86	11.52	14.47	16.76	18.44	19.75	21.14	22.31	24.64	24.85	26.11	27.20	29.22	265.27
AFF	1.35	1.52	1.61	1.69	1.73	1.77	1.89	1.96	2.14	2.11	2.14	2.16	2.26	24.33
Total	52.76	62.41	70.97	78.04	82.85	86.94	91.88	95.76	103.63	103.64	107.25	111.12	117.69	1164.94

Note: FIRE = Finance, Insurance, and Real Estate
TPU = Transportation and Public Utilities
AFF = Agriculture, Fishing, and Forestry

Source; Author's calculations using data from REMI.

Appendix G. Difference Between Baseline and 14% Simulations:
Output (millions of nominal dollars)

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing	197.94	201.99	267.40	294.07	324.00	374.08	409.08	444.14	455.58	512.49	527.25	583.00	608.93	5199.94
Mining	0.88	0.93	1.29	1.43	1.58	1.84	2.02	2.16	2.16	2.35	2.45	2.75	2.91	24.74
Construction	4.78	5.16	7.39	8.26	9.32	10.88	11.97	12.85	13.68	14.36	14.75	15.84	16.13	145.38
TPU	5.43	5.49	7.82	8.47	9.25	10.52	11.34	12.10	12.45	13.43	13.55	14.69	14.88	139.41
FIRE	11.70	12.33	18.08	19.86	22.07	25.16	27.13	28.82	32.56	33.17	33.15	35.37	36.82	336.22
Retail Trade	6.76	7.20	10.63	11.80	13.25	15.20	16.59	17.78	18.88	20.09	20.35	21.89	21.95	202.35
Wholesale Trade	8.97	9.30	13.20	14.76	16.56	19.40	21.46	23.54	24.60	27.44	28.30	31.52	33.12	272.16
Services	13.68	14.01	20.49	22.30	24.62	28.00	30.28	32.25	34.06	35.87	36.05	38.45	39.73	369.79
AFF	5.10	4.98	6.67	7.24	7.67	8.60	9.28	10.08	10.43	11.37	11.40	12.16	12.37	117.33
Total	255.24	261.39	352.97	388.18	428.33	493.68	539.15	583.70	604.38	670.57	687.25	755.65	786.83	6807.32

Note: FIRE = Finance, Insurance, and Real Estate
TPU = Transportation and Public Utilities
AFF = Agriculture, Fishing, and Forestry

Source: Author's calculations using data from REMI.

Appendix H. Difference Between Baseline and 14% Forecast Simulations:
Employment (number of people)

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing	1152	995	1182	1230	1236	1254	1276	1285	1285	1266	1244	1219	1197	15821
Mining	3	2	3	3	3	3	3	3	3	2	2	2	2	34
Construction	68	65	80	87	91	92	92	88	90	80	76	71	66	1046
TPU	28	24	29	28	27	25	24	21	20	16	13	10	7	272
FIRE	82	74	91	95	95	89	85	77	80	67	60	52	45	992
Retail Trade	137	125	160	165	168	165	163	156	159	139	127	113	98	1875
Wholesale Trade	83	74	92	97	101	103	106	106	108	105	102	99	97	1273
Services	254	224	285	296	297	288	280	265	268	235	215	193	176	3276
AFF	86	75	87	89	88	87	90	90	92	88	85	81	78	1116
Total	1893	1658	2009	2090	2106	2106	2119	2091	2105	1998	1924	1840	1766	25705

Note: FIRE = Finance, Insurance, and Real Estate
TPU = Transportation and Public Utilities
AFF = Agriculture, Fishing, and Forestry

Source: Author's calculations using data from REMI.

Appendix I. Difference Between Baseline and 14% Forecast Simulations:
Labor and Proprietor's Income (millions of nominal dollars)

Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing	29.47	28.02	34.38	37.92	40.21	42.58	45.33	47.56	50.05	50.41	51.41	52.61	54.58	564.53
Mining	0.11	0.12	0.16	0.18	0.21	0.23	0.26	0.28	0.29	0.28	0.29	0.30	0.30	3.01
Construction	3.13	3.69	4.81	5.78	6.56	7.12	7.66	7.88	8.99	8.61	8.85	8.88	9.05	91.01
TPU	1.47	1.72	2.31	2.65	2.99	3.24	3.49	3.68	3.92	3.84	3.86	3.87	3.88	40.92
FIRE	2.24	2.94	4.05	5.10	6.01	6.67	7.34	7.76	9.20	9.13	9.60	9.95	10.49	90.48
Retail Trade	3.38	4.09	5.71	6.83	7.92	8.81	9.70	10.44	11.54	11.55	11.88	12.18	12.49	116.52
Wholesale Trade	2.75	2.99	3.97	4.66	5.33	5.90	6.49	7.01	7.70	7.80	8.08	8.46	8.97	80.11
Services	8.86	10.28	14.47	17.47	20.14	22.34	24.57	26.44	29.56	29.97	31.44	32.45	34.30	302.29
AFF	1.35	1.34	1.63	1.80	1.92	2.03	2.20	2.32	2.55	2.51	2.52	2.53	2.60	27.30
Total	52.76	55.19	71.49	82.39	91.29	98.92	107.04	113.37	123.80	124.10	127.93	131.23	136.66	1316.17

Note: FIRE = Finance, Insurance, and Real Estate
TPU = Transportation and Public Utilities
AFF = Agriculture, Fishing, and Forestry

Source: Author's calculations using data from REMI.

Appendix J. Output in Billions of 1977 Dollars

Sector	1969	1971	1973	1975	1977	1979	1981	1983	1985
Manufacturing	3.6	3.5	4.2	4.0	4.5	6.3	7.3	8.1	9.8
F.I.R.E.	2.0	2.4	3.2	3.7	4.2	4.9	4.3	4.5	5.5
Services	1.9	2.2	2.6	2.9	3.4	4.2	4.5	5.0	5.9
Retail Trade	1.4	1.5	1.8	1.9	2.2	2.6	2.6	2.9	3.3
T.P.U.	1.0	1.2	1.4	1.4	1.7	2.1	2.0	2.1	2.2
Construction	0.9	0.9	1.1	1.0	1.4	1.6	1.2	1.2	1.7
Wholesale Trade	0.5	0.5	0.6	0.7	0.9	1.0	1.0	1.2	1.5
A.F.F.	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3
Mining	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2

Note: F.I.R.E. = the Finance, Insurance, and Real Estate industry.
T.P.U. = Transportation and Public Utilities.
A.F.F. = Agriculture, Forestry, and Fishing.

Source: REMI.

Appendix K. Labor and Proprietor's Income (billions of nominal dollars)

Sector	1969	1971	1973	1975	1977	1979	1981	1983	1985
Manufacturing	0.69	0.70	0.86	1.02	1.24	1.85	2.45	2.83	3.55
F.I.R.E.	0.19	0.25	0.31	0.32	0.53	0.80	0.78	1.02	1.32
Services	0.65	0.82	1.02	1.26	1.74	2.43	3.19	3.90	5.27
Retail Trade	0.46	0.58	0.66	0.81	1.04	1.36	1.51	1.80	2.15
T.P.U.	0.19	0.25	0.31	0.37	0.47	0.63	0.82	0.98	1.08
Construction	0.27	0.33	0.43	0.47	0.78	1.11	1.15	1.19	1.74
Wholesale Trade	0.13	0.15	0.19	0.24	0.33	0.46	0.57	0.71	0.91
A.F.F.	0.03	0.04	0.06	0.07	0.10	0.14	0.14	0.16	0.17
Mining	0.01	0.01	0.01	0.03	0.04	0.04	0.08	0.06	0.09

Note: F.I.R.E. = Finance, Insurance, and Real Estate.
T.P.U. = Transportation and Public Utilities.
A.F.F. = Agriculture, Fishing, andForestry.

Source: REMI.

Appendix L

Tijuana's Maquiladora Industrial Distribution

By Number of Firms and Employment

Industrial Category	% of Firms	% of Employment
Electrical & Electronic Products	26	45
Wood & Paper Products	20	16
Textiles, Apparel & Leather	14	7
Plastic Products	8	7
Metal & Sheet Products	13	5
Chemical, Rubber, Synthetics & Glass	7	7
Auto Parts & Products	4	2
Other	8	11
Total	100	100

Source: Subdelegacion de Fomento Industrial (SECOFI), Tijuana, B.C., October 1988, as reported by the San Diego Economic Development Corporation.

Appendix M

Employment Size of Maquiladoras

Employment Size	Number of Firms	% Total
0 - 49	278	54
50 - 99	116	22
100 - 499	110	21
500 - 999	11	2
1000+	5	1
Total	520	100

Source: Author's calculations using data and information provided by the San Diego Economic Development Corporation, 1989 and 1990.

Bibliography

Beemiller, Richard M., Zoe O. Ambargis, and Howard L. Friedenberg, 1986. Regional Multipliers: A User's Handbook for the Regional Input-Output Modeling System (RIMSII). Washington, D.C.: U.S. Department of Commerce, Bureau of Economic Analysis.

Clement, Norris C., et al., Maquiladora Resource Guide, Institute for Regional Studies of the Californias, San Diego State University. San Diego, Ca. 1989.

The Economist, "A Survey of Mexico," September 5, 1987.

Fernandez-Kelly, Maria Patricia, 1983. For We Are Sold, I and My People: Women and Industry in Mexico's Frontier. Albany, N.Y.: SUNY Press.

George, Edward, and Robert Tollen, 1985. "The Economic Impact of the Border Industrialization Program." Border Issues and Public Policy Series, No. 20. El Paso: Center for Inter-American and Border Studies, University of Texas at El Paso.

Grunwald, Joseph, and Kenneth Flamm (eds.), 1985. The Global Factory: Foreign Assembly in International Trade, Washington, D.C., Brookings Institute.

Glickman, Norman, 1977. Chapter 2 in Econometric Analysis of Regional Systems: Exploration in Model Building and Policy Analysis. New York, N.Y.: Academic Press, pp. 13-73.

Harrison, B., and Barry Bluestone, 1988. The Great U-Turn: Corporate Restructuring and the Polarizing of America. Basic Books, Inc., New York.

Houston Area Research Center for Growth Studies, 1989. Woodlands Conference on "U.S.-Mexico Industrial Integration: Today and Tomorrow."

Institute for Regional Studies of the Californias, San Diego State University, The Maquiladora Program in Trinational Perspective: Mexico, Japan, and the United States, Border Issues Series, 2, 1987.

Musgrave, P. (ed.), 1985. Mexico and the United States: Studies in Economic Interaction, Westview Special Studies in International Economics, Westview Press.

Otay Mesa: Its Potential For Industrial Development, A summary of the conference sponsored by the County of San Diego Department of Planning and Land Use and the Institute for Regional Studies of the Californias at San Diego State University. Published by the Economic and Demographic Section, Department of Planning and Land Use, County of San Diego, October 24, 1985.

Pleeter, S., 1980. "Methodologies of Economic Impact Analysis: An Overview," in Economic Impact Analysis: Methodologies and Applications, edited by Saul Pleeter. The Hague, The Netherlands: Martinus Nijnoff Publishing, pp. 7-31.

Rodriguez, R., 1987. "Across the Borders of History: Tijuana and San Diego Exchange Futures," Harper's Magazine, March.

Rowe, Patricia, 1982. Detailed Statistics on the Urban and Rural Population of Mexico, 1950 to 2010. U.S. Bureau of Census, International Demographic Data Center, 1982.

San Diego Economic Development Corporation, 1989. "Maquiladora Industry: The Economic Impact on San Diego's Economy," Working Paper, June.

Sand, P., 1988. "The Use of Impact Tables for Policy Applications of Input-Output Models," in Input-Output Analysis: Current Developments, edited by Maurizio Ciaschini. London: Chapman and Hall, pp. 263-386, 1988.

Sivitanidou, Rena, and Karen Polenske, 1988. "Assessing Regional Economic Impacts with Microcomputers," Journal of the American Planning Association, Winter 1988, Volume 54, No. 1.

Sklair, L., 1986. "Free Zones, Development and the New International Division of Labor," The Journal of Development Studies.

United State international Trade Commission, 1986. Report to Congress on the Impact of Items 807.00 and 806.30 of the United States Trade and Tariff Code.

Weintraub, S., 1988. Mexican Trade Policy and the North American Trade Community, The Center for Strategic and International Studies, Washington, D.C., Vol X, No. 14.