THE ECONOMIC IMPACT OF ENVIRONMENTAL
REGULATION ON THE ECONOMY
OF OKLAHOMA

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CHAPTER I

INTRODUCTION

Need for the Study

The history of conservation and resource
management in the United States began since 1872 when the
Yellowstone National Park was established. Following the
Second World War, the United States also experienced
unprecedented gains in wealth. That economic prosperity was
accompanied by polluted rivers, air, and other environmental
decay. Since the 1960's, such environmental deterioration
has created a general public concern. As a result, a number
of policies and programs have been implemented to tackle
these environmental problems. The most comprehensive, early
anti-pollution legislation in the United States was federal
government based, which included the National Environmental
Policy Act of 1969; the 1970 Clean Air Act and the 1972
Clean Water Act. Since the mid-1970's, many other pieces of

Most macrolevel studies on the impact of pollution control costs on the economy are based on the compliance cost imposed by federal environmental legislation. The major federal environmental legislation in the past three decades is outlined in Table 1.1.

TABLE 1.1

MAJOR FEDERAL ENVIRONMENTAL REGULATION

Media Category	Legislation	Year
Establishment of EPA	National Environmental Policy Act	1969
Air Pollution		
	Clean Air Act (CAA)	1970
	Clean Air Act Amendments (CAA)	1990
	Radon Gas and Indoor Air Quality Research Act	1986
	Radon Pollution Control Act	1988
Water Pollution		
	Clean Water Act (CWA)	1972
	Safe Drinking Water Act	1974
	Soil & Water Resources Conservation Act	1977
Land Pollution		
	Resource Conservation and Recovery Act (RCRA)	1976
	Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund")	1980
	Superfund Amendments and Reauthorization Act (SARA)	1986
	Emergency Planning and Community Right-to-know Act (Title III of SARA) (EPCRA)	1986

Chemical Control
                    Toxic Substances Control Act   1976
                      (TSCA)
                    Federal Insecticide, Fungicide,   1972
                      and Rodenticide Act (FIFRA)

The Impact of Environmental Regulation

    Based on the list above, there is no doubt that

protecting the environment has been a major U.S. priority.

The legislation and regulations have improved the nation's

environment and have set in motion for ongoing programs

that will have significant effects on the nation's

environment, economy and job market into the next century.

These regulations also trigger a chain reaction.

    Some of the effects resulting from these regulations

are obvious and easily categorized. For example, a cleaner

environment is a positive effect, whereas compliance with

regulation can lead to either the creation or loss of jobs.

There are many other effects that result from initial

compliance which are not accounted for or are difficult to

identify or link to those regulations. Statistics have been

released in the U.S. that the business and public sectors

spent billions of dollars to comply with environmental

regulation. Whether the expenditures to comply with these

regulations are too large or small depends on the assessment

of the total impact of the respective regulations. Economic

theory suggests that environmental legislation and

regulations may reduce economic growth. Standard analysis shows a shift in the supply curve to the left as firms comply with regulations. This leads to reduced output at higher prices. On the other hand, there are studies using the location theory found that regions with stricter environmental requirements and conditions are in a better position to attract firms, generate employment, and experience more rapid economic growth (Gordon,1996).

(a)   Pollution Abatement and Control Cost

As a result of the above legislative efforts, industries and institutions were forced to undertake substantial outlays for pollution abatement. The total U.S. expenditure on pollution abatement and control (PAC) increased from $16.586 billion in 1972 to $121.81 billion in 1994 (in current dollars). In 1994 pollution abatements share of PAC was 96.6 percent, compared to Regulation and Monitoring at 1.8 percent, and Research and Development at 1.6 percent. PAC spending in 1994 was about 1.8 percent of the U.S. Gross Domestic product (GDP).[1] According to EPA estimates, PAC expenditures will grow in the future and

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[1] BEA Pollution & Abatement Control Expenditure, 1994. *Survey of Current Business*, September, 1996.

could reach 2.6 percent of GDP in the year 2000 with current regulations.[2]

In 1994, about 65.2 percent ($79.4 billion) of the real pollution abatement spending was incurred by the business sector. 26.6 percent and 8.3 percent of the spending were incurred by the public sector and household sector, respectively. By media type, expenditure on water pollution abatement is the largest at 34.8 percent, followed by solid waste (34.3 percent) and air (30.9 percent).[3]

The federal government spends several billion dollars each year for environmental protection, mainly through the EPA. However, federal spending for pollution control has declined significantly since the late 1970's. The EPA budget was reduced from $8,434 million in 1978 to $4,485 million in 1992.[4] State governments spent around $4 billion in 1992.[5]

One of the most significant criticisms of environmental protection focuses on capital costs imposed on industry. Environmental regulation requires many industries to invest in pollution control equipment, often called "non-productive capital investment" by industry economists.[6] Industry spent

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[2] US EPA *Environmental Investments: The Cost of a Clean Environment* (Washington, DC:1990)

[3] Op. cit.

[4] E.J. Ringquist, *Environmental Protection at the State Level* (New York: M.E. Sharpe, Inc., 1993).

[5] US E.P.A. op.cit.

[6] Ringquist op.cit.

over $24 billion on pollution control capital investment in 1994 (an increase of $4 billion over the preceding year). Critics of environmental protection fear that all of the PAC by industry displaces capital investment.

(b) The Environment Industry

Environmental regulations and standards set the broad framework for demand for environmental goods and services. In response, the environmental industry supplies pollution control, reduction, clean-up, and waste handling equipment and related services, and a growing range of other environmental services. There is a wide disparity in the definitions and classifications used for the environment industry. The environment industry basically consists of producers of end-of-pipe and clean-up equipment, and suppliers of associated environmental services and other services with a clear environmental purpose. To calculate the costs of environmental protection, the United Nations classification of the environmental production and service activities has been used. The environmental protection activities are classified into five categories. They are the external environmental protection (EP) activities; internal EP activities; fixed capital formation for EP; household EP activities; and government EP activities (Nestor and

Pasurka, 1996). Further discussion of these categories is found in Chapter IV.

There are many approaches taken to estimate output and employment in the EP industry. The results are different because different definitions are used in different studies. A summary of the estimates by some of the studies are highlighted in Table 1.2.

TABLE 1.2

OUTPUT AND EMPLOYMENT IN THE ENVIRONMENT PROTECTION
INDUSTRY IN THE U.S. (1990)

Source	Output (direct + indirect)	Employment
OECD	$80 billion	800,000
Environmental Business Journal	$122 billion	1,006,374
EPA	$150 million	n.a.
Management Information System	n.a	4 million (1.9m directly; 2.1m indirectly)
Nestor & Pasurka	$121.6 billion (1991) (value-added)	1.96m (0.74m directly) (1991)

Source: OECD 1996b (p 225-247).

Nestor & Pasurka (OECD, 1996b) compared the direct value-added size of the EP industry against other major industries in the U.S. In 1991, the direct value-added for

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the EP industry was $46.65 billion which was comparable to the size of Aircraft and Parts - SIC 372 ($49.05 billion) and the Primary Metal Industry - SIC 33 ($46.61 billion). This shows that the EP industry is a major industry in the U.S. economy, although it is not categorized under a single SIC code.

Currently, the U.S. Environmental Industry exports about 10 percent of its total output. The U.S. is a net exporter of environmental industry output. The OECD estimates that, in 1992, the United States experienced a positive trade balance in the environmental industry at $1,113 million.[7]

A considerable change in the structure of the environmental industry is taking place with a shift from "end-of-pipe" equipment and clean-up services to integrated and 'clean' environmental technologies. The 1990 Pollution Prevention Act, for example, was enacted to encourage pollution prevention or reduction at the source whenever feasible, thereby reducing the requirement for disposal and release into the environment.

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[7] OECD c 1996. *The Global Environmental Goods and Services Industry*. Paris.OECD.

Impact of Environmental Regulation
on Oklahoma

Federal and state environmental regulation have an impact on Oklahoma's economy. Current environmental laws and regulation are mainly administered by the following state agencies:[8]

1. Department of Environmental Quality

2. Oklahoma Water Resources Board

3. Oklahoma Corporation Commission

4. State Department of Agriculture

5. Oklahoma Department of Mines

6. Oklahoma Conservation Commission

7. Department of Wildlife Conservation

8. Department of Public Safety

9. Department of Labor

10. Department of Civil Emergency Management.

The total cost of compliance with environmental regulation in Oklahoma has been estimated roughly at $1.6 billion.[9] Table 1.3 shows the total Pollution Abatement and Control Expenditure (PACE) for the manufacturing sector in Oklahoma.

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[8] Department of Environmental Quality. 1996. *How to Select an Environmental Consultant*. Oklahoma City. DEQ.

[9] Kent W. Olson, "State Environmental Regulation:Toward a Lower-cost Future in *State Policy and Economic Development in Oklahoma*." A Report to Oklahoma 2000 Inc., Oklahoma City, 1996.

TABLE 1.3

OKLAHOMA: PACE FOR THE MANUFACTURING SECTOR ($ MILLION)

Year	Total Cost	Capital Expenditure	Operating Cost
1988	108.9	20.7	88.2
1989	117.2	34.5	82.7
1990	123.1	38.3	84.8
1991	173.4	63.4	110.0
1992	165.2	42.6	122.6
1993	165.0	41.5	123.5
1994	175.3	34.4	140.9

Source: U.S. Bureau of the Census, Pollution Abatement Costs and Expenditures: 1994.

From Table 1.3, it is noted that the capital expenditure incurred by Oklahoma manufacturers doubled between 1988 and 1993. Total pollution abatement costs for Oklahoma increased by 61% from 1988 ($108.9m) to 1994 ($175.3m). The costs required to comply with environmental regulation are likely to have a negative impact on Oklahoma's Gross State Product and employment if they displace expenditures that would have been more productive.[10] The exact determination of the loss to the

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[10] Olson, Ibid, spectulates that environmental regulations cost Oklahoma 30,000 jobs a year.

state economy will be one of the main purposes of this research.

As stated earlier, however, environmental regulations have promoted the development of a flourishing Environmental Industry. Official estimates for Oklahoma of the size or impact of this industry are not available. However, calculations based on information from the Oklahoma Directory of Manufacturers and Directory of Services indicate that over 60 firms are involved in manufacturing pollution control and abatement products. These firms employ almost 3000 people and earned revenue between $320 million to $700 million in 1995. In addition, there are almost 200 businesses involved in environmental services in Oklahoma. The total number of employees in these businesses is about 7000 and the total sales revenue of these firms ranged between $290 million to $510 million. Based on this preliminary estimation, the environmental protection industry in Oklahoma might be able to offset the losses incurred by the environmental costs. This research will also analyze the impact of this sector on Oklahoma's economy.

Problem Statement

The problem of this study is to determine the net impact of environmental regulation on Oklahoma. The opportunity cost of pollution abatement is the output, or

income, or employment lost because resources are diversed to PACE that are not available for projects that might have larger benefits for the society. At the same time, environmental regulation has also created a new sector, the environmental industry, which contributes output, income, and employment to the economy. The rationale for this study arises from the need to know which of these two impacts of environmental regulation is larger. Most impact assessments todate have been done at the national level. Impact studies on abatement assessment at the regional level are also important. For the most part, the pollution problem is still addressed on a region-by-region basis. The linkages between environmental regulation and state output, income, and jobs could alter the existing evaluation of economic performance in Oklahoma. No studies have been done, however, of these linkages. Therefore, a study of the impact of environmental regulation on the Oklahoma economy appears overdue.

Objective

The objective of this research is to quantify the impact of environmental regulation on Oklahoma. This objective is achieved by using a state-level, static, input-output model to estimate empirically the impact of both PACE and the environmental industry on Oklahoma's output, income

and employment. The use of such a model also provides an estimate of effects disaggregated by industry.

Organization of the Study

A review of the literature is presented in Chapter II. Chapter III provides the theoretical background and develops the proposed methodology. Chapter IV describes the data sources and the processes involved in constructing an input-output model for PACE and the environmental industry in Oklahoma. Chapter V describes the estimated impacts of PACE and the environmental industry on the economy of Oklahoma. Chapter VI presents a comparison of total output, employment, and personal income of PACE and the opportunity cost of PACE. The chapter also presents conclusions and recommendations for future studies.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The modern empirical analysis of the impact of
environmental regulation begins with the publication of
Wassily Leontief's paper in 1970 regarding the macroeconomic
repercussions of air pollution control regulations. Since
then there have been many contributions to the literature.
Each study has its own focus and assumptions and reaches its
own conclusions on the impact of environmental regulations.
Most of the complex models that have been constructed are
national level studies. There have been a few studies done
at the regional level, focusing on gross output as the
measure of aggregate activity. Discussion of this literature
will be divided into two eras. First, the review will focus
on studies or models undertaken in the 1970's and early
1980's. The second part of the discussion will focus on more
recent studies, especially those done in the 1990's.

Earlier Studies the 1970's and 1980's

From the late 1960's into the early 1970's, there was a proliferation of environmental-related regulations and the establishment of related federal agencies. It was not until the middle of the 1970's, however, that economists generally realized the need to measure the effects of environmental regulation on the economy.

One of the earliest models was developed in 1976 by Chase Econometric Associates (1976). They used a macroeconomic model based on an interindustry forecasting system to measure the direct and indirect effects of U.S. environmental control costs on GNP, prices, employment, and the trade balance. The model also estimated industry level effects on prices, output, and employment. The Chase study used data on environmental control costs of fifteen major polluting industries to derive the price, output, and employment effects on 30 industries. The study estimated an - average decrease of national output at 0.3 percent annually from 1974 to 1982.

As pointed out by Ketkar (1980), the main shortcoming of this study is that it did not take into account the environmental costs undertaken by all the industries in the U.S. economy. Similar studies done by Data Resources, Inc. in 1978 found that the economy grew by less than 1 percent per year due to air and water pollution control regulations.

Ketkar (1980) in conducted research that resulted in one of the most comprehensive studies utilizing the input-output framework. He pointed out the major shortcomings of earlier studies in the 1970's. His research showed that most of the earlier studies using input-output methodology failed to include the effects of environmental costs on the requirements of intermediate and primary inputs.[1] Those studies did not make any adjustment to the direct input coefficients matrix for inputs required for air pollution abatement. However, at least two regional studies - by Adam Rose (1977), and Miernyk and Sears (1974) for the states of New York and West Virginia respectively - incorporated some adjustments to the input coefficients.

Ketkar used a static input-output model to quantify the various effects of pollution control costs in the United States. The 1971 input-output table of the United States was used as the main data in this study. The analysis incorporated the increased demand for various inputs, both intermediate and primary, that are needed for pollution abatement. This was done by adjusting the 1971 direct intermediate and primary input coefficients table. The adjustments used detailed data on firm level expenditures on pollution abatement. This study concluded that the pollution abatement expenditure of $15 billion generated a net

[1]The earlier studies refered are Data Resources, Inc. (1979), Hollenbeck (1979), Chase Econometric Associates (1976), Richardson and Mutti (1976), Environmental Protection Agency (1974), and Yezer Philipson (1977).

additional income of $42 billion and created 13,000 jobs. The author also concluded that the burden of the current level of environmental regulation at the time was not excessive.

Ketkar also did a comparison of the effectiveness of the existing control policies (i.e. command-and-control) versus an alternative tax-cum-subsidy policy. Under the tax-cum-subsidy policy, all polluting industries were fully subsidized for their pollution abatement expenditures. The subsidy was to be financed by a general production tax. Overall, the control policy approach was found to be more favorable than the tax-cum-subsidy policy in terms of effects on national income, gross outputs and price effects (Ketkar, 1980).

Using an input-output framework, Carl A. Pasurka, Jr. (1984) researched the magnitude of the impact of environmental protection costs on prices in the U.S. in 1977. With the imposition of environmental costs, the projected total price increase for industries ranged from 0.12 percent to 6.58 percent.

The early studies used the input-output methodology to estimate the impact of environmental regulations, particularly in the assessment of the Clean Air Act and the Clean Water Act. Ketkar's research was the most comprehensive undertaken during this period. Some more recent studies of environmental assessment in the 1990's

have used Ketkar's model as a basis to work on a more complex input-output methodology.

Recent Studies

In the 1990's, most studies regarding an evaluation of environmental policies have been based mainly on the Computable General Equilibrium Models (static and dynamic) or complex input-output models. Overall, the number of studies and research on the impact of environmental regulation has increased more rapidly and used more sophisticated models during this period compared to the earlier period.

In a 1990 econometric simulation, Jorgenson and Wilcoxen estimated the impact of environmental regulation on the U.S. economy. Their study was done by simulating economic growth between 1974 and 1985 with and without such regulations.[2] They concluded that the U.S. economy grew 0.2 percent per year less than it would have in the absence of environmental regulation. As a result, they estimated that the Gross National Product (GNP) was 2.5 percent lower in the early 1990's due to regulation. In another study in 1992, aimed at assessing the impact of the Clean Air Act Amendments of 1990, they estimated that the US GNP in 2005

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[2] Dale W. Jorgenson and Peter Wilcoxen, "Environmental Regulation and U.S. Economic growth," *RAND Journal of Economics* **21**, No. 2 (Summer 1990): 314-40.

would be 3 percent lower.[3] The Jorgenson-Wilcoxen model is a disaggregated dynamic computable General Equilibrium (CGE) Model. However, their studies did not attempt to estimate net job impact and other benefits from environmental regulation. Their model also did not account for environmental industries that developed as a result of environmental regulation.

Hazilla and Kopp utilized a model similar to the JorgensonWilcoxen model to estimate the impact of the Clean Air and Clean Water Acts. Their model simulated the economic impact of these two acts from 1970 to 1990. Their estimate showed an even greater effect on the national economy. Using a 36-sector dynamic model, and using the EPA's estimates of compliance cost, they estimated that the social cost of regulation increased over time, reaching 6 percent of GNP in 1990.[4]

Boyd and Uri studied the impact of the 1990 Clean Air Act Amendments using a static CGE Model with 12 producing sectors and 13 consumer goods. The base case in the model is an economy without the 1990 Amendments. Their finding confirmed that using regulation strategy (command-and-

[3] Roger H. Bezdek, "Environment and Economy: What's the Bottom Line?" *Environment* Vol **35** No. 7 (September 1993): 6-32.

[4] Michael Hazilla and Raymond J. Kopp, "Social Cost of Environmental Quality Regulations: A General Equilibrium Analysis," *Journal of Political Economy* Vol **98(4)** (1990): 853-873.

control), production drops by 0.11 percent while consumer prices increase by 0.11 percent overall. Using a taxation strategy overall production would decline by 0.09 percent. The highlight of Boyd and Uri's results is that the 1990 Amendments imposed a very small cost on the economy, regardless of the method used to reduce emissions.[5]

Stephen Meyer did a comprehensive study of the impact of environmental legislation on the rates of economic performance in various states. His hypothesis was that the pursuit of environmental quality hinders economic growth and job creation. He ranked the 50 U.S. states on the basis of the stringency of their environmental laws and then compared the rankings with measures of economic growth and job creation between 1973 and 1989. The results of the study showed no evidence of a negative relationship between environmental regulation and economic growth. The study concluded that states with the most ambitious environmental programs had the highest level of economic growth and employment (Gordon, 1996). More in-depth studies for each of the wazzu states are required to fully support Meyer's conclusions.

Goetz, Ready, and Stone (1996) did a study on the relationship between economic growth and environmental conditions. They empirically studied the effect of

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[5] R. Boyd and N.D. Uri, "The Cost of Improving the Quality of the Environment," *Journal of Policy Modeling* Vol **13(1)** (1991): 115-140.

environmental conditions and policies on economic growth using published state-level data. A Barro-type economic model was estimated for the period of 1982 to 1991. The results of their study showed that states with better environmental conditions had higher income growth rates. This is another study which used general data that is readily available at the state level for all the states in the U.S. source They did not use detailed data for individual states in this study.

Deborah Vaughn Nestor and Carl A. Pasurka, Jr. (1996) used the input-output framework as a means of defining and measuring the environmental protection (EP) industry and estimating the direct and indirect employment associated with this industry. This study was an application of the United Nations' System for Integrated Environmental and Economic Accounting (SEEA). SEEA is a special satellite account system which is related to their System of National Accounts.

The results of their study showed that EP activities constituted between 0.71 and 0.8 percent of the U.S. GNP in 1977 and 1991 respectively. The size of the EP industry was 1.53% and 2.12% of GNP, respectively, when both direct and indirect value-added were considered. The direct value-added for EP was $46,646.6 million in 1991, whereas direct and indirect value added amounted to $121,625.2 million. The direct employment in EP activities increased from 678,000 in 1977 to 741,000 in 1991. However, direct and indirect

employment for the same period was 1,267,082 and 1,965,818 respectively. This study did not attempt to make conclusions about the net economic impacts of environmental regulation.[6]

Rationale for the Present Study

This research attempts to shed new light on previous work done on the impact of environmental regulation. First, this research aims to measure the impact of environmental regulation at the state level, concentrating specifically on Oklahoma. Basically, it produces an estimate of the change in output, income and employment "with-and-without" environmental regulations. The key to this process is how the effects of environmental regulations are accounted for in the state's economy. The earlier studies did not do impact studies at the state level. Second, this research attempts to use the data on both environmental compliance and the environmental industry in Oklahoma. Third, this research is the first to use the input-output framework to study the net impact of environmental regulation on the Oklahoma economy. Earlier studies on the impact of environmental regulations are one-sided, focusing on pollution abatement costs only. The impact of PACE alone is

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[6] Deborah Vaughn Nestor and Carl A. Pasurka, Jr., The U.S. Environmental Protection Industry: A Proposed Framework for Assessment. In *"The Environment Industry: The Washington Meeting* (Paris: OECD, 1996).

not a good indicator of how regulations affect an economy.

These costs could be offset by the expansion of the

Environmental Protection industry, which grew as a result of

environmental regulation.

CHAPTER III

THEORY AND METHODOLOGY

Introduction

This study estimates the net economic impact of environmental regulation on the Oklahoma economy. This is accomplished through the use of an input-output (I-O) model for the state. The Oklahoma I-O transactions table (Table 3.1) is adjusted to separate environmental protection (EP) activities against non-environmental protection activities. The resulting I-O tables are used to estimate the impact on output, income, and employment in Oklahoma for the given year with and without environmental regulation.

As in previous studies, the problem of defining the EP industry and related activities needs to be resolved before developing a specific I-O model. This chapter discusses the definition of the EP industry classification of sectors, I-O tables and adjustments to include the EP industry, and data sources and data construction techniques.

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Input-Output Analysis

A static input-output (I-O) model is used in this study to quantify the impact of pollution abatement cost and the environmental protection sector. Input-output analysis is concerned with the interdependence among economic sectors. The input-output model is based upon work done initially by Wassily Leontief.[17]

All input-output models consist of three fundamental components: a transactions or flow table, a table of direct or technical coefficients, and a table of interdependence (or direct and indirect coefficients). The transactions table in Table 3.1 shows the flows of goods and services between the various sectors of the economy.

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[17] Wassily W. Leontief, *The Structure of the American Economy, 1919-1929.* (New York: Oxford University Press, Second Edition, 1951).

Table 3.1

Input–Output Transactions Table

To / From	1	2 ...	j	...	n	Y	X
1	X_{11}	X_{12} ...	X_{1j}	...	X_{1n}	Y_1	X_1
2	X_{21}	X_{22} ...	X_{2j}	...	X_{2n}	Y_2	X_2
.	.		.		.	.	.
.	.		.		.	.	.
.	.		.		.	.	.
i	X_{i1}	X_{i2} ...	X_{ij}	...	X_{in}	Y_i	X_i
.	.		.		.	.	.
.	.		.		.	.	.
.	.		.		.	.	.
n	X_{n1}	X_{n2} ...	X_{nj}	...	X_{nn} ...	Y_n	X_n
V	V_1	V_2 ...	V_j	...	V_n		
X	X_1	X_2 ...	X_j	...	X_n		

The transactions table can be divided into three large parts. These are the processing, final payment and final demand sectors:

1. **Processing Sector (X_{ij}):** The upper left hand section of Table 3.1 gives the processing sector, or the intermediate transactions. It is a square matrix in which the rows indicate and services produced for sale to other industries by the industries in the first column and final demand. The

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column entries are purchases made by the industries at the top of the column to produce output. The purchases and sales of goods within the processing sector are called intermediate transactions.

2. Final Payment Sector (V_j): The lower left hand section of Table 3.1 shows the final payment sector (V_j) which accounts for primary inputs purchased by the processing sectors. The entries in this section include payments to households in the form of wages, salaries, rental income, interest income and profits; payments to government; inventory depletion; and depreciation. This study uses the IMPLAN database which has divided Final Payments, or Value-Added, into four components (MIG Inc., 1996). They are:

(i)   Employee Compensation

      All income received by workers from employers.

(ii) Proprietary Income

      Payments or income received by private business
      entities or individuals.

(iii) Other Property Income

      Corporate income plus payments from interest,
      royalties, rents, dividends and profits.

(iv) Indirect Business Taxes

      Excise and sales taxes and other forms of indirect
      taxes paid by individuals to businesses.

3. Final Demand Sector (Y_i): The upper right hand section of Table 3.1 is the final demand sector (Y_i), which consists primarily of household expenditures, net exports, capital

expenditures, and government purchases. Entries in each cell of this sector represent the value of output purchased from the processing sectors. The IMPLAN database (MIG Inc., 1996) used in this study divides the Final Payments Sector into the following categories:

(i) Personal Consumption Expenditure (PCE) - Payments on personal consumption by households and individuals to industries for goods and services received. The PCE is further divided into three household income levels: Low, Medium, and High.

(ii) Federal Government Purchases - These purchases are for two ypes of expenditures: defense and non-defense.

(iii) State and local Government Purchases - The purchases are divided into education and non-education expenditures.

(iv) Capital Formation - Expenditures used to obtain capital goods.

(v) Inventory - These are net purchases when industries overproduce or underproduce output in one year.

(vi) Net Exports - Represent goods and services exported less imports.

Table 3.1 shows the interrelationships that exist in an economy during a given time and expresses them mathematically. The row total for a given sector, X_i, represents the total output for the sector, i.e. the sum of sales to processing sectors X_{ij} and the final demand sectors, Y_i. Y_i is the total final demand for the output of the sector in the ith row and includes personal consumption

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expenditures, gross private domestic investment, net exports, and government purchases. The row total, X_i, is equivalent to total demand (intermediate and final):

$$X_i = \sum_{j=1}^{n} X_{ij} + Y_i \qquad\qquad (1)$$

The column total for a given sector, X_j, represents the total outlay for a sector, that is, the sum of purchases from the processing sectors X_{ij}, and the sum of payments to primary inputs, V_j, or value added. The primary inputs include payments to labor, proprietors' income, other property income, and indirect business tax. The sum of the column entries, X_j, is equivalent to total cost of production:

$$X_j = \sum_{i=1}^{n} X_{ij} + V_j \qquad\qquad (2)$$

Since all the transactions are given in dollar amounts, the row totals are identically equal to the column sums.

$$X_j = \sum_{i=1}^{n} X_{ij} + V_j = \sum_{j=1}^{n} X_{ij} + Y_i = X_i \quad \text{(for i=j),} \qquad (3)$$

where n denotes the number of industries or sectors in the economy. From Equation 3, it follows that

$$\sum_{i=1}^{n} Y_i = \sum_{j=1}^{n} V_j = \text{GSP} \quad (\text{Gross State Product}) \qquad (4)$$

Equation (4) is equivalent to the national income accounting identity: aggregate income equals aggregate expenditure.

The basic analytical tools of input-output analysis are matrices of direct and indirect coefficients. The calculations of these coefficients produce a table of direct and indirect requirements per dollar of final demand. They are obtained by subtracting the matrix of direct coefficients, A, from an identity matrix, I, of the same order to get the Leontief matrix (I-A) and then inverting that matrix. The resulting matrix, $(I-A)^{-1}$, is the table of direct and indirect coefficients.

The equation to calculate direct coefficients, a_{ij}, is

$$a_{ij} = \frac{X_{ij}}{X_j} \quad , \qquad (5)$$

which equals the amount of industry i's output necessary to produce one unit of industry j's output expressed as a proportion of j's output. Direct coefficients are computed for each industry in the processing sector, resulting in a direct coefficients table, denoted by the 'A' matrix.

The I-O problem is that of determining the interindustry transactions or output required to sustain a

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given level of final demand. The solution of the input-output model can be obtained by rewriting equation (1) as

$$X_i = \sum_{j=1}^{n} a_{ij} X_j + Y_i \qquad (6)$$

If X represents a column vector of total output, A represents the direct coefficients matrix, and Y the column vector of final demand, then

$$X \quad = \quad AX + Y$$
$$Y \quad = \quad [I - A]X \qquad (7)$$

Using the identity matrix and matrix algebra, both sides of equation (6) can be multiplied by the inverse (I - A), giving

$$X = (I - A)^{-1} Y. \qquad (8)$$

The transaction (flow) table, direct coefficients table, and direct and indirect coefficients tables are the basic analytical tools of the I-O model. These are used in making impact analyses and estimating changes in productive requirements resulting from changes in final demand.

Economic impacts resulting from changes in the final demand are often measured through multipliers. A multiplier is a number or coefficient that measures the sum of all changes throughout an economy caused by a change in a single sector of that economy. The most common I-O multipliers are

output, income, and employment. These sets of multipliers recognize that the total impact on the economy will differ depending on which sector experiences the change in final demand. The multipliers can be termed as direct and indirect impacts (Type I multiplier), or as direct, indirect and induced impacts (Type II and Type III multipliers).

Direct effects are production changes linked to the immediate effects of changes in final demand. Indirect effects are changes in production of other industries caused by the changes in input needs of the directly-affected industries. Induced effects are the changes in household or consumer spending. Type I Multipliers are calculated by adding direct and indirect effects and dividing them by the direct effect. The Type II multiplier is calculated by summing direct, indirect, and induced effects divided by the direct effect. Type III Multipliers are a modification of the Type II multipliers and are intended to minimize the overestimation that can occur with Type II multipliers. The data of this study is based on IMPLAN data and the results are generated by micro-IMPLAN (MIG Inc., 1996). Micro IMPLAN is used to calculate the Type I and Type II multipliers of this study.

Output Multiplier

Output multipliers are the column totals of the direct and indirect coefficients table. Thus, the output multiplier

for the industry named at the top of the column is the sum
of the direct and indirect requirements from all industries
needed for the delivery of an additional one dollar of
output by the industry to final demand. There are output
multipliers of Type I, Type II and Type III. Output
multiplier Type I measures the sum of the direct and
indirect effects, whereas Type II and Type III measures
direct, indirect and induced effect of a one dollar change
in final demand for the output of that sector. The Type I is
derived by summing the column entries of the direct and
indirect matrix $(I-A)^{-1}$. The Type II multiplier takes into
account effects of consumer spending in addition to the
direct and indirect interindustry effects. Due to the
addition of the induced impact of the household sector, each
Type II multiplier is expected to be greater than the Type I
multiplier. These output multipliers can be used to measure
the interdependence of sectors. The larger the output
multiplier, the higher the dependence of the sector on the
rest of the economy.

Income Multiplier

The income multiplier measures the total change in
income throughout the economy resulting from a one dollar
change in income in a particular industry. Type I and Type
II income multipliers are computed from the direct, indirect
and induced income effects estimated in the I-O model. The
underlying basis of the income multiplier is that a certain

amount of income is generated with each change in output. The direct income effect is the amount of each dollar of output which goes to households in the form of income, as wages and salaries, proprietors' income, rents or profits.

The Type I income multiplier is the ratio of direct and indirect income effects to direct income effects resulting from sectoral changes in final demand. The Type II income multiplier is the ratio of direct, indirect, and induced income effects per unit change in final demand of a given sector.

Employment Multiplier

Employment multipliers measures the effects on employment from the production of one dollar of output for final demand. A Type I employment multiplier measures direct and indirect effects. A Type II employment multiplier goes an additional step in the chain of interdependencies by estimating the direct, indirect, and induced employment effects. The induced effect is the additional reverberations in the economy that are generated by the impacts on household incomes and expenditures.

Pollution Abatement Costs: Input Coefficients Adjustment

In order to include pollution abatement costs in the transactions table, the 'A' matrix of direct intermediate

inputs needs to be adjusted. This part of the model is heavily drawn from the model developed by Kusum Wadhawan Ketkar (1980).

The initial step in this adjustment procedure is to estimate a pollution abatement transactions matrix. This matrix gives the inter-industry flows of output that occur to abate pollution to meet environmental regulations in Oklahoma. Let 'Ap' be the matrix of direct input requirements coefficients of pollution abatement. Therefore, the matrix 'A*', adjusted to reflect intermediate input requirements of pollution abatement, is given by

$$A^* = A + Ap$$

'Ap' is also a square matrix. The addition of Ap to A can be justified for one principal reason. Empirical evidence suggests that over 75 percent of pollution abatement technology is end-of-the process type (OECD, 1992). This means that pollution abatement technology does not normally interfere with the production technology of goods and services. The pollution abatement equipment, in most cases, is added at the end of the production process. This assumption underscores one of the weaknesses of the I-O approach.

Definition of the Environmental Sector

The size of the Environmental Protection (EP) sector and its activities can be measured from three perspectives.

First, the EP industry can be measured by the cost of
compliance with environmental regulations. Second, the EP
industry can be measured by the output of goods and services
for pollution abatement activities. The first definition has
been used by the EPA (EPA, 1990), while the second approach
has been widely used by the World Environmental Directory
and the Environmental Business Journal (Nestor and Pasurka,
1996). The OECD uses a third measure which includes the
output of firms which produce pollution abatement equipment
and expenditures for goods and services for environmental
protection and management (OECD, 1992). In this study the
definition of the EP industry incorporates all three
approaches and excludes environmental technologies which are
incorporated in industrial processes (clean technologies).
In the process of aggregation for the industry
classification in this study, some sectors are divided into
two parts, i.e. "environmental" and "non-environmental"
components. For example, 'Blowers and Fans' sector (IMPLAN
sector 334), provide both "environmental" and "non-
environmental" services. Thus, the EP and non-EP
expenditures are estimated in different cells of the I-O
table.

Sector Classification

In this study, the construction of the I-O table for
Oklahoma is based mainly on the prior classification of the
various costs of compliance with environmental regulations

by Deborah V. Nestor and Carl A. Pasurka, Jr. (1996). Based on the United Nations' Handbook of National Accounting, Nestor and Pasurka proposed that EP activities be classified into five categories[18]:

1) external EP activities,

2) internal EP activities,

3) fixed capital formation for EP,

4) household EP activities, and

5) government EP activities.

The external EP activities refers to firms or businesses in which EP constitutes the main or secondary production activity. The important characteristic of external EP activities is that they are delivered to other establishments or "third parties". Thus, external EP activities are represented as separate rows and columns in the I-O matrix (i.e. row and column, n+1, in Table 3.2). An example of external EP activities is solid waste management services (part of SIC codes 493, 4953, 4959, 4960, 4970).

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[18] Ibid.

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Table 3.2:

**The I-O framework modified to display the
Environmental Protection (EP) Sector in the economy**

To From	1	2 ..... n	(n+1)	Y	X
1	$X_{11}^{NE} + X_{11}^{EP}$	$X_{12}^{NE} + X_{12}^{EP} \cdot \cdot \quad X_{1n}^{NE} + X_{1n}^{EP}$	$X_{1(n+1)}$	$Y_1^{NE} + Y_1^{EP}$	$X_1^{NE} + X_1^{EP}$
2	$X_{21}^{NE} + X_{21}^{EP}$	$X_{22}^{NE} + X_{22}^{EP} \cdots \quad X_{2n}^{NE} + X_{2n}^{EP}$	$X_{2(n+1)}$	$Y_2^{NE} + Y_2^{EP}$	$X_2^{NE} + X_2^{EP}$
.		.	.	.	.
.		.	.	.	.
.		.	.	.	.
n	$X_{n1}^{NE} + X_{b1}^{EP}$	$X_{n2}^{NE} + X_{n2}^{EP} \cdots \quad X_{nn}^{NE} + X_{nn}^{EP}$	$X_{n(n+1)}$	$Y_n^{NE} + Y_n^{EP}$	$X_n^{NE} + X_n^{EP}$
(n+1)	$X_{(n+1)1}$	$X_{(n+1)2} \quad \cdots \cdot \quad X_{(n+1)n}$	$X_{(n+1)\,(n+1)}$	$Y_{(n+1)}$	$X_{(n+1)}$
V	$V_1^{NE} + V_1^{EP}$	$V_2^{NE} + V_2^{EP} \cdot \cdot \quad V_n^{NE} + V_n^{EP}$	$V_{(n+1)}$		
X	$X_1^{NE} + X_1^{EP}$	$X_2^{NE} + X_2^{EP} \cdots \quad X_n^{NE} + X_n^{EP}$	$X_{(n+1)}$		

Source: Nestor, D.V., and Carl A. Pasurka, Jr. 1996.

Internal EP activities, on the other hand, are measured
by inputs purchased for and combined as pollution abatement
activities by a polluting industry and include intermediate
inputs and value-added. These activities are performed
within the polluting industry. Internal EP activities are
not separated from the main activities of an establishment,
and, in the I-O framework, are accounted for by separating
out the portion of total inputs used by polluting industries
for pollution abatement. The adjustment is reflected by the
X_{ij}^{EP} for intermediate inputs used for EP activities and the

X_{ij}^{NE} for intermediate inputs used in non-EP activities, in Table 3.2.

The fixed capital formation for EP represents the investment in EP activities that is part of the gross private domestic investment in the I-O format. For example, the purchase of a scrubber represents an investment in air pollution abatement. The household and government EP activities are also adjusted for EP and non-EP activities. These three adjustments are identified in the final demand sector the addition of the Y_i^{EP} and Y_i^{NE} transactions in Table 3.2.

Following closely Nestor and Pasurka's study (1996), the input-output table for the state of Oklahoma is aggregated into 40 intermediate sectors. For external EP activities, 5 sectors were identified:

1. New sewer system facilities and related maintenance and repair

2. Water supply and water treatment ("environmental")

3. "Environmental" sewerage systems (under 'Other state & local government services')

4. Solid waste management (sanitary services)

5. Selected industrial air pollution control equipment

The five activities stated above are categorized into three major industry groups. The sewer system, water supply, and the sewerage system under government are aggregated as

the "water and effluents treatment" sector. This sector is the largest segment of the EP industry because of significant government expenditures on municipal water and wastewater treatment plants. This sector plays an important role in removing pollutants or reducing pollutants from aqueous streams or lakes or other bodies of water before being discharged or reused.

The waste management sector includes products and services to collect, transport, treat and dispose wastes from homes, municipalities, commercial businesses, and manufacturing plants. The air quality control equipment sector is also a major industry in external environmental protection. The products of this industry are designed to remove pollutants from a gaseous stream or to convert pollutants to less-polluting forms before being discharged into the atmosphere. Among the major products included in this sector are fabric filters, electrostatic precipitators, scrubbers, catalytic reduction, desulfurization, oxidation, carbon absorption and many other auxiliary products.

Environmental Protection Industry: Input Adjustment

Adjustments also need to be made in the input-output framework to include the Environmental Protection industry. The adjustment can be done using the proposed I-O framework

suggested by D.V. Nestor and C.A. Pasurka Jr.[19] The Environmental Protection activities are represented as separate rows and columns in an I-O matrix as in Table 3.2.

The five categories used to classify EP costs and the environmental industry are used to adjust the I-O table. These categories determine the data that enters different cells in the format. Following Nestor and Pasurka, it is assumed that EP-related costs are already included in existing I-O tables (Nestor & Pasurka 1996). Ketkar's assumption was a little different. Since Ketkar used 1970 data, it was assumed that no EP costs were incurred in that year and adjustments for EP costs were added to the base year matrix 'A' for subsequent years.

Conceptually, a separate I-O table can be constructed for the EP industry and EP costs. Table 3.3 below is an I-O framework that displays only the EP industry and EP costs for specific sectors in the state's economy. In this study, I-O sectors 36-40 are specific environmental sectors. These five sectors can also be aggregated as a single sector for all environmental industries and services. In fact, the United Nations initial proposal to calculate the impact of the sector was to aggregate all the environmental sectors into a single row and column entry.

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[19] op.cit.

Table 3.3

The EP Industry and Costs displayed in an I-O framework

To / From	1	2 ..... n	(n+1)	Y	X
1	X_{11}^{EP}	$X_{12}^{EP} \cdots X_{1n}^{EP}$	$X_{1(n+1)}$	Y_1^{EP}	X_1^{EP}
2	X_{21}^{EP}	$X_{22}^{EP} \cdots X_{2n}^{EP}$	$X_{2(n+1)}$	Y_2^{EP}	X_2^{EP}
.	.	. .	.	.	.
.	.	. .	.	.	.
.	.	. .	.	.	.
n	X_{n1}^{EP}	$X_{n2}^{EP} \cdots X_{nn}^{EP}$	$X_{n(n+1)}$	Y_n^{EP}	X_n^{EP}
(n+1)	$X_{(n+1)1}$	$X_{(n+1)2} \cdots X_{(n+1)n}$	$X_{(n+1)(n+1)}$	$Y_{(n+1)}$	$X_{(n+1)}$
V	V_1^{EP}	$V_2^{EP} \cdots V_n^{EP}$	$V_{(n+1)}$		
X	X_1^{EP}	$X_2^{EP} \cdots X_n^{EP}$	$X_{(n+1)}$		

Source: Nestor, D.V., and Carl A. Pasurka, Jr. 1996.

CHAPTER IV

DATA SOURCES AND ADJUSTMENTS OF THE I-O TABLES

Introduction

Detailed information on pollution abatement costs and data on the environmental protection industry in Oklahoma are required to develop the pollution abatement and environmental protection industry transactions tables. The pollution abatement cost and expenditure data for Oklahoma industries can be obtained from various issues of Current Industrial Reports by the Bureau of the Census of the U.S. Department of Commerce. The pollution abatement cost data for the manufacturing sector are given by 2-digit SIC code. The detailed data from secondary sources for the environmental protection industry in Oklahoma can be obtained by estimation based on previous studies at the national level and from data related to local industries. The most important sources of Oklahoma data for this study are the IMPLAN (Impact Analysis for PLANning) database (MIG Inc., 1996) and the U.S. 1987 Input-Output Table (US BEA, 1992). Procedures and estimates used by Nestor and Pasurka (1996), and Ketkar (1980) are used to estimate the elements of Oklahoma's environmental industry

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and the state's pollution abatement and control cost (PACE)

for non-manufacturing sectors. This chapter discusses the

state IMPLAN data on Oklahoma, the derivation of Oklahoma's

aggregated I-O model based on IMPLAN data, and the method used

to adjust the Oklahoma I-O Table into EP and non-EP

activities.

Data Source

The main source of data for the Oklahoma I-O table is

the micro IMPLAN database for 1994 which was released in 1996.

IMPLAN is a nonsurvey-based regional input-output model

developed by the U.S. Forest Service of the U.S. Department of

Agriculture. IMPLAN includes 528 intermediate sectors, 12

final demand sectors, and 6 final payments sectors. Micro

IMPLAN is a microcomputer program that can be used to develop

regional I-O accounts and models. Based on the data available,

a model can be constructed for any region in the United States

using IMPLAN. However, as in the case of this study, IMPLAN

data can be adjusted or substituted to construct a specific I-

O model (Olson & Lindall, 1994). IMPLAN can also be used to

generate regional accounts for Oklahoma. Separate accounts can

be created for counties, and other regions, based on the

respective data applied to national matrices.

The IMPLAN data are based on the assumption of U.S.

production technology and the estimation of regional purchase

coefficients (RPC). RPCs are used to determine the domestic content of goods and services in a state. An RPC represents the locally produced proportion of the amount of goods or services required to meet an industry's intermediate and final demands. RPC also accounts for regional imports and exports of commodities for a particular sector. The IMPLAN software can be used to generate RPC's automatically. This software is also flexible in allowing the researcher to change the RPC based on local or regional information. One important assumption behind IMPLAN's RPC is that the regions will import goods and services at the same rate as the nation on the whole.

Location Quotients (LQ) can also be used to estimate state and regional data. The location quotient technique can be used to check the accuracy of the IMPLAN data at the state level. The LQ is a measure that compares the relative importance of an industry in a region and its relative importance in the nation. It is essentially based on the ratio of local production to national production. The LQ for industry i is calculated as follows:

$$LQ_i = \frac{X_i / X}{Z_i / Z}$$

where X_i is the regional output of industry i, X is the total regional output, Z_i is the national output of industry i and Z is the total output of the nation. All the data for the Xs and Zs should be for the same base year.

Environmental Industry/Sector

The initial step taken using the Micro-IMPLAN software was to aggregate the 528 IMPLAN sectors into the 40 sectors as laid out in Table 4.1. The aggregation was formulated by dividing all the sectors into 'environmental sectors' and 'non-environmental sectors'. Environmental sectors are identified based on respective sector activity. If a sector has all or a majority of its activities involved in producing products or services to protect or keep the environment clean, it is labeled an 'environmental sector'. The following discussion explains the estimation of the industries comprising the environmental sector for Oklahoma.

Table 4.1
Aggregated I-O Sectors for Oklahoma

I-O #	Description
1.	Agriculture, Forestry and Fisheries
2.	General Mining sectors
3.	Coal Mining
4.	Crude Petroleum and Natural Gas
5.	Construction
6.	Food and kindred
7.	Tobacco Products
8.	Textile Mill Products
9.	Apparel and Other textile Products
10.	Lumber and Wood Products
11.	Furniture and Fixtures
12.	Paper and Allied Products
13.	Printing and Publishing
14.	Chemical and Allied Products
15.	Petroleum (refining) and Coal Products
16.	Rubber, Plastics, and Leather
17.	Stone, Clay, and Glass Products
18.	Primary Metals
19.	Fabricated Metal Products
20.	Industrial Machinery and Equipment
21.	Electric and Electronic Equipment
22.	Motor Vehicles and other Transport Equipment
23.	Instruments and Related Products
24.	Misc. the Manufacturing Industries
25.	Transportation
26.	Communication
27.	Electric Utilities
28.	Gas Supply and Distribution
29.	Trade and Eating/Drinking Places
30.	Finance, Insurance and Real Estate
31.	Other services
32.	Government Enterprises
33.	Non-Comparable Imports and Scrap
34.	General Government Industry
35.	Other General Industry
36.	Sewer System Facilities (new, and maintenance and repair)
37.	Industrial Pollution Control Equipment
38.	Water Supply
39.	Solid Waste services
40.	Sewerage System Services (Other State & Local Government)

Note: In Appendix A, the sector aggregation table lists all the I-O sectors above with the IMPLAN Sector Number; RIMS Sector Number; and the respective SIC Codes.

(I) Industrial Pollution Control Equipment
     (I-O Sector 37)

In the IMPLAN database, Industrial Pollution Control
Equipment is found in IMPLAN Sector 334 which is identified as
'Fans and blowers'. Under this category, there are also 'non-
environmental' products produced. In this study, the value or
output of the environmental part of the 'Fans and blowers'
category is calculated and highlighted separately as I-O
Sector 37. The remaining value of IMPLAN Sector 334 ('non-
environmental') is added to I-O Sector 20 Industrial Machinery
and Equipment. In their study, Nestor and Pasurka (1996) used
the value of air pollution control equipment (SIC 35646) as
stated in the Department of Commerce publication, "Selected
Industrial Air Pollution Control Equipment" (MA35J). This
value was used to calculate the 'environmental' portion of the
'Fans and Blowers' category. It was estimated that about
43.14% of the 'Fans and Blowers' sector was 'environmental
industry'. Using this national percentage, the total output of
I-O Sector 37 for Oklahoma in 1994 is $23.95 million. The
remaining 56.86% of $55.52 million from the state's 'Fans and
Blowers' sector were added to I-O Sector 20. As in the
national model, it is assumed that all the $23.95 million was
used for capital expenditure; thus, it is assigned to the row
entry (capital) of I-O Sector 37. In the column vector for
Sector 37, input purchases reflect the same production

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function of the 'Fans and blowers' sector of the IMPLAN database.

(ii) Sewer System Facilities (including repair and maintenance)

Data on sewer system facilities are included in IMPLAN in Sectors 50 and 56. These data were adjusted for inclusion in Sector 36 in this study based on relationships in the national Regional I-O Modeling Systems (RIMS) Sectors 11.0307 and 12.0210. A total of 2.6% of IMPLAN sectors 50 and 56 were calculated as the 'environmental' component of the 'New Sewer System Facilities'. This amounted to $194.42 million for Oklahoma in 1994. The remainder of the values in these two sectors were included in I-O Sector 5, Construction. Sector 36 has the highest number of direct jobs (2899) of all the 'environmental' sectors. The production function for the distribution of the data for the row and column of the I-O Table was based on the existing function underlying sectors 50 and 56 in the IMPLAN database.

(iii) Water Supply

This sector corresponds to part of IMPLAN Sector 445, which is part of 68.0301 (RIMS) and part of SIC Codes 494 and 4952. On the whole this sector consists of water supply and water treatment activities. Using EPA's estimate of percent of expenditures for water treatment, the total output of the 'environmental' part of the water supply sector is estimated as 12.4% of the total value. For Oklahoma, the total output for this environmental sector was estimated as $39.18 million

in 1994. The row and column entries for this sector was based
on the same production function used for sector 445 of IMPLAN.
The remainder of the value and inputs of sector 445 which are
'non-environmental' are included in I-O sector 31, the
'General Services' sector.

(iv) Sewerage System Services

This I-O Sector 40 is part of the IMPLAN Sector 512,
Other State and Local Government Services, and part of 79.0300
of the RIMS model. It is assumed that all the services
provided in this sector are sewage treatment services which
are publicly produced. Based on the national study (Nestor and
Pasurka, 1996), the 'environmental' component of this sector
represents 54.7 percent of the total output of the IMPLAN
sector 512. The rest of the value of this sector goes into I-O
sector 32, 'Government Enterprises'. The total output of the
'environmental' component is $332.68 million. This sector is
the biggest 'environmental' sector in Oklahoma in terms of
total output. In terms of employment, 2,357 direct jobs were
created by this sector in 1994.

(v) Solid Waste Services

The IMPLAN Sector 446 includes solid waste services such
as sanitary services, steam supply and irrigation services. It
is estimated, based on a national study, that 62.39% of this
sector goes to the 'environmental' part which is categorized
as I-O sector 39 in this study. The remaining value of IMPLAN
Sector 446 is included in the I-O Sector 31 'General
services'. The national study estimate of the 'environmental'

component of this sector comes from data published by the
Bureau of Economic Analysis and data reported in Current
Industrial Reports MA-200(94)-1 (U.S. Bureau of Census, 1996).
The cost estimation for this environmental sector includes
expenditures for solid waste management services, operation
and maintenance expenditures in solid waste pollution
abatement, labor, materials and depreciation (Nestor and
Pasurka 1996). The production function in IMPLAN for sector
446 is used to estimate inputs purchased and output sold by
sector 39. In 1994, I-O Sector 39 produced $138.08 million
worth of output and created 843 direct jobs.

Pollution Abatement and Control Expenditure (PACE)

The five environmental sectors , defined above are
categorized as external environmental protection activities.
However, most of the other sectors in the economy also use
inputs to abate pollution. Most of the expenditures related to
pollution abatement comprise labor, depreciation, services,
and materials inputs purchased from other sectors (Nestor and
Pasurka 1996). In this study, the estimation of this internal
environmental protection expenditure for the manufacturing
sector in Oklahoma is obtained from the Current Industrial
Reports MA200(94)-1 (Ibid.). This report provides state data
in terms of capital costs and operating costs for industries

at the 2-digit SIC Code level. It is assumed that the current

data on total output, final demand, final payments (value

added), and intermediate output already include the relevant

Pollution Abatement and Control Expenditures (PACE). For the

manufacturing sector, it is assumed that the production

function of the respective sector in IMPLAN holds. Adjustments

for PACE were made by subtracting the PACE expenditure from

total intermediate output, value added, and final demand for

the affected manufacturing sectors.

Environmental expenditure data for the non-manufacturing

sectors are not available at the state level. This study used

national estimates to estimate Oklahoma's pollution abatement

and control expenditures for all other sectors. The national

'Environmental Protection Expenditures Input-Output Table'

generated by Nestor and Pasurka (1996) was used to estimate

similar data for the non-manufacturing sectors in Oklahoma.

Once the state-level environmental protection

expenditures table is generated, another transaction table for

Oklahoma can be generated, which excludes both environmental

protection expenditures and environmental industry/services

output. All the environmental expenditures are subtracted from

the main transaction table which is assumed to have already

incorporated all environment-related expenditures. This

assumption is the same as the assumption made in Nestor and

Pasurka's (1996) national model. This assumption is different

than Ketkar's (1980) assumption. Ketkar assumed that the

national transaction table of his study did not include the

environmental expenditures. This assumption is valid because his study was based on the 1971 national input-output table. During that period most of the major environmental legislation was newly-passed or was still under consideration.

Employment Data

The data sources and methods used for constructing the estimates of employment in this study are identical to sources and methods used in the national study (Nestor and Pasurka, 1996). Employment in the environmental sectors was based on the percentage of the 'environmental' component of a particular sector. From IMPLAN Sector 445 'Water Supply', 12.4 percent of the employment is put under I-O sector 38. The remaining number of jobs (non-environmental) were added to Sector 31 'General services'. I-O Sector 36 'Sewer System Facilities', employed 2.6 percent of jobs from the IMPLAN Sectors 50 and 57. The Industrial Pollution Control Sector, I-O Sector 37, accounted for 45 percent of total employment from the IMPLAN sector 446 'Fans and Blowers'. The remaining jobs in this sector (non-environmental) were included in I-O sector 20 'Industrial Machinery'. A total of 62.39 percent of jobs in the IMPLAN sector 446 'Sanitary Services' were placed in I-O Sector 39, 'Solid Waste Services'. The remaining jobs from IMPLAN Sector 446 were included in I-O Sector 31 'General Services'. As for Sewerage System Services (I-O Sector 40),

54.7 percent of the number of jobs from IMPLAN Sector 512 were included. The remaining jobs (non-environmental) were added to I-O Sector 32 'Government Enterprises'.

Employment data for internal EP activities were based on the expenditures incurred for pollution abatement and control in the respective sectors. The expenditures are then multiplied by the number of jobs created per million dollar of output in each sector. The total employment for the state was 1,792,152 jobs in 1994. The 'environmental' related jobs were estimated to be 9,497 jobs for the same year.

This Chapter outlined the estimation techniques used to derive the data for all the transactions in the state economy. Protocols and procedures used to estimate the environmental components of the state economy were elaborated. Chapter V explains the findings of the study. Discussions are focused on the size and impact of the environmental related expenditures in the state.

CHAPTER V

IMPACT OF ENVIRONMENTAL EXPENDITURES
AND RELATED MULTIPLIERS

Introduction

Based on the estimation processes discussed in Chapter
IV, aggregated transaction tables are generated for
Oklahoma. This Chapter discusses the results obtained from
the state's Input-Output Table, the transactions table for
Pollution Abatement and Control Expenditures (PACE) and the
PACE and Environmental Sectors transactions table. Using
IMPLAN software, other related tables also were generated.
These include Output, Income and Employment Multipliers,
Final Demand and Final Payments. The empirical results
discussed in this chapter show the impact of the
environmental sectors and environmental protection
expenditures on the Oklahoma economy.

Input-Output Tables

The first task this study addressed was to quantify the expenditures incurred by industries in the state to comply with environmental regulations. Since the objective is to measure the impact of environmental regulation, this study started by constructing the state's input-output table with and without environmental-related expenditures. The difference between the transactions with and without environmental expenditures generated the pollution abatement and control expenditure and the environmental sector transaction table (Table 5.3). Table 5.1 was generated to show transactions between all the sectors in the state in 1994. As done in earlier studies, it is assumed that the inputs in this transaction table already incorporate environmental-related expenditures. Thus, Table 5.1 is Oklahoma's transaction table after compliance with environmental regulations.

TABLE 5.1
OKLAHOMA: TRANSACTIONS TABLE 1994 ($M) *

Sector	1	2	3	4	5	6	7
1 Agriculture, forestry, & fisheries	442.95	0	0	0	6.74	836.15	0
2 Other Mining	0.37	2.61	0	0	11.94	0	0
3 Coal mining	0.00	0	1.5	0	0	0	0
4 Crude Petroleum & Nat. Gas	0	0	0	115.25	0	0	0
5 Construction	0	0	0	1268.88	0	0	0
6 Food & Kindred Products	37.25	0	0	0		193.52	0
7 Tobacco Products	0	0	0	0	0	0	0
8 Textile Mills Products	0.44	0	0	0	1.45	0	0
9 Apparel Other Textile Products	0.	0	0	0	1.71	0.39	0
10 Lumber & Wood Products	0.78	0.16	0.16	0	139.83	0.19	0
11 Furnitures & Fixtures	0.5	0	0	0	8.37	0	0
12 Paper & Allied Products	0.5	0	0	0	0	0.94	0
13 Printing & Publishing	0.26	0	0	0.31	0.39	4.9	0
14 Chemicals & Allied Products	17.66	0.95	0.2	15.77	17.89	11.22	0
15 Refined Petroleum & Coal Products	8.95	1.1	1.62	9.76	83.28	2.8	0
16 Rubber, Plastics, & Leather Products	0.54	0.19	0.21	0.23	6.04	12.32	0
17 Stone, Clay, & Glass Products	0	0	0	0	1.49	0.18	0
18 Primary Metals	0	0	0	0.33	1.93	0	0
19 Fabricated Metal Products	0.08	0	0	0.63	9.4	2.86	0
20 Industrial Machinery	6.06	2.72	5.13	23.41	43.73	4.1	0
21 Electric & Electronic Equipment	1.42	0.34	0.33	3.72	51.5	0	0
22 Motor Vehicle & Oth Transportation	0	0	0	0	0	0	0
23 Instruments & Related Products	0.15	0.04	0.02	0.39	9.72	0.38	0
24 Misc. Manufacturing Industries	0	0	0	0	0.39	0	0
25 Transportation	23.23	1.9	3.13	13.27	75.88	72.7	0
26 Communication	1.4	47 0.11	0	2.99	8.02	3.21	0
27 Electric Utilities	7.48	7.52	3.07	50.28	5.83	29.84	0
28 Gas Utilities	0.76	1.28	0	18.87	1.61	11.9	0
29 Trade, Eating & Drinking Places	59.11	2.89	4.78	25.85	582.81	221.84	0.01
30 Finance, Insurance, & Real Estate	64.65	4.09	4.22	568.97	68.93	25.77	0.01
31 General Services	36.27	4.78	2.48	75.73	443.53	125.84	0.01
32 Government Enterprises	0.55	0.14	0.01	0.08	1.46	2.32	0.01
33 Non-comparable Imports & Scrap	0.89	0	0	8.77	0	15.31	0.01
34 General Government Industry	0	0	0	0	0	0	0
35 Other General Industry	0	0	0	0	0	0	0
36 New Sewer Sys + Repair/Mainten.	1.44	0.22	0.17	0.55	0.37	1.64	0
37 Industrial Air Pollution Control Equip	0	0	0	0	0	0	0
38 Water Supply	0.62	0	0	3.55	0	1.23	0
39 Solid Waste Services	4.31	1.89	0.64	5.15	3.61	9.69	0
40 Sewerage System (St/Loc Gov Serv)	0.14	0	0	0	0.26	0.98	0
Tot Intmd	719.23	32.93	27.67	2212.74	1588.11	1592.22	0.05
Emp com	242.52	55.5	18.52	1108.63	2201.72	466.66	0.05
Prop inc	1091.8	5.33	4.37	228.51	751.09	18.39	0.03
oth prop In	646.73	33.4	10.52	2967.65	1039.07	426.33	0.02
ind bus tax	88.02	11.81	2.44	393.22	23.76	6.97	0.04
Tot VA	2069.07	106.04	35.85	4698.01	4015.64	918.35	0.14
Tot Output	2788.3	138.97	63.52	6910.75	5603.75	2510.57	0.19

Source: Derived from IMPLAN Database.

Sector	8	9	10	11	12	13	14	15	16
1	3.53	2.89	29.96	0	1.57	0	1.54	0	0
2	0	0	0	0	0.78	0	3.25	6.79	0.16
3	0	0	0	0	0.42	0.01	0.16	0	0
4	0	0	0	0	0	0	5.29	1335.25	1.36
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	1.2	0	2.23	0.98	3.3
7	0	0	0	0	0	0	0	0	0
8	5.29	30.8	0.13	2.45	2.27	0.24	0.1	0.66	5.74
9	0.16	29.42	0	0.16	0	0	0	0	0.26
10	0	0	47.06	7.3	14.86	0	0	0.75	2.47
11	0	0	0.43	2.77	0	0	0	0	0
12	0	0	0.01	0	2.17	1.12	0.12	0	0.29
13	0	0	0	0	0.28	19.49	0.74	0.1	0.46
14	7.69	2.65	3.92	1.33	27.61	8.9	94.34	30.48	140.78
15	0.22	0.42	1.37	0.25	4.05	.22	3.94	143.58	3.63
16	0.19	2.25	0.57	1.22	3.93	2.37	4.05	4.45	18.92
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0.33	0	0	0	0	0.23
19	0	0	0.4	0.25	0.19	0.01	0.33	0.52	0.68
20	1.05	0.47	2.26	0.68	7.02	3.62	1.51	1.4	9.11
21	0	0	1.28	0	0.05	0.2	0	0.17	2.75
22	0	0	0	0	0	0	0.27	0	0
23	0	0	0.15	0.2	0.36	4.05	0.42	0.56	0.78
24	0	0.14	0	0	0	0	0	0	0
25	1.16	3.02	9.02	2.47	32.73	17.27	21.19	166.73	53.65
26	0	0.44	0.42	0.26	1.3	1.67	1.5	3.15	2.97
27	1.99	2.83	6.55	1.47	24.41	6.1	16.66	34.26	23.06
28	0.38	0.47	1.85	0.33	8.36	0.66	12.41	23.48	7.71
29	4.35	22.92	24.91	11.31	55.3	33.65	42.78	178.01	96.43
30	0.66	6.63	5.02	3.48	10.44	20.34	9.41	47.21	20.55
31	3.16	13.5	12.72	10.74	24.56	49.95	53.19	60.98	59.05
32	0.11	0.98	0.35	0.34	0.8	6.7	0.68	1.36	1.5
33	0.1	0.32	0	0	2.87	0.59	2.37	2.14	4.64
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	0.15	0.39	0.23	0.77	0.43	0.68	3.23	1.27
37	0	0	0	0	0	0	0	0	0
38	0	0	0.23	0	2.99	0	1.69	1.3	0.35
39	0.37	1.06	1.9	0.61	15.24	1.22	2.44	8.38	7.2
40	0	0	0	0	0.47	0	0.16	0.13	0.21
Tot Intmd	30.41	121.36	150.9	48.18	247	179.81	283.45	2056.05	469.51
Emp com	15.78	130.01	94.45	68.44	161.96	332.22	171.67	298.63	523.87
Prop inc	-0.02	1.3	24.82	6.74	4.19	23.48	7.39	39.92	20.22
oth prop In	5.58	61.55	39.93	25.94	298.19	204.86	120.43	208.41	245.85
ind bus tax	0.29	1.6	3.38	0.57	6.9	3.66	10.35	351.15	22.99
Tot VA	21.63	194.46	162.58	101.69	471.24	564.22	309.84	898.11	812.93
Tot Output	52.04	315.82	313.48	149.87	718.24	744.03	593.29	2954.16	1282.44

Sector	17	18	19	20	21	22	23	24
1	0	0	0	0	0	0	0	0.23
2	16.34	15.96	0.22	0.13	0.26	0	0	0
3	0.87	1.3	0	0	0	0.12	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0.12	0	0	0	0	0	0.12	0.18
7	0	0	0	0	0	0	0	0
8	0.53	0	0	0.7	0	2.04	1.22	0.73
9	0.1	0	1.08	0.21	0.15	28.44	0	0.75
10	2.48	0.85	2.51	2.7	0.53	4.39	0.46	3.02
11	0	0.14	0	0	1.72	25.92	0.11	0
12	0.2	0	0.11	0.13	0	0.04	0	0.16
13	0.21	0.12	0.99	1.01	0.3	0.47	0.22	0.2
14	19.05	11.62	18.18	10.55	10.43	21.32	3.42	4.35
15	3.16	4.58	3.36	5.52	2.28	5.32	0.67	0.65
16	1.03	1.14	4.85	13.52	10.28	27.68	2.41	1.94
17	0.66	0	0	0	0	0.17	0	0
18	0.16	6.9	16.07	11.97	2.19	5.12	0.47	0.58
19	0.23	0.36	4.53	5.83	1.53	9.37	0.52	0.12
20	4.21	18.08	37.38	548.55	13.85	176.8	6.18	2.24
21	1.15	2.57	4.35	140.77	116.81	82.44	41.02	3.87
22	0	0	0	0.38	0	3.85	0	0
23	0.59	0.34	2.74	12.76	4.41	31.44	11.41	0.18
24	0	0	0	0	0.34	0	0.22	0.69
25	58.99	30.61	42.45	54.56	16.95	76.19	5.27	4.66
26	4.56	1.34	4.1	10.21	3.42	7.93	1.57	0.43
27	29.08	37.25	28.47	42.59	16.11	27.31	4.52	2.76
28	20.7	18.55	10.55	9.56	2.83	8.69	0.75	0.54
29	42.21	72.67	136.43	309.15	86.64	271.53	25.71	19.76
30	14.08	8.66	33.51	72.4	30.11	52.85	9.49	5.81
31	40.27	39.99	87	165.82	57.09	162.02	30.37	25.89
32	1.1	0.97	2.14	4.14	1.56	5.4	0.75	0.77
33	1.55	15.08	11.1	7.61	2.03	6.21	1.01	0.92
34	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
36	1.39	2.15	4.04	5.73	1.74	4.03	0.43	0.31
37	0	0	0	0	0	0	0	0
38	0.56	3.16	0.39	0.96	0.39	0.41	0	0
39	4.92	4.71	6.72	7.76	1.94	6.46	1.64	2.49
40	0.1	0.16	0.32	0.31	0.16	0.54	0	0
Tot Intmd	270.6	299.26	463.59	1445.53	386.05	1054.5	149.96	84.23
Emp com	345.79	183.65	709.6	1270.83	343.79	892.55	181.74	85.21
Prop inc	5.77	11.66	21.91	27.63	8.07	14.04	3.62	4.22
oth prop inc	181.03	103.81	269.86	481.38	214.95	320.65	114.4	59.74
ind bus tax	10.05	7.6	14.45	24.66	5.98	56.89	3.3	7.55
Tot VA	542.64	306.72	1015.82	1804.5	572.79	1284.13	303.06	156.72
Tot Output	813.24	605.98	1479.41	3250.03	958.84	2338.63	453.02	240.95

Sector	25	26	27	28	29	30	31
1	0.27	0	0.17	0	31.84	49.36	10.22
2	0	0	0	0	0	0	0
3	0	0	21.59	0	0	0	0
4	1.1	0	0	376.69	0	0	0
5	0	0	0	0	0	258.59	0
6	1.23	0	0	0	153.49	0.43	22.07
7	0	0	0	0	0	0	0
8	0.4	0	0	0	0.48	0.14	0.99
9	2.53	0.57	0	0	2.64	3.08	10.74
10	0.38	0	0	0	8.36	0.2	3.17
11	0	0	0	0	0	0	0.2
12	0.05	0.02	0	0	1.45	0.2	0.62
13	3.78	2.6	0.44	0.11	17.36	19.61	60.66
14	3.23	1.94	2.6	0	2.09	7.06	100.32
15	173.14	1.03	44.13	4.09	37.45	7.78	28.66
16	4.49	1.11	0.22	0	8.49	4.12	.93
17	0	0	0	0	0	0	0.14
18	0.17	0.07	0	0	0	0	0.04
19	0.77	0.23	0	0	0.61	0.18	2.34
20	23.72	8.08	7.89	2.55	15.45	0.93	62.14
21	8.41	44.69	4.05	1.21	4.12	8.45	108.51
22	0.26	0	0	0	0	0	0.38
23	2.26	2.7	1.04	0.34	4.36	11.73	91.98
24	0.17	0.09	0.02	0	0.66	0.53	2.33
25	807.49	8.89	49.16	12.04	145.7	117.17	146.03
26	39.73	303.93	1.44	0.38	94.95	65.42	94.37
27	50.89	6.98	0.31	3.94	204.6	36.06	111.98
28	1.58	0.29	68.93	435.29	39.94	7.92	36.34
29	359.78	21.86	38.45	9.84	490.22	110.39	371.63
30	221.67	94.9	37.09	17.4	772.72	2196.41	893.13
31	373.46	215.96	47.96	21.19	1566.96	1032.72	2328.04
32	5.21	3.46	3.78	2.84	27.39	83.43	74.61
33	40.52	15.06	0	0	14.08	15.03	8.24
34	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0
36	15.14	16.88	22.47	2.7	21.78	31.02	26.57
37	0	0	0	0	0	0	0
38	1.43	0.99	1.45	0.39	14.26	4.5	7.93
39	11.97	35.28	4.64	0.6	10.21	15.93	11.1
40	1.52	0.25	0	0	4.21	1.72	3.59
Tot Intmd	2156.75	787.86	357.83	891.6	3695.87	4090.11	4652
Emp com	1133.48	530.19	350.07	241.87	5686.6	2113.93	7480.49
Prop inc	211.84	52.58	83.08	38.73	768.11	167.02	2161.13
oth prop inc	711.05	483.7	683.33	297.73	1289.44	5769.37	1766.08
ind bus tax	188.67	191.17	108.41	62.26	2046.91	1793.75	231.57
Tot VA	2245.04	1257.64	1224.89	640.59	9791.06	9844.07	11639.27
Tot Output	4401.79	2045.5	1582.72	1532.19	13486.93	13934.18	16291.27

Sector	32	33	34	35	36	37	38	39	40
1	0.2	0	0	0	2.36	0	0	0	0.33
2	0	0	0	0	1.03	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	2.89
6	0.95	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0.15	0	0	0	0	0	0	0	0
9	1.22	0	0	0	0	0.12	0	0	0
10	0	0	0	0	3.85	0	0	1.24	0
11	0	0	0	0	0.11	0		0	0
12	0.28	0	0	0	0	0	0	0	0
13	3.53	0	0	0	0	0	0	0	0
14	0.47	0	0	0	1.45	0	0.44	3.08	3.1
15	10.98	0	0	0	5.39	0	0	2.14	1.49
16	0.73	0	0	0	0.94	0	0.37	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0.19	0	0	0	0
19	0	0	0	0	0.55	0	0.05	0.1	0
20	2.27	0	0	0	4.12	0.9	0	0	3.55
21	5.29	0	0	0	4.11	0.37	0.14	0	0.57
22	0	0	0	0	0	0	0	0	0
23	0.34	0	0	0	0.78	0	0	3.53	0
24	0	0	0	0	0	0	0	0	0
25	99.37	0	0	0	4.67	0.21	0.32	1.61	2.04
26	2.28	0	0	0	0.7	0.43	0.3	0.1	0.76
27	16.66	0	0	0	0.42	0.17	0.19	0.18	21.03
28	2.87	0	0	0	0.46	0	0	7.6	10.13
29	15.88	0	0	0	19.65	1.07	1.12	7.97	3.37
30	21.27	0	0	0	4.94	0.37	3.28	5.05	6.03
31	44.12	0	0	0	9.13	0.48	2.59	4.83	17.69
32	7.11	0	0	0	0	0	0.29	0	0.23
33	5.9	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	3.67	0	0	0	0.02	0	0.98	0.35	11.53
37	0	0	0	0	0	0	0	0	0
38	1.56	0	0	0	0	0	0	0.67	1.46
39	1.31	0	0	0	0.22	0	0.27	21.67	0.11
40	0.3	0	0	0	0	0	0	0	0
Tot Intmd	248.71	0	0	0	65.09	4.12	10.34	60.12	86.31
Emp com	541.87	0	8368.53	107.76	19.81	8.42	7.65	27.25	64.68
Prop inc	0	0	0	0	10.07	0.22	1.77	5.9	0
oth prop inc	7.33	0	0	-138	15.18	3.5	-1.22	-0.84	67.06
ind bus tax	0.13	0	0	0	0.23	0.06	1.76	2.49	0.16
Tot VA	549.33	0	8368.53	-30.24	45.29	12.2	9.96	34.8	131.9
Tot Output	798.04	0	8368.53	-30.24	110.38	16.32	20.3	94.92	218.21

Sector	Tot Intmd	Households	Fed Gov	State & L/G	Capital	Inventory
1	1420.31	363.10	0.28	45.06	0.00	78.49
2	59.84	1.10	0.64	3.50	1.94	4.55
3	25.97	1.43	0.00	0.36	0.00	13.31
4	1834.94	0.00	1.48	0.00	34.01	0.00
5	1530.36	0.00	152.68	1662.08	2180.35	0.00
6	417.07	3141.43	13.28	83.24	4.00	47.31
7	0	276.73	0.00	0.00	0.00	0.00
8	56.95	116.11	0.19	3.38	22.25	3.26
9	84.2	973.93	1.23	27.58	0.00	22.82
10	247.7	28.77	0.25	1.79	36.83	10.42
11	40.27	229.98	2.00	26.36	124.45	7.75
12	8.41	143.39	0.48	38.95	1.20	13.71
13	138.54	352.92	0.00	77.20	0.00	4.92
14	606.09	1033.16	2.95	138.87	4.26	18.95
15	608.01	853.86	353.70	127.42	11.00	125.87
16	173.73	363.76	0.68	31.81	1.71	40.97
17	2.64	69.03	0.01	7.82	1.80	8.88
18	46.75	1.16	14.71	2.43	3.10	71.65
19	42.67	106.73	10.97	16.55	348.55	101.83
20	1051.16	79.43	8.46	77.26	2275.66	206.46
21	644.66	638.12	24.46	30.77	553.18	104.84
22	5.14	1526.20	116.23	35.54	1809.18	83.93
23	200.15	151.76	9.92	110.40	320.57	3.55
24	5.58	418.00	0.00	27.74	49.17	20.50
25	2181.73	997.77	2.24	98.86	64.27	74.86
26	665.79	1092.83	35.33	160.75	79.20	0.00
27	862.85	974.19	0.33	196.72	0.00	0.00
28	773.59	365.22	13.54	26.74	0.00	0.00
29	3782.28	10458.20	456.68	218.44	846.98	237.58
30	5361.55	12071.20	7.13	437.85	226.77	0.00
31	7250.07	14727.00	399.03	579.59	102.85	3872.76
32	242.57	368.26	0.00	42.14	0.00	0.00
33	182.35	702.97	0.00	0.00	0.00	95.28
34	0	0	2842.42	5526.11	0.00	0.00
35	0	0	281.68	0.00	0.00	477.29
36	184.47	0	0.00	77.86	28.80	0.00
37	0	0.00	0.00	0.00	23.95	0.00
38	52.47	28.18	0.28	3.97	0.00	0.00
39	213.66	33.02	1.25	7.84	0.00	0.00
40	15.53	158.13	0.00	3.28	0.00	0.00
Total	31020.05	52847.06	4754.50	9956.24	9156.03	5751.74

Emp com	36586.39
Prop inc	5824.93
oth prop in	19033.99
IBT	5685.2
Tot VA	67130.51
Tot Output	98150.56

Sector	Export	imports	Net Exports	Tot Fin Dd	Tot Output
1 Agriculture, forestry, & fisheries	357.12	-416.51	-59.39	427.54	1847.85
2 Other Mining	6.61	-23.63	-17.02	-5.30	54.54
3 Coal mining	8.95	-23.44	-14.49	0.61	26.58
4 Crude Petroleum & Nat. Gas	26.87	-610.84	-583.97	-548.48	1286.46
5 Construction	0.00	-1622.62	-1622.62	2372.49	3902.85
6 Food & Kindred Products	163.05	-1342.22	-1179.17	2110.09	2527.16
7 Tobacco Products	0.01	-0.10	-0.09	276.64	276.64
8 Textile Mills Products	5.46	-43.88	-38.42	106.77	163.72
9 Apparel & Other Textile Products	45.08	-214.27	-169.19	856.37	940.57
10 Lumber & Wood Products	29.60	-177.71	-148.11	-70.05	177.65
11 Furnitures & Fixtures	26.96	-76.57	-49.61	340.94	381.21
12 Paper & Allied Products	45.98	-476.11	-430.13	-232.41	-224.00
13 Printing & Publishing	15.98	-295.38	-279.40	155.65	294.19
14 Chemicals & Allied Products	153.74	-297.37	-143.63	1054.57	1660.66
15 Refined Petroleum & Coal Products	257.76	-2147.61	-1889.85	-418.00	190.01
16 Rubber, Plastics, & Leather Products	172.82	-570.26	-397.44	41.49	215.22
17 Stone, Clay, & Glass Products	60.62	-351.31	-290.69	-203.15	-200.51
18 Primary Metals	117.59	-461.21	-343.62	-250.57	-203.82
19 Fabricated Metal Products	204.90	-1001.90	-797.00	-212.37	-169.70
20 Industrial Machinery	1359.06	-1443.00	-83.94	2563.32	3614.48
21 Electric & Electronic Equipment	316.00	-483.32	-167.32	1184.04	1828.70
22 Motor Vehicle & Oth Transportation	778.60	-2291.37	-1512.77	2058.31	2063.45
23 Instruments & Related Products	107.69	-170.14	-62.45	533.75	733.90
24 Misc. Manufacturing Industries	49.83	-108.27	-58.44	456.96	462.54
25 Transportation	578.75	-1064.38	-485.63	752.36	2934.09
26 Communication	37.53	-630.27	-592.74	775.37	1441.16
27 Electric Utilities	2.57	-444.83	-442.26	728.98	1591.83
28 Gas Utilities	8.01	-618.70	-610.69	-205.19	568.40
29 Trade, Eating & Drinking Places	402.25	-1998.47	-1596.22	10621.66	14403.94
30 Finance, Insurance, & Real Estate	409.76	-2087.44	-1677.68	11065.26	16426.81
31 General Services	171.19	-62.04	109.15	19790.38	27040.45
32 Government Enterprises	3.82	-310.91	-307.09	103.31	345.88
33 Non-comparable Imports & Scrap	0.00	0.00	0.00	798.25	980.60
34 General Government Industry	0.00	0.00	0.00	8368.53	8368.53
35 Other General Industry	606.87	0.00	606.87	1365.84	1365.84
36 New Sewer Sys + Repair/Maintenance	0	0.00	0.00	106.66	291.13
37 Industrial Air Pollution Control Equipt	0	0.00	0.00	23.95	23.95
38 Water Supply	0.00	0.00	0.00	32.43	84.90
39 Solid Waste Services	0	0.00	0.00	42.11	255.77
40 Sewerage System (St/Loc Gov Serv)	0	0.00	0.00	161.41	176.94
Total	6531.03	-21,866.08	-15335.05	67130.51	98150.56

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*Compiled from IMPLAN data.

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It is observed from Table 5.1 that, when combined, the
environmental sector (I-O sectors 36-40) is sizable in the
state's economy compared to many other sectors. This shows
that the environmental sector is a major industry in
Oklahoma although it is not categorized under a single
'environmental' SIC code. It is assumed that environmental
regulation generated this industry and contributed to the
state's economy. A related question that needs to be
addressed is what the impact to the economy would have been
if these environmental expenditures had been used instead to
purchase capital equipment in other 'productive' sectors.
This relates to one of the most significant criticisms of
environmental protection expenditures, namely, that
environmental protection expenditures are 'non-productive
capital'. This study will address this question in the next
Chapter.

The Environmental Sector and PACE

The environmental sector (I-O Sectors 36-40) produced
$832.69 million worth of output in Oklahoma in 1994. This
amounted to about 0.85 percent of the state's total output.
In terms of Gross State Product, these sectors
(collectively) when compared to other major sectors in the
state, show that the environmental sector is nearly as large

as the Apparel Industry ($936.67 million), and larger than Instruments and Related products ($733.90 million). This sector ranks 16th among the top 20 sectors in aggregated terms of output.

Another important indicator that shows the importance of an industry in the economy is the comparison of relevant multipliers. The state's Output, Employment, and Personal Income Multipliers are attached in Appendix III. The environmental sector (I-O 36 to 40) has a comparatively high multiplier. The total Output Multiplier (Type II)[1] for this sector is 1.75, a value within the range of the major industries in the state. In terms of the Employment Multiplier, this sector ranked among the highest in the state. The average Type II employment multiplier is 4.03. The average Personal Income Type II Multiplier for this sector is 2.07. All the three multipliers for this sector indicate significant potential to increase output, income and employment in this state.

Another important expenditure category created by environmental regulation is Pollution Abatement and Control Expenditures (PACE). These are the expenditures that were incurred by almost all sectors to comply with major environmental regulation. Table 5.2 shows the direct effects of PACE in Oklahoma. Total PACE expenditure in 1994 is

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[1] Definitions and discussions on Type I and Type II Multipliers are in Chapter III.

estimated at $507.4 million, about 0.52 percent of the state's total output. Altogether, the environmental sector and PACE accounted for $1306.11 million in output in 1994 (Table 5.4), or about 1.3 percent of the state's total output. These results are close to the estimates made by Olson for the state (Olson, 1996).

TABLE 5.2

OKLAHOMA: POLLUTION ABATEMENT AND CONTROL EXPENDITURES TRANSACTIONS TABLE 1994 ($M)

Sector	1	2	3	4	5	6	7	8	9	10
1	0.86	0	0	0.03	0.01	0.88	0	0	0	0.03
2	0	0.01	0	0	0.01	0	0	0	0	0
3	0	0.00	0.01	0	0	0.1	0	0	0	0
4	0	0	0	1.34	0	0	0	0	0	0
5	0	0	0	14.72	0	0	0	0	0	0
6	0.09	0	0	0	0	0.3	0	0	0	0
7	0	0	0	0	0	0	0	0.01	0	0
8	0	0	0	0	0	0	0	0	0.06	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0.01	0	0.06	0	0	0	0.1	0
11	0	0	0	0	0.01	0	0	0	0	0
12	0	0	0	0	0	0.01	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0.10	0	0	0.2	0.04	0.04	0	0.02	0	0.01
15	0.02	0	0.02	0.01	0.1	0	0	0	0	0
16	0.01	0	0.01	0.01	0.01	0	0	0	0.1	0
17	0	0	0	0	0.01	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
19	0.08	0	0.00	0	0.02	0	0	0	0	0
20	0.01	0	0.06	0.28	0.05	0	0	0	0	0
21	0	0	0	0.03	0.12	0	0	0	0	0
22	0	0	0	0	0.1	0	0	0	0	0
23	0	0	0.02	0	0	0	0	0	0	0
24	0	0	0	0	0.09	0	0	0	0	0
25	0.07	0	0.03	0.15	0.01	0.13	0	0	0	0.02
26	0	0	0	0.04	0.07	0.01	0	0	0	0
27	0.10	0.07	0.07	1.14	0.01	0.39	0	0.02	0.03	0.08
28	0.01	0	0	0.22	0	0.02	0	0	0	0
29	0.16	0	0.05	0.3	0.09	0.4	0	0	0.01	0.04
30	0.18	0	0.05	6.6	0.53	0.05	0	0	0	0.01
31	0.07	0	0.00	0.88	0.01	0.23	0	0	0.01	0.02
32	0	0	0.01	0.08	0.26	0.01	0	0	0	0
33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0
Tot Intmd	1.76	0.08	0.34	26.03	1.61	2.57	0	0.05	0.31	0.21
Emp com	0.01	0	0.20	22.19	10.31	0.84	0	0.02	0.01	0.18
Prop inc	0	0	0.01	0.55	0.15	0.05	0	0	0	0.22
Oth prop inc	0	0	0.02	12.12	0.21	1.07	0	0.01	0.03	0.34
Ind bus tax	0	0	0	0	0	0	0	0	0	0
Imports	0	0	0	0	0	0	0	0	0	0
Tot VA	0.01	0.00	0.23	34.86	10.67	1.96	0	0.03	0.04	0.74
Tot Output	1.77	0.08	0.57	60.89	12.28	4.53	0.00	0.08	0.35	0.95

Sector	11	12	13	14	15	16	17	18	19	20	21
1	0	0.02	0	0.02	0	0	0	0	0	0	0
2	0	0.01	0	0.04	0.04	0	0.08	0.15	0	0.1	0
3	0	0.01	0.01	0.01	0	0	0	0	0	0	0
4	0	0	0	0.07	10.15	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0.02	0.01	0	0.04	0	0.02	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0.01	0.02	0	0	0.01	0.02	0	0	0	0	0
9	0	0	0.03	0	0	0	0	0	0	0	0
10	0	0.08	0	0	0.01	0.01	0.01	0.01	0	0	0
11	0.01	0	0	0	0	0	0	0	0	0	0.01
12	0	0	0.01	0	0	0	0.01	0	0	0	0
13	0	0.01	0	0.01	0	0	0	0	0	0	0
14	0	0.31	0.02	1.46	0.26	0.82	0.13	0.14	0.06	0.02	0.03
15	0	0.04	0	0.06	1.09	0.02	0.02	0.05	0	0.01	0
16	0	0.03	0	0.65	0.02	0.05	0.01	0.01	0	0.01	0
17	0	0	0	0	0	0	0.01	0	0	0	0
18	0	0	0	0	0	0	0	0.06	0.01	0.01	0
19	0	0.01	0.01	0	0	0	0	0	0	0.01	0.01
20	0	0.07	0	0.02	0.01	0.04	0.03	0.2	0.07	0.75	0.02
21	0.06	0.05	0	0	0	0.01	0	0.02	0.01	0.29	0.17
22	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0.04	0	0	0.01	0	0	0.02	0.13	0.04
24	0	0	0	0.02	0	0	0	0	0	0	0
25	0	0.33	0.02	0.3	1.27	0.27	0.35	0.34	0.09	0.08	0.04
26	0	0.01	0.01	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01
27	0.02	1.49	0.08	0.42	0.64	0.53	0.5	0.81	0.37	0.53	0.22
28	0	0.08	0	0.18	0.18	0.04	0.12	0.2	0.02	0.01	0.01
29	0.02	0.55	0.03	0.61	1.35	0.48	0.26	0.8	0.29	0.44	0.17
30	0.01	0.11	0.02	0.13	0.35	0.1	0.08	0.1	0.07	0.1	0.06
31	0.01	0.25	0.04	0.77	0.47	0.72	0.24	0.44	0.18	0.23	0.11
32	0	0	0	0.01	0.01	0.01	0	0.01	0	0	0
33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0
Tot Intmd	0.16	3.49	0.32	4.85	15.88	3.17	1.88	3.36	1.2	2.73	0.9
Emp com	0.04	1.08	0.08	1.89	23.14	2.46	1.38	0.75	0.78	0.76	0.31
Prop inc	0.02	0.08	0.01	0.09	0.52	0.22	0.08	0.11	0.09	0.06	0.07
Ot prop	0.06	5.67	0.08	1.45	2.71	2.7	2.35	0.93	1.08	1.06	1.81
IBT	0	0	0	0.11	7.81	0	0	0	0	0	0
Imports	0	0	0	0	0	0	0	0	0	0	0
Tot VA	0.12	6.83	0.17	3.54	34.18	5.38	3.81	1.79	1.95	1.88	2.19
Tot Output	0.28	10.32	0.49	8.39	50.06	8.55	5.69	5.15	3.15	4.61	3.09

Sector	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0.01	0.02	0.1	0.08	0.03	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0.1	0	0	0	0	0.73	0	0	0	0	0
4	0	0	0	0	0	0	0.71	0	0	0	0
5	0	0	0	0	0	0	0	0	0.62	0	0
6	0	0	0.01	0	0	0	0	0.56	0	0.07	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0.04	0	0	0	0	0	0	0.01	0	0.04	0
10	0	0	0	0	0	0	0	0.01	0	0	0
11	0.06	0	0	0	0	0	0	0	0.02	0	0
12	0.04	0	0	0.05	0	0	0	0.01	0	0.01	0
13	0	0	0	0.01	0.03	0.02	0	0.06	0.04	0.18	0
14	0.06	0.02	0.01	0.02	0.03	0.1	0.01	0.01	0.03	0.46	0
15	0.01	0.01	0	0.64	0.01	1.7	0	0.15	0.02	0.1	0.03
16	0.01	0	0	0	0.01	0.01	0	0.01	0	0.04	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0.03	0	0.04	0
19	0.02	0	0	0	0.01	0	0	0	0	0.01	0
20	0.29	0.01	0	0.09	0.1	0.3	0	0.06	0	0.22	0.01
21	1.15	0.06	0.01	0.01	0.42	0.14	0	0	0.01	0.01	0
22	0	0	0	0	0	0	0	0	0	0	0
23	0.3	0.1	0	0.01	0	0.03	0	0.03	0.1	0.7	0
24	0	0.01	0	0	0.09	0.02	0	0	0	0	0
25	0.13	0.01	0.01	2.99	0.12	1.89	0.02	0.57	0.28	0.51	0.2
26	0.02	0	0	0.15	3.93	0.05	0	0.37	0.16	0.33	0.01
27	0.35	0.06	0.03	0.75	0.16	0.02	0.05	3.07	0.48	1.63	0.21
28	0.02	0	0	0.01	0	2.65	0.82	0.16	0.02	0.13	0
29	0.45	0.05	0.02	1.33	0.28	1.48	0.02	1.91	0.26	1.29	0.03
30	0.09	0.02	0.01	0.82	1.23	1.42	0.03	3.02	5.27	3.09	0.05
31	0.28	0.06	0.03	1.38	2.8	1.84	0.04	6.11	2.48	8.05	0.09
32	0.01	0	0	0.03	0.05	0.15	0.01	0.11	0.2	0.26	0.01
33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0
Tot Intmd	3.43	0.41	0.13	8.29	9.27	12.56	1.73	16.36	10.07	17.2	0.64
Emp com	1.73	0.29	0.04	0	0.06	31.03	2.18	1.54	1.44	1.5	0
Prop inc	0.07	0	0.01	0	0	10.71	0.11	0.31	0.02	0.43	0
Oth prop	1.55	0.23	0.07	0	0.04	15.88	0.86	0.52	0.69	0.35	0
IBT	0	0	0	0	0	0	0	0	0	0	0
Imports	0	0	0	0	0	0	0	0	0	0	0
Tot VA	3.35	0.52	0.12	0	0.1	57.62	3.15	2.37	2.15	2.28	0
Tot Output	6.78	0.93	0.25	8.29	9.37	70.18	4.88	18.73	12.22	19.48	0.64

Sector	33	34	35	36	37	38	39	40	Tot Intmd
1	0	0	0	0	0	0	0	0	2.09
2	0	0	0	0	0	0	0	0	0.44
3	0	0	0	0	0	0	0	0	0.97
4	0	0	0	0	0	0	0	0	12.27
5	0	0	0	0	0	0	0	0	15.34
6	0	0	0	0	0	0	0	0	1.12
7	0	0	0	0	0	0	0	0	0.01
8	0	0	0	0	0	0	0	0	0.12
9	0	0	0	0	0	0	0	0	0.12
10	0	0	0	0	0	0	0	0	0.30
11	0	0	0	0	0	0	0	0	0.11
12	0	0	0	0	0	0	0	0	0.14
13	0	0	0	0	0	0	0	0	0.36
14	0	0	0	0	0	0	0	0	4.41
15	0	0	0	0	0	0	0	0	4.11
16	0	0	0	0	0	0	0	0	1.00
17	0	0	0	0	0	0	0	0	0.02
18	0	0	0	0	0	0	0	0	0.15
19	0	0	0	0	0	0	0	0	0.18
20	0	0	0	0	0	0	0	0	2.69
21	0	0	0	0	0	0	0	0	2.57
22	0	0	0	0	0	0	0	0	0.10
23	0	0	0	0	0	0	0	0	1.53
24	0	0	0	0	0	0	0	0	0.23
25	0	0	0	0	0	0	0	0	10.23
26	0	0	0	0	0	0	0	0	5.31
27	0	0	0	0	0	0	0	0	14.33
28	0	0	0	0	0	0	0	0	4.90
29	0	0	0	0	0	0	0	0	13.17
30	0	0	0	0	0	0	0	0	23.60
31	0	0	0	0	0	0	0	0	27.84
32	0	0	0	0	0	0	0	0	1.23
33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
Tot Intmd	0	0	0	0	0	0	0	0	150.99
									0.00
Em com	0	0	174.37	0	0	0	0	0	280.61
Prop inc	0	0	0	0	0	0	0	0	13.99
Ot prop	0	0	0	0	0	0	0	0	53.89
IBT	0	0	0	0	0	0	0	0	7.92
Imports	0	0	0	0	0	0	0	0	0.00
Tot VA	0	0	174.37	0	0	0	0	0	356.41
Tot O/p	0.00	0.00	174.37	0	0	0	0	0	507.40

Sector	Households	Fed Gov.	St & L. Gov	Capital	Inventory	Export	Tot Fin Dd	Tot Output
1	0	0	0.41	0	0	0	0.41	2.50
2	0	0	0	0	0	0	0	0.44
3	0	0	0	0	0	0	0	0.97
4	0	0	0	0.33	0	0	0.33	12.60
5	0	0.24	2.65	34.89	0	0	37.78	53.12
6	0	0.06	0.84	4	0	0	4.9	6.02
7	0	0	0	0	0	0	0	0.01
8	0	0	0	1.31	0	0	1.31	1.43
9	0	0.28	0	0	0	0	0.28	0.40
10	0	0	0	0	0	0	0	0.30
11	0	0	0.17	0	0	0	0.17	0.28
12	0	0	0.39	1.2	0	0	1.59	1.73
13	0	0	0.27	0	0	0	0.27	0.63
14	0	0	1.07	4.1	0	0	5.17	9.58
15	12.5	10.16	3.67	11	0	0	37.33	41.44
16	0	0	0.03	0	0	0	0.03	1.03
17	0	0	0.05	1.8	0	0	1.85	1.87
18	0	0	0	3.1	0	0	3.1	3.25
19	0	0.06	0.07	31.02	0	0	31.15	31.33
20	0	0.2	1.89	36.41	0	0	38.5	41.19
21	0	0	0	2.66	0	0	2.66	5.23
22	71.63	4.63	1.42	68.93	0	0	146.61	146.71
23	0	0.07	0.77	3.08	0	0	3.92	5.45
24	0	0	0.23	0	0	0	0.23	0.46
25	0	0	0.86	4.24	0	0	5.1	15.33
26	0	0.12	0.55	0	0	0	0.67	5.98
27	0	0	0.26	0	0	0	0.26	14.59
28	0	0.04	0.08	0	0	0	0.12	5.02
29	0	10.4	4.98	0	0	0	15.38	28.55
30	0	0	0.43	0	0	0	0.43	24.03
31	14.72	0.38	0.29	0	0	0	15.39	43.23
32	0	0	1.47	0	0	0	1.47	2.70
33	0	0	0	0	0	0	0	0.00
34	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0.00
36	0	0	0	0	0	0	0	0.00
37	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0	0.00
39	0	0	0	0	0	0	0	0.00
40	0	0	0	0	0	0	0	0.00
Total output	98.85	26.64	22.85	208.07	0	0	356.41	507.40

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The sectors that incur high PACE expenditures in the state are those sectors which incur high compliance costs to meet environmental standards. In Oklahoma, the Motor vehicle Sector (I-O 22) ranked the highest in terms of PACE expenditures. The top ten industries in terms of PACE expenditures are in Table 5.3.

Table 5.3

OKLAHOMA: INPUTS PURCHASED AS PACE BY SECTORS 1994

Rank	Sector	Total ($mil)	% of Total PACE
1.	Motor Vehicles	146.71	28.9
2.	Construction	53.12	10.5
3.	Petroleum Refining	41.44	8.2
4.	Industrial Machinery	41.19	8.1
5.	Fabricated Metal products	31.33	6.2
6.	Trade, Eating and Drinking Places	28.55	5.6
7.	Finance, Insurance, and Real Estate	24.03	4.7
8.	Transportation	15.33	3.0
9.	Electric Utilities	14.59	2.9
10.	Crude Petroleum and Natural Gas	12.60	2.5
11.	All other sectors	99.11	19.5
	Total PACE	507.40	100.0

TABLE 5.4
OKLAHOMA: PACE AND THE ENVIRONMENTAL SECTOR TRANSACTIONS
TABLE 1994 (M$)

Sector	1	2	3	4	5	6	7	8	9	10
1	0.86	0	0	0.03	0.01	0.88	0	0	0	0.03
2	0	0.01	0	0	0.01	0	0	0	0	0
3	0	0.00	0.01	0	0	0.1	0	0	0	0
4	0	0	0	1.34	0	0	0	0	0	0
5	0	0	0	14.72	0	0	0	0	0	0
6	0.09	0	0	0	0	0.3	0	0	0	0
7	0	0	0	0	0	0	0	0.01	0	0
8	0	0	0	0	0	0	0	0	0.06	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0.01	0	0.06	0	0	0	0.1	0
11	0	0	0	0	0.01	0	0	0	0	0
12	0	0	0	0	0	0.01	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0.10	0	0	0.2	0.04	0.04	0	0.02	0	0.01
15	0.02	0	0.02	0.01	0.1	0	0	0	0	0
16	0.01	0	0.01	0.01	0.01	0	0	0	0.1	0
17	0	0	0	0	0.01	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
19	0.08	0	0.00	0	0.02	0	0	0	0	0
20	0.01	0	0.06	0.28	0.05	0	0	0	0	0
21	0	0	0	0.03	0.12	0	0	0	0	0
22	0	0	0	0	0.1	0	0	0	0	0
23	0	0	0.02	0	0	0	0	0	0	0
24	0	0	0	0	0.09	0	0	0	0	0
25	0.07	0	0.03	0.15	0.01	0.13	0	0	0	0.02
26	0	0	0	0.04	0.07	0.01	0	0	0	0
27	0.10	0.07	0.07	1.14	0.01	0.39	0	0.02	0.03	0.08
28	0.01	0	0	0.22	0	0.02	0	0	0	0
29	0.16	0	0.05	0.3	0.09	0.4	0	0	0.01	0.04
30	0.18	0	0.05	6.6	0.53	0.05	0	0	0	0.01
31	0.07	0	0.00	0.88	0.01	0.23	0	0	0.01	0.02
32	0	0	0.01	0.08	0.26	0.01	0	0	0	0
33	-2.66	-1.32	0	-9.15	0	-11.04	0	-0.04	-0.24	0
34	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0
36	1.44	0.21	0.17	0.55	0.37	1.64	0	0	0.15	0.39
37	0	0	0	0	0	0	0	0	0	0
38	0.62	0	0	3.55	0	1.23	0	0	0	0.23
39	4.31	1.89	0.64	5.15	3.61	9.69	0	0.37	1.06	1.9
40	0.14	0	0	0	0.26	0.98	0	0	0	0
Tot Intmd	5.61	0.86	1.15	26.13	5.85	5.07	0	0.38	1.28	2.73
Emp com	0.01	0	0.20	12.19	0.31	0.84	0	0.02	0.01	0.18
Prop inc	0	0	0.01	0.55	0.15	0.05	0	0	0	0.22
Oth prop inc	0	0	0.02	7.12	0.21	1.07	0	0.01	0.03	0.34
Ind bus tax	0	0	0	0	0	0	0	0	0	0
Tot VA	0.01	0.00	0.23	19.86	0.67	1.96	0	0.03	0.04	0.74
Tot Output	5.62	0.86	1.38	45.99	6.52	7.03	0.00	0.41	1.32	3.47

Sector	11	12	13	14	15	16	17	18	19	20	21
1	0	0.02	0	0.02	0	0	0	0	0	0	0
2	0	0.01	0	0.04	0.04	0	0.08	0.15	0	0.1	0
3	0	0.01	0.01	0.01	0	0	0	0	0	0	0
4	0	0	0	0.07	10.15	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0.02	0.01	0	0.04	0	0.02	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0.01	0.02	0	0	0.01	0.02	0	0	0	0	0
9	0	0	0.03	0	0	0	0	0	0	0	0
10	0	0.08	0	0	0.01	0.01	0.01	0.01	0	0	0
11	0.01	0	0	0	0	0	0	0	0	0	0.01
12	0	0	0.01	0	0	0	0.01	0	0	0	0
13	0	0.01	0	0.01	0	0	0	0	0	0	0
14	0	0.31	0.02	1.46	0.26	0.82	0.13	0.14	0.06	0.02	0.03
15	0	0.04	0	0.06	1.09	0.02	0.02	0.05	0	0.01	0
16	0	0.03	0	0.65	0.02	0.05	0.01	0.01	0	0.01	0
17	0	0	0	0	0	0	0.01	0	0	0	0
18	0	0	0	0	0	0	0	0.06	0.01	0.01	0
19	0	0.01	0.01	0	0	0	0	0	0	0.01	0.01
20	0	0.07	0	0.02	0.01	0.04	0.03	0.2	0.07	0.75	0.02
21	0.06	0.05	0	0	0	0.01	0	0.02	0.01	0.29	0.17
22	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0.04	0	0	0.01	0	0	0.02	0.13	0.04
24	0	0	0	0.02	0	0	0	0	0	0	0
25	0	0.33	0.02	0.3	1.27	0.27	0.35	0.34	0.09	0.08	0.04
26	0	0.01	0.01	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.01
27	0.02	1.49	0.08	0.42	0.64	0.53	0.5	0.81	0.37	0.53	0.22
28	0	0.08	0	0.18	0.18	0.04	0.12	0.2	0.02	0.01	0.01
29	0.02	0.55	0.03	0.61	1.35	0.48	0.26	0.8	0.29	0.44	0.17
30	0.01	0.11	0.02	0.13	0.35	0.1	0.08	0.1	0.07	0.1	0.06
31	0.01	0.25	0.04	0.77	0.47	0.72	0.24	0.44	0.18	0.23	0.11
32	0	0	0	0.01	0.01	0.01	0	0.01	0	0	0
33	0	-2.02	-0.42	-1.66	-1.52	-3.32	-1.1	-10.63	-9.2	-5.49	-1.47
34	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0
36	0.23	0.77	0.43	0.68	3.23	1.27	1.39	2.15	4.04	5.73	1.74
37	0	0	0	0	0	0	0	0	0	0	0
38	0	2.99	0	1.69	1.3	0.35	0.56	3.16	0.39	0.96	0.39
39	0.61	15.24	1.22	2.44	8.38	7.2	4.92	4.71	6.72	7.76	1.94
40	0	0.47	0	0.16	0.13	0.21	0.1	0.16	0.32	0.31	0.16
Tot Intmd	1	20.94	1.55	8.16	27.4	8.88	7.75	2.91	3.47	12	3.66
Emp com	0.04	1.08	0.08	1.89	13.14	2.46	1.38	0.75	0.78	0.76	0.31
Prop inc	0.02	0.08	0.01	0.09	0.52	0.22	0.08	0.11	0.09	0.06	0.07
Oth prop	0.06	5.67	0.08	1.45	2.71	2.7	2.35	0.93	1.08	1.06	1.81
IBT	0	0	0	0.11	2.81	0	0	0	0	0	0
Imports	0	0	0	0	0	0	0	0	0	0	0
Tot VA	0.12	6.83	0.17	3.54	19.18	5.38	3.81	1.79	1.95	1.88	2.19
Tot Output	1.12	27.77	1.72	11.70	46.58	14.26	11.56	4.70	5.42	13.88	5.85

Sector	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0.01	0.02	0.1	0.08	0.03	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0.1	0	0	0	0	0.73	0	0	0	0	0
4	0	0	0	0	0	0	0.71	0	0	0	0
5	0	0	0	0	0	0	0	0	0.62	0	0
6	0	0	0.01	0	0	0	0	0.56	0	0.07	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0.04	0	0	0	0	0	0	0.01	0	0.04	0
10	0	0	0	0	0	0	0	0.01	0	0	0
11	0.06	0	0	0	0	0	0	0	0.02	0	0
12	0.04	0	0	0.05	0	0	0	0.01	0	0.01	0
13	0	0	0	0.01	0.03	0.02	0	0.06	0.04	0.18	0
14	0.06	0.02	0.01	0.02	0.03	0.1	0.01	0.01	0.03	0.46	0
15	0.01	0.01	0	0.64	0.01	1.7	0	0.15	0.02	0.1	0.03
16	0.01	0	0	0	0.01	0.01	0	0.01	0	0.04	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0.03	0	0.04	0
19	0.02	0	0	0	0.01	0	0	0	0	0.01	0
20	0.29	0.01	0	0.09	0.1	0.3	0	0.06	0	0.22	0.01
21	1.15	0.06	0.01	0.01	0.42	0.14	0	0	0.01	0.01	0
22	0	0	0	0	0	0	0	0	0	0	0
23	0.3	0.1	0	0.01	0	0.03	0	0.03	0.1	0.7	0
24	0	0.01	0	0	0.09	0.02	0	0	0	0	0
25	0.13	0.01	0.01	2.99	0.12	1.89	0.02	0.57	0.28	0.51	0.2
26	0.02	0	0	0.15	3.93	0.05	0	0.37	0.16	0.33	0.01
27	0.35	0.06	0.03	0.75	0.16	0.02	0.05	3.07	0.48	1.63	0.21
28	0.02	0	0	0.01	0	2.65	0.82	0.16	0.02	0.13	0
29	0.45	0.05	0.02	1.33	0.28	1.48	0.02	1.91	0.26	1.29	0.03
30	0.09	0.02	0.01	0.82	1.23	1.42	0.03	3.02	5.27	3.09	0.05
31	0.28	0.06	0.03	1.38	2.8	1.84	0.04	6.11	2.48	8.05	0.09
32	0.01	0	0	0.03	0.05	0.15	0.01	0.11	0.2	0.26	0.01
33	-4.48	-0.74	-0.67	-29.09	-10.57	0	-0.17	-10.1	-10.83	-5.93	-4.25
34	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0
36	4.03	0.43	0.31	15.14	16.88	22.47	2.7	21.78	31.02	26.57	3.67
37	0	0	0	0	0	0	0	0	0	0	0
38	0.41	0	0	1.43	0.99	1.45	0.39	14.26	4.5	7.93	1.56
39	6.46	1.64	2.49	11.97	35.28	4.64	0.6	10.21	15.93	11.1	1.31
40	0.54	0	0	1.52	0.25	0	0	4.21	1.72	3.59	0.3
Tot Intmd	10.39	1.74	2.26	9.26	52.1	41.12	5.25	56.72	52.41	60.46	3.23
Emp com	1.73	0.29	0.04	0	0.06	11.03	2.18	1.54	1.44	1.5	0
Prop inc	0.07	0	0.01	0	0	0.71	0.11	0.31	0.02	0.43	0
Oth prop	1.55	0.23	0.07	0	0.04	5.88	0.86	0.52	0.69	0.35	0
IBT	0	0	0	0	0	0	0	0	0	0	0
Imports	0	0	0	0	0	0	0	0	0	0	0
Tot VA	3.35	0.52	0.12	0	0.1	17.62	3.15	2.37	2.15	2.28	0
Tot Output	13.74	2.26	2.38	9.26	52.20	58.74	8.40	59.09	54.56	62.74	3.23

Sector	33	34	35	36	37	38	39	40	Tot Intmd
1	0	0	0	2.36	0	0	0	0.33	4.78
2	0	0	0	1.03	0	0	0	0	1.47
3	0	0	0	0	0	0	0	0	0.97
4	0	0	0	0	0	0	0	0	12.27
5	0	0	0	0	0	0	0	2.89	18.23
6	0	0	0	0	0	0	0	0	1.12
7	0	0	0	0	0	0	0	0	0.01
8	0	0	0	0	0.12	0	0	0	0.24
9	0	0	0	0	0	0	0	0	0.12
10	0	0	0	3.85	0	0	1.24	0	5.39
11	0	0	0	0.11	0	0	0	0	0.22
12	0	0	0	0	0	0	0	0	0.14
13	0	0	0	0	0	0	0	0	0.36
14	0	0	0	1.45	0	0.44	3.08	3.1	12.48
15	0	0	0	5.39	0	0	2.14	1.49	13.13
16	0	0	0	0.94	0	0.37	0	0	2.31
17	0	0	0	0	0	0	0	0	0.02
18	0	0	0	0.19	0	0	0	0	0.34
19	0	0	0	0.55	0	0.05	0.1	0	0.88
20	0	0	0	4.12	0.9	0	0	3.55	11.26
21	0	0	0	4.11	0.37	0.14	0	0.57	7.76
22	0	0	0	0	0	0	0	0	0.10
23	0	0	0	0.78	0	0	3.53	0	5.84
24	0	0	0	0	0	0	0	0	0.23
25	0	0	0	4.67	0.21	0.32	1.61	2.04	19.08
26	0	0	0	0.7	0.43	0.3	0.1	0.76	7.60
27	0	0	0	0.42	0.17	0.19	0.18	21.03	36.32
28	0	0	0	0.46	0	0	7.6	10.13	23.09
29	0	0	0	19.65	1.07	1.12	7.97	3.37	46.35
30	0	0	0	4.94	0.37	3.28	5.05	6.03	43.27
31	0	0	0	9.13	0.48	2.59	4.83	17.69	62.56
32	0	0	0	0	0	0.29	0	0.23	1.75
33	0	0	0	0	0	0	0	0	-138.11
34	0	0	0	0	0	0	0	0	0.00
35	0	0	0	0	0	0	0	0	0.00
36	0	0	0	0.02	0	0.98	0.35	11.53	184.46
37	0	0	0	0	0	0	0	0	0.00
38	0	0	0	0	0	0	0.67	1.46	52.47
39	0	0	0	0.22	0	0.27	21.67	0.11	213.66
40	0	0	0	0	0	0	0	0	15.53
Tot Int	0	0	0	65.09	4.12	10.34	60.12	86.31	667.70
									0.00
Emp com	0	0	302.28	19.81	8.42	7.65	27.25	64.68	486.33
Prop inc	0	0	0	10.07	0.22	1.77	5.9	0	21.95
Oth prop	0	0	0	15.18	3.5	-1.22	-0.84	67.06	122.57
IBT	0	0	0	0.23	0	1.76	2.49	0.16	7.56
Tot VA	0	0	302.28	45.29	12.14	9.96	34.8	131.9	638.41
									0.00
Tot Output	0.00	0.00	302.28	110.38	16.26	20.30	94.92	218.21	1306.11

Sector	Households	Fed Gov.	St & L. Gov	Capital	Inventory	Net Export	Tot Fin Dd	Tot Output
1	0	0	0.41	0	0	0	0.41	5.19
2	0	0	0	0	0	0	0	1.47
3	0	0	0	0	0	0	0	0.97
4	0	0	0	0.33	0	0	0.33	12.60
5	0	0.24	2.65	34.89	0	0	37.78	56.01
6	0	0.06	0.84	4	0	0	4.9	6.02
7	0	0	0	0	0	0	0	0.01
8	0	0	0	1.31	0	0	1.31	1.55
9	0	0.28	0	0	0	0	0.28	0.40
10	0	0	0	0	0	0	0	5.39
11	0	0	0.17	0	0	0	0.17	0.39
12	0	0	0.39	1.2	0	0	1.59	1.73
13	0	0	0.27	0	0	0	0.27	0.63
14	0	0	1.07	4.1	0	0	5.17	17.65
15	12.5	10.16	3.67	11	0	0	37.33	50.46
16	0	0	0.03	0	0	0	0.03	2.34
17	0	0	0.05	1.8	0	0	1.85	1.87
18	0	0	0	3.1	0	0	3.1	3.44
19	0	0.06	0.07	31.02	0	0	31.15	32.03
20	0	0.2	1.89	36.41	0	0	38.5	49.76
21	0	0	0	2.66	0	0	2.66	10.42
22	71.63	4.63	1.42	68.93	0	0	146.61	146.71
23	0	0.07	0.77	3.08	0	0	3.92	9.76
24	0	0	0.23	0	0	0	0.23	0.46
25	0	0	0.86	4.24	0	0	5.1	24.18
26	0	0.12	0.55	0	0	0	0.67	8.27
27	0	0	0.26	0	0	0	0.26	36.58
28	0	0.04	0.08	0	0	0	0.12	23.21
29	0	10.4	4.98	0	0	0	15.38	61.73
30	0	0	0.43	0	0	0	0.43	43.70
31	14.72	0.38	0.29	0	0	0	15.39	77.95
32	0	0	1.47	0	0	0	1.47	3.22
33	0	0	0	0	0	0	0	-138.11
34	0	23.88	46.42	0	0	0	70.3	70.30
35	0	0	0	0	-154.86	0	-154.86	-154.86
36	0	0	77.86	28.8	0	0.00	106.66	291.12
37	0	0	0	23.95	0	0.00	23.95	23.95
38	28.18	0.28	3.97	0	0	0.00	32.43	84.90
39	33.02	1.25	7.84	0	0	0.00	42.11	255.77
40	158.13	0	3.28	0	0	0.00	161.41	176.94
Tot Intmd	318.18	52.05	162.22	260.82	-154.86	0.00	638.41	1306.11

In terms of employment, PACE expenditures 'created' 3,117 direct jobs in the state. This represents only 0.17 percent of the state's total employment in 1994. The environmental sector employed 6,380 workers (0.36 percent) in the state. Appendix VI lists the breakdown of direct employment according to sectors in Oklahoma. However, the number of jobs involving these sectors are much larger when the total employment effects (direct, indirect, and induced) are considered based on the estimate of jobs per million dollar output. The total employment involving PACE is estimated at 6,407 jobs in 1994.

This chapter discussed the results obtained from adjusting the basic transactions table for Oklahoma. The question that needs to be addressed further is whether the expenditures from environmental regulation exert an expansionary or contractionary influence on the economy. The opportunity cost of pollution abatement expenditures (PACE) is the value that could have been produced by the resources diverted to PACE. The next chapter discusses this issue. Conclusions and recommendations for future research are also made in the next chapter.

CHAPTER VI

IMPLICATIONS, SUMMARY AND LIMITATIONS

Introduction

The objective of this research is to quantify the impact of environmental regulation on Oklahoma. In the previous chapter, an input-output framework was used to estimate the impact of the environmental sector and PACE on Oklahoma's output, employment and income. This chapter addresses the question of the opportunity cost of PACE incurred by all the sectors in the state. This is done by calculating the total opportunity cost of PACE in terms of value added. This chapter also provides an estimate of the net effect of PACE on Gross State Product (GSP), and of the impact of PACE on employment and personal income. The chapter also draws some overall conclusions based on all the study's findings and highlights the limitations of this study and recommendations for future research.

Opportunity Cost of PACE

The opportunity cost of PACE is only the total value added foregone. It does not include either employment or income foregone. These are impacts that would have occurred if PACE had been spent differently. PACE data in Table 5.2 and the value added multipliers in from IMPLAN are used to estimate the opportunity cost of PACE. The estimate made here assumes that PACE would have been used to buy capital goods. In this process, this study assumes that when PACE is transferred to investment, damages to the environment as a result are not considered. In reality, the costs to repair environmental damages without PACE may be higher than the total PACE. Table 6.1 lists all the relevant sectors with PACE which are used for this analysis.

Table 6.1

Oklahoma: PACE in all sectors 1994

Sector	PACE ($ million)
1 Agriculture, forestry, & fisheries	2.5
2 Other Mining	0.44
3 Coal mining	0.97
4 Crude Petroleum & Nat. Gas	12.6
5 Construction	53.12
6 Food & Kindred Products	6.02
7 Tobacco Products	0.01
8 Textile Mills Products	1.43
9 Apparel & Other Textile Products	0.4
10 Lumber & Wood Products	0.3
11 Furnitures & Fixtures	0.28
12 Paper & Allied Products	1.73
13 Printing & Publishing	0.63
14 Chemicals & Allied Products	9.58
15 Refined Petroleum & Coal Products	41.44
16 Rubber, Plastics, & Leather Products	1.03
17 Stone, Clay, & Glass	1.87
18 Primary Metals	3.25
19 Fabricated Metal Products	31.33
20 Industrial Machinery	41.19
21 Electric & Electronic Equipment	5.23
22 Motor Vehicle & Transp. Equip.	146.71
23 Instruments & Related Products	5.45
24 Misc. Manufacturing Industries	0.46
25 Transportation	15.33
26 Communication	5.98
27 Electric Utilities	14.59
28 Gas Utilities	5.02
29 Trade, Eating & Drinking Placeswazzu	28.55
30 Finance, Insurance, & Real Estate	24.03
31 General Services	43.23
32 Government Enterprises	2.7
Total	**507.4**

Opportunity Cost of PACE and the Net Effect
on Gross State Product

A comparison of the present value (PV) of benefits with
the present value of costs of environmental regulation is
required to measure the effects on economic welfare. The
measurement of the PV of benefits is beyond the scope of this
study. This study contributes, however, to a better
understanding of costs.

PACE is often referred to as a measure of the cost of
environmental regulation. However, in economics, the
appropriate measure of cost is the opportunity cost of
environmental regulation. The opportunity cost is the value of
the final output that would have been produced if PACE had
been spent differently. It is not possible to know how PACE
would have been spent. This study estimates the opportunity
cost of PACE by simulating a scenario in which PACE would have
been spent for capital goods. This is done by allocating the
amount spent on PACE as expenditures for capital goods in each
sector. This amount is multiplied with the sector's respective
value-added Type II Multipliers to obtain the total
opportunity cost of PACE. This is a good measure of what the
economy gives up. Table 6.2 shows the estimate of the
opportunity cost of PACE, or Gross State Product foregone, in
column 5. It is the product of the numbers in columns 1 and 4.
Table 6.2 also shows the contribution taht PACE makes to the
state GSP in column 3. It is the product of the number in
columns 1 and 2. The net effect of PACE on GSP is the

difference between the totals in columns 5 and 3, or $275.09 million, provided that PACE is interpreted as a source of benefits to the economy. Some economists would argue that PACE is a measure of costs, not benefits.

Table 6.2

Opportunity Cost of PACE

Sector	1 Value added Type II Multiplier.	2 Final DD/ Val-added of PACE ($ million)	3 Total Fin. DD/ Val-added of PACE ($ million)	4 Expenditure not made on capital goods ($ million)	5 Opportunity cost of PACE * ($ million)
1 Agriculture, forestry	1.82	0.41	0.75	2.50	4.55
2 Other Mining	1.79	0.00	0.00	0.44	0.79
3 Coal mining	1.91	0.00	0.00	0.97	1.85
4 Cr. Petroleum & Nat. Gas	1.70	0.33	0.56	12.60	21.42
5 Construction	1.84	37.78	69.52	53.12	97.74
6 Food & Kindred Product	1.82	4.90	8.92	6.02	10.96
7 Tobacco Products	1.61	0.00	0.00	0.01	0.02
8 Textile Mills Products	1.75	1.31	2.29	1.43	2.50
9 Apparel & Oth Textile Pr.	1.68	0.28	0.47	0.40	0.67
10 Lumber & Wood Product	1.82	0.00	0.00	0.30	0.55
11 Furnitures & Fixtures	1.77	0.17	0..30	0.28	0.50
12 Paper & Allied Products	1.54	1.59	2.45	1.73	2.66
13 Printing & Publishing	1.70	0.27	0.46	0.63	1.07
14 Chemicals & Allied Prod	1.81	5.17	9.36	9.58	17.34
15 Refined Petr. & Coal Pr.	1.74	37.33	64.95	41.44	72.11
16 Rubber, Plastics, Leather	1.79	0.03	0.05	1.03	1.84
17 Stone, Clay, & Glass Pr.	1.78	1.85	3.29	1.87	3.33
18 Primary Metals	1.73	3.10	5.36	3.25	5.62
19 Fabricated Metal Product	1.70	31.15	52.96	31.33	53.26
20 Industrial Machinery	1.89	38.50	72.77	41.19	77.85
21 Electric & Electronic Eq.	1.77	2.66	4.71	5.23	9.26
22 Motor Vehicle & Equip.	1.65	146.61	241.91	146.71	242.07
23 Instruments & Related Pr	1.77	3.92	6.94	5.45	9.65
24 Misc. Manufacturing	1.74	0.23	0.40	0.46	0.80
25 Transportation	2.06	5.10	10.51	15.33	31.58
26 Communication	1.87	0.67	1.25	5.98	11.18
27 Electric Utilities	1.75	0.26	0.46	14.59	25.53
28 Gas Utilities	1.86	0.12	0.22	5.02	9.34
29 Trade, Eating & Drink.Pl	2.03	15.38	31.22	28.55	57.96
30 Finance, Insur., Real Est	1.91	0.43	0.82	24.03	45.90
31 General Services	1.63	15.39	25.09	43.23	70.46
32 Government Enterprises	2.21	1.47	3.25	2.70	5.97
Total		**356.41**	**621.24**	**507.40**	**896.33**

* Assuming PACE would have been used to buy capital goods.

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There are two problems with this measure that cannot be connected by input-output analysis alone. First, this is only a one year estimate of effects on GSP, but the impact of capital expenditures is multi-year in nature. The ideal measure is the PV of total state output. So, this one-year measure is probably an underestimate of the net effect on GSP. On the other hand, this measure may be an overestimation, if PACE would have been spent instead for another combination of final and intermediate products. The opportunity cost of PACE exceeds the contribution of PACE to GSP because the opportunity cost calculation assumes that PACE would have been spent entirely for final products.

Effects of PACE on Employment

Jobs are created via PACE and environmental sectors due to environmental regulation. However, without environmental regulation, jobs would have been created through the money spent on capital goods. This study also estimates the total employment impact using the same scenarios discussed earlier, as summarized in Table 6.3.

Table 6.3

Employment Effects Associated with Changes in GSP

Sector	Expend. not made on capital goods ($ million)	PACE Expend. for Final Demand	Total employment per $ million value-added	Total jobs for PACE in final demand	Tot effect on employment (no. of jobs)
1 Agriculture, forestry	2.5	0.41	44.7	18	112
2 Other Mining	0.44	0	22.6	0	10
3 Coal mining	0.97	0	17.8	0	17
4 Cr. Petroleum & Nat. Gas	12.6	0.33	15.5	5	195
5 Construction	53.12	37.78	31.5	1190	1673
6 Food & Kindred Products	6.02	4.9	19.8	97	119
7 Tobacco Products	0.01	0	21.1	0	0
8 Textile Mills Products	1.43	1.31	18.1	24	26
9 Apparel & Oth Textile Prod	0.4	0.28	26.2	7	10
10 Lumber & Wood Products	0.3	0	24.1	0	7
11 Furnitures & Fixtures	0.28	0.17	25.3	4	7
12 Paper & Allied Products	1.73	1.59	11.3	18	20
13 Printing & Publishing	0.63	0.27	24	6	15
14 Chemicals & Allied Prod	9.58	5.17	15.2	79	146
15 Refined Petr. & Coal Prod	41.44	37.33	9.29	347	385
16 Rubber, Plastics, & Leather	1.03	0.03	19	1	20
17 Stone, Clay, & Glass Prod	1.87	1.85	19.6	36	37
18 Primary Metals	3.25	3.1	15.5	48	50
19 Fabricated Metal Products	31.33	31.15	19.2	598	602
20 Industrial Machinery	41.19	38.5	19.7	758	811
21 Electric & Electronic Equip.	5.23	2.66	18.6	49	97
22 Motor Vehicle & Equip.	146.71	146.61	13.5	1979	1981
23 Instruments & Related Prod	5.45	3.92	19.8	78	108
24 Misc. Manufacturing	0.46	0.23	23.5	5	11
25 Transportation	15.33	5.1	25.6	131	392
26 Communication	5.98	0.67	17.4	12	104
27 Electric Utilities	14.59	0.26	14.4	4	210
28 Gas Utilities	5.02	0.12	10.8	1	54
29 Trade, Eating & Drinking Pl	28.55	15.38	39.5	608	1128
30 Finance, Insurance, Real Es	24.03	0.43	37.9	16	911
31 General Services	43.23	15.39	15.8	243	683
32 Government Enterprises	2.7	1.47	29.7	44	80
Total	**507.4**	**356.41**		**6407**	**10022**

Overall, the total employment that would have been created by using all of PACE for capital expenditures is estimated as 10,022 jobs in the state. This can be interpreted as the total number of jobs foregone by not spending the $507.40 million for capital goods. It is 3,615 more jobs compared to the 6407 total jobs created when only part of PACE are for final products. As above, the employment impact is only a one-year estimate of total employment impact. The employment impact of capital expenditures foregone is multi-year in nature because capital goods are long-lived. So, this one-year measure of employment impact is an underestimate of the total employment impact. On the other hand, this may be an overestimation if PACE had been spent on something other than final products such as capital goods.

Impact of PACE on Personal Income

Environmental regulation increases personal income through PACE and the output produced in the environmental sectors. Without environmental regulation, personal income would have increased through money spent on capital goods instead. Table 6.4 shows the summary of this personal income effect for the state of PACE.

Table 6.4

Personal Income (PI) Effect of PACE*

Sector	Expend. not made on capital goods ($ million)	Pace For Final Demand ($ mil)	Personal Income per $ value-added	Total effect on PI of actual PACE ($ million)	Tot effect on PI if PACE spent on capital ($ million)
1 Agriculture, forestry	2.5	0.41	0.7	0.29	1.75
2 Other Mining	0.44	0	0.63	0.00	0.28
3 Coal mining	0.97	0	0.55	0.00	0.53
4 Cr. Petroleum & Nat. Gas	12.6	0.33	0.41	0.14	5.17
5 Construction	53.12	37.78	0.69	26.07	36.65
6 Food & Kindred Products	6.02	4.9	0.41	2.01	2.47
7 Tobacco Products	0.01	0	0.49	0.00	0.00
8 Textile Mills Products	1.43	1.31	0.4	0.52	0.57
9 Apparel & Oth Textile Prod	0.4	0.28	0.46	0.13	0.18
10 Lumber & Wood Products	0.3	0	0.51	0.00	0.15
11 Furnitures & Fixtures	0.28	0.17	0.59	0.10	0.17
12 Paper & Allied Products	1.73	1.59	0.31	0.49	0.54
13 Printing & Publishing	0.63	0.27	0.58	0.16	0.37
14 Chemicals & Allied Prod	9.58	5.17	0.45	2.33	4.31
15 Refined Petr. & Coal Prod	41.44	37.33	0.26	9.71	10.77
16 Rubber, Plastics, & Leather	1.03	0.03	0.55	0.02	0.57
17 Stone, Clay, & Glass Prod	1.87	1.85	0.56	1.04	1.05
18 Primary Metals	3.25	3.1	0.42	1.30	1.37
19 Fabricated Metal Products	31.33	31.15	0.53	16.51	16.60
20 Industrial Machinery	41.19	38.5	0.57	21.95	23.48
21 Electric & Electronic Equip.	5.23	2.66	0.5	1.33	2.62
22 Motor Vehicle & Equip.	146.71	146.61	0.41	60.11	60.15
23 Instruments & Related Prod	5.45	3.92	0.55	2.16	3.00
24 Misc. Manufacturing	0.46	0.23	0.51	0.12	0.23
25 Transportation	15.33	5.1	0.59	3.01	9.04
26 Communication	5.98	0.67	0.51	0.34	3.05
27 Electric Utilities	14.59	0.26	0.46	0.12	6.71
28 Gas Utilities	5.02	0.12	0.35	0.04	1.76
29 Trade, Eating & Drinking PI	28.55	15.38	0.86	13.23	24.55
30 Finance, Insurance, Real Es	24.03	0.43	0.73	0.31	17.54
31 General Services	43.23	15.39	0.34	5.23	14.70
32 Government Enterprises	2.7	1.47	0.87	1.28	2.35
Total	**507.4**	**356.41**		**170.02**	**252.68**

If PACE had been spent on capital goods, there would have been $252.68 million more of total personal income. The Motor Vehicle, Construction, and Trade, Eating, and Drinking Places sectors together contribute about 48 percent of this personal income impact in Oklahoma. As is, only an additional $170.02 million of total personal income is generated by PACE. Thus, the net personal income effect would be a $82.66 million gain for the state if PACE were used for capital goods. As stated for the other effects, the personal income effect is only a one-year estimate of the total impact overtime.

Taking into consideration the output, employment, and income created by PACE in its current uses, this study finds that there would have been higher output, employment, and personal income for Oklahoma if PACE had been used for capital expenditures. This shows that environmental expenditures are more 'productive' when used in capital investment. This result may not hold, however, if the environmental damage factor is brought into the model. Without PACE, more pollution is discharged which in turn will increase other expenditures in the economy to overcome health, environmental, and occupational hazards brought about by increased pollution.

Lessons for Policymakers

This study finds that the opportunity cost of PACE is not large relative to GSP. The total effect of the opportunity cost of PACE on output is 0.91 percent of GSP compared to the total effect of PACE at 0.63 percent of GSP. The net effect of the opportunity cost of PACE on employment is also small. The extra 3,615 jobs created by the opportunity cost of PACE represent only 0.2 percent of the state's total employment in 1994. The $82.66 million net personal income effect of the opportunity cost of PACE represents only 0.12 percent of the state's total personal income. It is quite possible that the net effect on GSP is offset by benefits from environmental regulation that are not included in GSP such as benefits from cleaner air, water, and land.

Conclusion

This study measured the size of the PACE activity and the environmental industry/services in the state of Oklahoma. These expenditures totaled $1306.11 million in 1994, 0.95 percent of the state's Gross State Product (GSP) in 1994. PACE activities alone accounted for 0.53 percent of the state's GSP. This state estimate is less than the national average of 1.8 percent for the same year (Vogan 1996). This study created a hypothetical scenario to measure the opportunity cost of

PACE in the economy. This study found that the effects of PACE on output, employment and personal income would have been higher if PACE had been used to purchase capital goods instead. Table 6.5 summarizes some of the findings of this study.

Table 6.5
Summary of Impacts of Environmental
Regulation in Oklahoma (1994)

Description	Data
1. Total expenditure on environmental regulation (PACE + Environmental sector)	$1,306.11 million
2. Total expenditure on PACE	$507.40 million
3. Opportunity cost of PACE	$896.33 million
4. Total jobs related to PACE	6,407 jobs
5. Total jobs related to the opportunity cost of PACE	10,022 jobs
8. Total personal income from PACE	$134.25 million
9. Total personal income related to the opportunity cost of PACE	$252.68 million

Limitations

The limitations of this study arise from (1) data limitations, and (2) model assumptions. This study used data from the Micro-IMPLAN database which was based on national transactions. Data limitations occurred because a vast amount of data is required and time and funds are the main

constraints to collect primary data. With the availability of
primary data, this model could have been developed in greater
detail for a more comprehensive analysis. Model assumptions
are also a limitation to the study. This input-output model is
based on the assumption that the production functions of all
the sectors are fixed. Another major assumption is that all
the environmental expenditures are already incorporated in the
existing transaction table of the model. The Pollution
Abatement and Control Expenditures in the model also did not
include expenditures for product development to comply with
the existing environmental regulations. The other limitation
of the model is the absence of a cost relationship between
environmental expenditures and the corresponding environmental
regulations. In measuring the net impact, this study did not
consider the cost to repair damages to the environment if PACE
had been transferred to investment.

Additional Research

Further research is needed to overcome the above data
and model limitations. Primary data needs to be used to
estimate PACE activities and transactions of environmental
industry expenditures. Future research can concentrate on each
of these expenditures separately. The production functions for
sectors with pollution abatement expenditures need to be
reconstructed based on local conditions.

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APPENDIXES

SECTOR AGGREGATION FOR INPUT-OUTPUT TABLE

I-O#	Sector	IMPLAN Sector #	BEA I - O SECTOR	SIC
1.	**Agriculture, Forestry & Fisheries**	1 - 27	1.010 - 4.0002	01 - 09
	Mining:			
2.	Other Mining	28 - 36, 40-47	5.000 - 6.000 9.000 - 10.000	10, 14
3.	Coal Mining	37	7.000	12
4.	Crude Petroleum & Natural Gas	38,39	8.000	13 excl. 138
5.	**Construction:**	48 - 57 (excl. pt. 50 and pt. 56)	11.000 - 12.000 ((excl. 11.0307 (New Sewer Sys.), 12.0210 (Mainten. and repair of new sewer facilities))	15 - 17; 138
	Manufacturing:			
6.	Food & kindred products	58 - 103	14.000	20
7.	Tobacco Products	104 - 107	15.000	21
8.	Textile mill products	108 - 123	16.000 - 17.000	22(excl. 225)
9.	Apparel & other textile products	124 - 132	18 - 19	23, 225
10.	Lumber & wood products	133 - 147	20 - 21	24
11.	Furniture & fixtures	148 - 160	22 - 23	25
12.	Paper & allied products	161 - 173	24 - 25	26
13.	Printing & publishing	174 - 185	26	27
14.	Chemical & allied products	186 - 209	27 - 30	28
15.	Petroleum (refining) & Coal products	210 - 214	31	29
16.	Rubber, plastics, & leather products	215 - 229	32 - 34	30 - 31
17.	Stone, clay and glass products	230 - 253	35 - 36	32
18.	Primary Metals	254 - 272	37 - 38	33, 3462 - 3463
19.	Fabricated metal products	273 - 306	39 - 42	34
20.	Industrial Machinery & Equipment (excl. Blowers & Fans - 'environmental')	307 - 354 (excl. pt. 334)	43 - 52 (excl. pt. 49.0300)	35 (excl. pt. 3564)
21.	Electric & electronic equipment	355 - 383	53 - 58	36
22	Motor Vehicle & Equipment	384-399	59-61, 13	371-379, 348
23	Instruments & related products	400 - 414	62 - 63	38
24.	Misc. manufacturing industries	415 - 432	64	39
	Transportation and Utilities:			
25.	Transportation	433 - 440	65	40 - 47
26.	Communication	441 - 442	66 - 67	48
27.	Electric Utilities	443, 511, 514	68.0100; 78.0200; 79.0200	491, pt. 493
28.	Gas utilities	444	68.0200	492, pt. 493

29.	**Trade & eating & drinking places**	447 - 455;	69, 74	50 - 59 (excl. 546), 8042
30.	Finance, Insurance & Real Estate	456 - 463	70, 71	60 - 65 (excl. 6732, 6552)
	Services:			
31.	Other services (excl. pt. of water supply and sewerage system ('environmental') & pt. of sanitary services ('environmental')	pt. 445 - 446, 464 - 509 (excl. envir. pt. 445, 446)	pt. 68.0301; pt.68.0302; 72, 73, 75 - 77	70, 87 pt. 494 - 497
32.	Government Enterprises (non-environmental) (excl. 'environmental' pt. of other state and local government services)	510, 512, 513, 515 (excl. pt. 512)	78.0100; 78.03; 78.0400; 79.01; pt. 79.0300	43
33.	Noncomparable imports and scrap	516 - 518	80, 81	
34.	General government industry	519 - 523	82	
35.	Other general industry (Rest of the world industry; Household industry; Inventory valuation adjustment	524 - 528	83 - 85	
	Environmental Protection Activities and industries			
36.	New Sewer System Facilities, Maintenance & Repair of sewer facilities	pt. 50, pt. 56	11.0307; 12.0210	pt. 16 - 17
37.	Selected industrial air pollution control equipment (include. Blowers & Fans - 'environmental')	pt. 334	pt. 49.0300	pt. 3564
38.	Water supply services ('environmental-related')	pt. 445	pt. 68.0301	pt. 494, pt. 4952
39.	Solid Waste Management (sanitary services - 'environmental')	pt. 446	pt. 68.0302	pt. (493, 4953, 4959, 4960, 4970)
40.	Sewerage systems services (Other state & local government services - 'environmental')	pt. 512	pt. 79.0300	

Oklahoma: Transactions 1994 (without PACE and Envir. Sectors)

Sector		1	2	3	4	5
1	Agriculture, forestry, & fisheries	442.09	0	0	0.03	6.73
2	Other Mining	0.37	2.62	0	0	11.95
3	Coal mining	0	0	108 .49	0	0
4	Crude Petroleum & Nat. Gas	0	0	0	113.91	0
5	Construction	0	0	0	1254.16	0
6	Food & Kindred Products	37.16	0	0	0	0
7	Tobacco Products	0	0	0	0	0
8	Textile Mills Products	0.44	0	0	0	1.45
9	Apparel & Other Textile Products	0.47	0	0	0	1.71
10	Lumber & Wood Products	0.78	0.16	0.15	0	139.89
11	Furnitures & Fixtures	0.5	0	0	0	8.36
12	Paper & Allied Products	0.5	0	0	0	0
13	Printing & Publishing	0.26	0	0	0.31	0.39
14	Chemicals & Allied Products	17.56	0.95	0.2	15.57	17.85
15	Refined Petroleum & Coal Products	8.93	1.1	1.6	9.65	83.18
16	Rubber, Plastics, & Leather Products	0.53	0.19	0.2	0.22	6.05
17	Stone, Clay, & Glass Products	0	0	0	0	1.5
18	Primary Metals	0	0	0	0.33	1.93
19	Fabricated Metal Products	0	0	0.05	0.63	9.42
20	Industrial Machinery (exl 'env' pt. 334)	6.05	272	5.07	23.13	43.68
21	Electric & Electronic Equipment	1.42	0.34	0.33	3.69	51.62
22	Motor Vehicle & Oth Transportation Equip.	0	0	0	0	0
23	Instruments & Related Products	0.15	0.04	0	0.39	9.82
24	Misc. Manufacturing Industries	0	0	0.62	0	0.17
25	Transportation	23.16	1.9	3.1	13.12	75.79
26	Communication	1.4	0.11	0	2.95	8.01
27	Electric Utilities	7.38	7.44	3	49.14	5.76
28	Gas Utilities	0.75	1.28	0	18.65	1.6
29	Trade, Eating & Drinking Places	58.88	2.88	4.43	25.55	582.01
30	Finance, Insurance, & Real Estate	64.47	4.08	4.17	562.13	68.84
31	General Services	36.2	4.77	2.48	74.85	443
32	Government Enterprises	0.46	0.14	0	0	1.45
33	Non-comparable Imports & Scrap	-3.55	-1.31	0	18.2	-2.19
34	General Government Industry	0	0	0	0	0
35	Other General Industry	0	0	0	0	0
36	New Sewer Sys + Repair/Maintenance	0	0	0	0	0
37	Industrial Air Pollution Control Equipment	0	0	0	0	0
38	Water Supply	0	0	0	0	0
39	Solid Waste Services	0	0	0	0	0
40	Sewerage System (St/Loc Gov Serv)	0	0	0	0	0
	Tot Intmd	713.62	32.07	26.52	2186.61	1582.26
	Emp Compen.	242.51	55.5	18.32	1,096.44	2,201.41
	Prop Income	1,091.80	5.33	4.36	227.96	750.94
	Oth Prop Inc	646.73	33.4	10.5	2,960.53	1,038.86
	Indir Bus. Tax	88.02	11.81	2.44	393.22	23.76
	Tot Val. Added	2069.06	106.04	35.62	4678.15	4014.97
	Tot Output	2782.68	138.11	62.14	6864.76	5597.23

Sector	6	7	8	9	10	11	12	13	14	15
1	835.27	0	3.53	2.89	29.93	0	1.55	0	1.52	0
2	0	0	0	0	0	0	0.77	0	3.21	6.75
3	0.1	0	0	0	0	0	0.41	0	0.15	0
4	0	0	0	0	0	0	0	0	5.22	1325.1
5	0	0	0	0	0	0	0	0	0	0
6	193.22	0	0	0	0	0.02	1.19	0	2.19	0.98
7	0	0.05	0	0	0	0	0	0	0	0
8	0	0	5.3	30.86	0.13	2.46	2.25	0.24	0.1	0.65
9	0.39	0	0.16	29.42	0	0.16	0	0.03	0	0
10	0.19	0	0	0.1	47.06	7.3	14.74	0	0	0.74
11	0	0	0	0	0.43	2.76	0	0	0	0
12	0.95	0	0	0	0	0	2.17	1.13	0.12	0
13	4.9	0	0	0	0	0	0.27	19.49	0.73	0.1
14	11.18	0	7.67	2.65	3.91	1.33	27.3	8.88	90.88	30.22
15.	2.8	0	0.22	0.42	1.37	0.25	4.01	1.22	3.88	142.49
16	12.32	0	0.19	2.26	0.57	1.22	3.9	2.37	3.4	4.43
17	0.18	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0.33	0	0	0	0
19	2.86	0	0	0	0.4	0.25	0.18	0	0.33	0.52
20	4.1	0	1.05	0.47	2.26	0.68	6.95	3.62	1.49	1.39
21	0	0	0	0	1.28	0.06	0	0.2	0	0.17
22	0	0	0	0	0	0	0	0	0	0
23	0.38	0	0	0.82	0.15	0	0.36	4.03	0.42	0.56
24	0.53	0	0.28	0.14	1.37	0.57	3.82	0	0.02	5.07
25	72.57	0	1.16	3.02	9	2.47	32.4	17.01	19.89	165.46
26	3.2	0	0	0.44	0.42	0.26	1.36	1.66	1.47	3.13
27	29.45	0	1.97	2.8	6.47	1.45	22.92	6.02	16.24	33.62
28	11.79	0	0.38	0.47	1.85	0.33	8.28	0.66	12.2	23.3
29	221.34	0	4.06	22.91	24.57	11.15	55.15	33.62	40.23	176.34
30	25.72	0	0.66	6.32	5.01	3.47	10.33	20.32	9.28	46.86
31	125.61	0	3.16	13.49	12.7	10.73	24.71	49.37	50.75	60.51
32	2.31	0	0.11	0.98	0.35	0.34	0.8	6.7	0.67	1.35
33	26.35	0	0.18	0.56	0	0	4.89	1.01	4.03	3.66
34	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0
Tot Intmd	1587.15	0.05	30.03	120.08	148.17	47.18	226.06	178.26	275.29	2028.65
Emp Compen.	465.82	0.05	15.76	130	94.27	68.4	160.88	332.14	169.78	285.49
Prop Income	18.34	0.03	-0.02	1.3	24.6	6.72	4.11	23.47	7.3	39.41
Oth Prop Inc	425.26	0.02	5.57	61.51	39.59	25.88	292.52	204.78	118.98	205.71
Indir Bus. Tax	6.97	0.04	0.29	1.6	3.38	0.57	6.9	3.66	10.24	348.32
Tot Val. Added	916.39	0.14	21.6	194.41	161.84	101.57	464.41	564.05	306.3	878.93
Tot Output	2503.54	0.19	51.63	314.49	310.01	148.75	690.47	742.31	581.59	2907.58

Sector		16	17	18	19	20	21	22
	1	0	0	0	0	0.07	0	0
	2	0.16	16.26	15.81	0.22	0.14	0.26	0
	3	0	0.87	1.3	0	0	0	0.13
	4	1.36	0	0	0	0	0	0
	5	0	0	0	0	0	0	0
	6	3.28	0.12	0	0	0	0	0
	7	0	0	0	0	0	0	0
	8	5.72	0.53	0	0	0.7	0	2.04
	9	0.26	0.1	0	1.08	0.21	0.15	28.4
	10	2.46	2.47	0.84	2.51	2.7	0.53	4.39
	11	0	0	0.14	0	0	1.71	25.86
	12	0.29	0.21	0	0.11	0.13	0	0
	13	0.46	0.21	0.12	0.99	1.01	0.3	0.47
	14	133.13	18.91	11.48	18.12	10.53	10.4	21.26
	15	3.61	3.14	4.53	3.36	5.51	2.28	5.31
	16	18.87	1.02	1.13	4.85	13.53	10.28	27.69
	17	0	0.67	0	0	0	0	0.17
	18	0.23	0.16	6.84	16.08	11.98	2.19	5.12
	19	0.68	0.23	0.36	4.53	5.84	1.54	9.39
	20	9.07	4.18	17.88	37.91	547.82	13.83	179.22
	21	2.74	1.15	2.55	4.36	145.84	118.34	83.58
	22	0	0	0	0	0	0	3.85
	23	.79	0.59	0.34	2.76	12.89	4.45	31.74
	24	4.05	0	3.01	2.29	0	0	0
	25	53.38	58.1	30.27	42.36	54.48	16.91	76.06
	26	2.95	4.53	1.32	4.09	10.2	3.41	7.91
	27	32.53	28.51	36.24	28.1	42.06	15.89	26.96
	28	7.67	20.58	18.35	10.57	9.55	2.82	8.67
	29	95.75	41.95	71.83	144.35	308.71	86.47	269.68
	30	20.45	14	8.56	33.54	72.39	30.05	52.76
	31	53.78	40.03	39.48	86.86	165.5	56.98	161.5
	32	1.49	1.1	0.96	2.14	4.14	1.56	5.39
	33	7.96	2.65	25.71	1.91	13.1	3.5	10.69
	34	0	0	0	0	0	0	0
	35	0	0	0	0	0	0	0
	36	0	0	0	0	0	0	0
	37	0	0	0	0	0	0	0
	38	0	0	0	0	0	0	0
	39	0	0	0	0	0	0	0
	40	0	0	0	0	0	0	0
Tot Intmd		460.63	262.85	296.35	460.12	1433.53	382.39	1044.11
Emp Compen.		521.41	344.41	182.9	708.82	1,270.07	343.48	890.82
Prop Income		20	5.69	11.55	21.82	27.57	8	13.97
Oth Prop Inc		243.15	178.68	102.88	268.78	480.32	213.14	319.1
Indir Bus. Tax		22.99	10.05	7.6	14.45	24.66	5.98	56.89
Tot Val. Added		807.55	538.83	304.93	1013.87	1802.62	570.6	1280.78
Tot Output		1268.18	801.68	601.28	1473.99	3236.15	952.99	2324.89

Sector	23	24	25	26	27	28	29	30
1	0	0.23	0.27	0	0.16	0.02	31.74	49.28
2	0	0	0	0	0	0	0	0
3	0	0	0	0	20.55	0	0	0
4	0	0	1.1	0	0	375.65	0	0
5	0	0	0	0	0	0	0	257.97
6	0.12	0.17	1.23	0	0	0	152.93	0.43
7	0	0	0	0	0	0	0	0
8	1.22	0.73	0.4	0	0	0	0.48	0.14
9	0	0.75	2.53	0.57	0	0	2.63	3.
10	0.46	3.02	0.38	0	0	0	8.35	0.2
11	0.11	0	0	0	0	0	0	0.02
12	0	0	0	0.02	0	0	1.46	0.2
13	0.22	0.2	3.77	2.57	0.42	0.11	17.3	19.57
14	3.4	4.43	3.21	1.91	2.5	0	2.08	7.03
15	0.66	0.65	175.47	1.02	42.43	4.08	37.3	7.76
16	2.41	1.94	4.49	1.1	0.21	0	8.48	4.12
17	0	0	0	0	0	0	0	0
18	0.47	0.58	0.17	0	0	0	0.03	0
19	0.52	0.12	0.77	0.22	0	0	0.61	0.18
20	6.17	2.74	24.63	7.98	7.59	2.55	15.39	0.93
21	42.08	3.88	8.4	44.27	3.91	1.21	4.12	8.46
22	0	0	0.26	0	0	0	0	0
23	11.77	0.18	2.27	2.7	1.01	0.34	4.39	11.83
24	0.01	0.69	0.17	0	0	0	0.66	0.53
25	5.06	4.65	806.5	8.77	47.27	12.02	145.13	117.89
26	1.57	0.43	39.58	309.54	1.39	0.38	94.58	65.26
27	4.46	2.73	50.14	6.82	0.29	3.84	201.71	35.58
28	0.75	0.54	1.57	0.29	69.11	439.01	39.78	7.9
29	25.66	19.74	359.85	21.58	36.97	9.82	488.66	111.13
30	9.47	5.8	220.85	98.67	35.67	13.37	769.7	2195.14
31	30.31	26.86	372.08	219.16	46.12	21.15	1566.59	1033.13
32	0.75	0.77	5.19	3.41	3.63	2.83	27.28	83.99
33	1.75	1.59	69.61	26.63	0	0.17	24.18	25.86
34	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
Tot Intmd	149.67	81.97	2147.49	735.76	316.71	886.35	3639.15	4037.7
Emp Compen.	181.45	85.17	1,133.48	530.13	339.04	239.69	5,685.06	2,112.49
Prop Income	3.62	4.22	211.84	52.58	82.37	38.62	767.8	167
Oth Prop Inc	114.17	59.67	711.05	483.66	677.45	296.87	1,288.92	5,768.68
Indir Bus. Tax	3.3	7.54	188.67	191.17	108.41	62.26	2,046.91	1,793.75
Tot Val. Added	302.54	156.6	2245.04	1257.54	1207.27	637.44	9788.69	9841.92
Tot Output	452.21	238.57	4392.53	1993.30	1523.98	1523.79	13427.84	13879.62

Sector		31	32	33	34	35	36	37	38	39	40	Tot Intmd
	1	10.19	0.26	0	0	0	0	0	0	0	0	1415.53
	2	0	0	0	0	0	0	0	0	0	0	58.37
	3	0	0	0	0	0	0	0	0	0	0	25.00
	4	0	0	0	0	0	0	0	0	0	0	1822.67
	5	0	0	0.	0	0	0	0	0	0	0	1512.13
	6	22	0.95	0	0	0	0	0	0	0	0	415.95
	7	0	0	0	0	0	0	0	0	0	0	0.05
	8	0.99	0.15	0	0	0	0	0	0	0	0	56.71
	9	10.7	1.22	0	0	0	0	0	0	0	0	84.08
	10	3.17	0	0	0	0	0	0	0	0	0	242.31
	11	0.2	0	0	0	0	0	0	0	0	0	40.05
	12	0.63	0	0	0	0	0	0	0	0	0	8.27
	13	60.48	3.53	0	0	0	0	0	0	0	0	138.18
	14	99.86	0.47	0	0	0	0	0	0	0	0	593.61
	15	28.56	10.95	0	0	0	0	0	0	0	0	594.88
	16	32.89	0.73	0	0	0	0	0	0	0	0	171.42
	17	0.14	0	0	0	0	0	0	0	0	0	2.62
	18	0	0	0	0	0	0	0	0	0	0	46.41
	19	2.33	0	0	0	0	0	0	0	0	0	41.79
	20	61.92	2.26	0	0	0	0	0	0	0	0	1039.90
	21	108.5	5.29	0	0	0	0	0	0	0	0	636.90
	22	0.38	0	0	0	0	0	0	0	0	0	5.04
	23	92.68	0.34	0	0	0	0	0	0	0	0	194.31
	24	2.33	0	0	0	0	0	0	0	0	0	5.35
	25	145.52	99.57	0	0	0	0	0	0	0	0	2162.65
	26	94.04	2.27	0	0	0	0	0	0	0	0	658.19
	27	110.45	16.5	0	0	0	0	0	0	0	0	826.53
	28	36.18	2.87	0	0	0	0	0	0	0	0	750.50
	29	371.34	15.85	0	0	0	0	0	0	0	0	3735.93
	30	891.6	21.22	0	0	0	0	0	0	0	0	5318.28
	31	2322.99	44.63	0	0	0	0	0	0	0	0	7187.51
	32	74.35	7.1	0	0	0	0	0	0	0	0	240.82
	33	14.17	10.15	0	0	0	0	0	0	0	0	320.46
	34	0	0	0	0	0	0	0	0	0	0	0.00
	35	0	0	0	0	0	0	0	0	0	0	0.00
	36	0	0	0	0	0	0	0	0	0	0	0.00
	37	0	0	0	0	0	0	0	0	0	0	0.00
	38	0	0	0	0	0	0	0	0	0	0	0.00
	39	0	0	0	0	0	0	0	0	0	0	0.00
	40	0	0	0	0	0	0	0	0	0	0	0.00
												0.00
Tot Intmd		4591.54	245.48	0	0	0	0	0	0	0	0	30352.40
Emp Compen.		7,478.99	541.87	0	8,368.53	-194.52	0	0	0	0	0	36100.06
Prop Income		2,160.70	0	0	0	0	0	0	0	0	0	5803.00
Oth Prop Inc		1,765.73	7.33	0	0	-139.38	0	0	0	0	0	18910.04
Indir Bus. Tax		231.57	0.13	0	0	0	0	0	0	0	0	5678.95
Tot Val. Added		11636.99	549.33	0	8368.53	-333.9	0	0	0	0	0	66492.05
Tot Output		16228.53	794.81	0.00	8368.53	-333.90	0.00	0.00	0.00	0.00	0.00	96844.45

Sector	Households	Fed Gov.	St & L. Gov	Capital	Inventory
1	363.09	0.28	44.64	0.00	78.49
2	1.1	0.64	3.50	1.94	4.55
3	1.43	0	0.36	0.00	13.31
4	0	1.48	0.00	33.68	0.00
5	0	152.44	1659.43	2145.46	0.00
6	3,141.43	13.22	82.40	0.00	51.31
7	276.73	0	0.00	0.00	0.00
8	116.11	0.19	3.38	20.94	3.26
9	973.93	1.23	27.31	0.00	22.82
10	28.77	0.25	1.79	36.83	10.42
11	229.98	2	26.19	124.45	7.75
12	143.39	0.48	38.55	0.00	14.91
13	352.92	0	76.93	0.00	4.92
14	1,033.16	2.95	137.80	0.16	18.95
15	841.37	343.54	123.74	0.00	136.87
16	363.76	0.68	31.78	1.71	40.97
17	69.03	0.01	7.77	0.00	10.68
18	1.16	14.71	2.43	0.00	74.75
19	106.73	10.91	16.48	317.53	101.83
20	79.43	8.26	75.37	2239.25	206.46
21	638.12	24.46	30.77	550.53	104.84
22	1,454.58	111.6	34.12	1740.25	83.93
23	151.76	9.85	109.63	317.49	3.55
24	417.99	0	27.51	49.17	20.50
25	997.77	2.24	98.00	60.02	74.86
26	1,092.83	35.21	160.20	79.20	0.00
27	974.19	0.33	196.46	0.00	0.00
28	365.22	13.5	26.66	0.00	0.00
29	10,458.18	446.29	213.46	846.98	237.58
30	12,071.16	7.13	437.41	226.77	0.00
31	14,712.29	398.65	579.30	102.85	6622.75
32	368.26	0	40.67	0.00	0.00
33	702.97	0	0.00	0.00	19.79
34	0	2818.53	5479.70	0.00	0.00
35	0	281.68	0.00	0.00	633.15
36	0	0	0.00	0.00	0.00
37	0	0	0.00	0.00	0.00
38	0	0	0.00	0.00	0.00
39	0	0	0.00	0.00	0.00
40	0	0	0.00	0.00	0.00
Tot Intmd	52528.84	4702.74	9793.73	8895.21	8603.18

Emp Compen.
Prop Income
Oth Prop Inc
Indir Bus. Tax
Tot Val. Added

Tot Output

	Sectors	Export	Imports	Net Exports	Tot Fin Dd	Tot Output
1	Agriculture, forestry, & fisheries	357.12	-416.48	-59.36	427.13	1842.66
2	Other Mining	6.61	-23.64	-17.03	-5.30	53.07
3	Coal mining	8.95	-23.44	-14.49	0.61	25.61
4	Crude Petroleum & Nat. Gas	26.87	-610.84	-583.97	-548.81	1273.86
5	Construction	0.00	-1622.62	-1622.62	2334.71	3846.84
6	Food & Kindred Products	163.05	-1346.22	-1183.17	2105.19	2521.14
7	Tobacco Products	0.01	-0.16	-0.15	276.58	276.63
8	Textile Mills Products	5.46	-43.88	-38.42	105.46	162.17
9	Apparel & Other Textile Products	45.08	-214.28	-169.20	856.09	940.17
10	Lumber & Wood Products	29.60	-177.71	-148.11	-70.05	172.26
11	Furnitures & Fixtures	26.96	-76.57	-49.61	340.77	380.82
12	Paper & Allied Products	45.98	-477.31	-431.33	-234.00	-225.73
13	Printing & Publishing	15.98	-295.37	-279.39	155.38	293.56
14	Chemicals & Allied Products	153.74	-297.35	-143.61	1049.40	1643.01
15	Refined Petroleum & Coal Products	257.76	-2158.61	-1900.85	-455.33	139.55
16	Rubber, Plastics, & Leather Products	172.82	-570.26	-397.44	41.46	212.88
17	Stone, Clay, & Glass Products	60.62	-353.10	-292.48	-205.00	-202.38
18	Primary Metals	117.59	-464.31	-346.72	-253.67	-207.26
19	Fabricated Metal Products	204.90	-1001.89	-796.99	-243.52	-201.73
20	Industrial Machinery (exl 'env' pt. 334)	1345.52	-1429.47	-83.95	2524.82	3564.72
21	Electric & Electronic Equipment	316.00	-483.34	-167.34	1181.38	1818.28
22	Motor Vehicle & Oth Transportation Equip.	778.60	-2291.38	-1512.78	1911.70	1916.74
23	Instruments & Related Products	107.69	-170.15	-62.46	529.83	724.14
24	Misc. Manufacturing Industries	49.83	-108.28	-58.45	456.73	462.08
25	Transportation	578.75	-1064.38	-485.63	747.26	2909.91
26	Communication	37.53	-631.27	-593.74	773.70	1431.89
27	Electric Utilities	2.57	-444.83	-442.26	728.72	1555.25
28	Gas Utilities	8.01	-618.70	-610.69	-205.31	545.19
29	Trade, Eating & Drinking Places	402.25	-1998.45	-1596.20	10606.28	14342.21
30	Finance, Insurance, & Real Estate	409.76	-2087.40	-1677.64	11064.83	16383.11
31	General Services	83.19	-2724.04	-2640.85	19774.99	26962.50
32	Government Enterprises	3.82	-310.90	-307.08	101.85	342.67
33	Non-comparable Imports & Scrap	75.49	0.00	75.49	798.25	1118.71
34	General Government Industry	0.00	0.00	0.00	8298.23	8298.23
35	Other General Industry	606.87	0.00	606.87	1521.70	1521.70
36	New Sewer Sys + Repair/Maintenance	0.00	0.00	0.00	0.00	0.00
37	Industrial Air Pollution Control Equipment	0.00	0.00	0.00	0.00	0.00
38	Water Supply	0.00	0.00	0.00	0.00	0.00
39	Solid Waste Services	0.00	0.00	0.00	0.00	0.00
40	Sewerage System (St/Loc Gov Serv)	0.00	0.00	0.00	0.00	0.00
					0.00	
Total		6504.98	-24536.63	-18031.65	66492.05	96844.45

Oklahoma: Output Multipliers 1994

	Direct	Indirect	Induced	Total	Type I*	Type II**
1 agri, forestry, & fisheries	1	0.27	0.56	1.82	1.27	1.82
2 oth mining	1	0.29	0.5	1.79	1.29	1.79
3 coal mining	1	0.47	0.44	1.91	1.47	1.91
4 crude petr. & nat gas	1	0.37	0.32	1.7	1.37	1.70
5 construction	1	0.29	0.55	1.84	1.29	1.84
6 food & kindred	1	0.49	0.33	1.82	1.49	1.82
7 tobacco	1	0.22	0.39	1.61	1.22	1.61
8 textile mill prod	1	0.43	0.32	1.75	1.43	1.75
9 Apparel & oth text prod	1	0.31	0.37	1.68	1.31	1.68
10 lumber & wood prod	1	0.41	0.41	1.82	1.41	1.82
11 furniture & fixtures	1	0.3	0.47	1.77	1.3	1.77
12 paper & allied prod	1	0.29	0.25	1.54	1.29	1.54
13 printing & publishing	1	0.24	0.46	1.7	1.24	1.70
14 Chemicals & allied prod	1	0.44	0.36	1.81	1.44	1.81
15 refd. petrol. & coal prod	1	0.53	0.21	1.74	1.53	1.74
16 rubber,plast,leather	1	0.36	0.44	1.79	1.36	1.79
17 stone,clay,glass	1	0.34	0.44	1.78	1.34	1.78
18 primary metals	1	0.39	0.34	1.73	1.39	1.73
19 fabric. metal prod	1	0.27	0.42	1.7	1.27	1.70
20 industr. mach. & equip.	1	0.43	0.46	1.89	1.43	1.89
21 electr. & elctron. equip.	1	0.37	0.4	1.77	1.37	1.77
22 motor veh. & equip	1	0.32	0.33	1.65	1.32	1.65
23 instruments & related prod	1	0.33	0.44	1.77	1.33	1.77
24 misc. manuf. ind	1	0.33	0.41	1.74	1.33	1.74
25 transportation	1	0.59	0.47	2.06	1.59	2.06
26 communication	1	0.47	0.41	1.87	1.47	1.87
27 electric utilities	1	0.38	0.37	1.75	1.38	1.75
28 gas utilities	1	0.58	0.28	1.86	1.58	1.86
29 oth services	1	0.34	0.68	2.03	1.34	2.03
30 trade,eating & drink. pl	1	0.33	0.58	1.91	1.33	1.91
31 fin., insur., & real est.	1	0.36	0.27	1.63	1.36	1.63
32 govt enterprises	1	0.52	0.69	2.21	1.52	2.21

*Type I=(Direct + Indirect)/Direct
**Type II =(Direct + Indirect + Induced)/Direct

Source: IMPLAN

Oklahoma: Employment Multipliers 1994

	Direct^	Indirect^	Induced^	Total^	Type I*	Type II**
1 agri, forestry, & fisheries	30.3	5.6	8.85	44.7	1.18	1.48
2 oth mining	11.2	3.37	8.03	22.6	1.3	2.02
3 coal mining	5.27	5.57	6.99	17.8	2.06	3.38
4 crude petr. & nat gas	5.06	5.23	5.17	15.5	2.03	3.05
5 construction	18	4.63	8.81	31.5	1.26	1.75
6 food & kindred	4.25	10.33	5.24	19.8	3.43	4.66
7 tobacco	10.4	4.57	6.16	21.1	1.44	2.03
8 textile mill prod	7.57	5.54	5.03	18.1	1.73	2.4
9 Apparel & oth text prod	15.8	4.48	5.9	26.2	1.28	1.66
10 lumber & wood prod	10.9	6.66	6.54	24.1	1.61	2.22
11 furniture & fixtures	13.2	4.54	7.52	25.3	1.34	1.91
12 paper & allied prod	3.41	3.87	3.98	11.3	2.13	3.3
13 printing & publishing	13.1	3.53	7.38	24	1.27	1.83
14 Chemicals & allied prod	4.1	5.3	5.78	15.2	2.29	3.71
15 refd. petrol. & coal prod	0.99	4.94	3.36	9.29	5.98	9.37
16 rubber,plast,leather	7.74	4.32	6.94	19	1.56	2.45
17 stone,clay,glass	8.23	4.28	7.06	19.6	1.52	2.38
18 primary metals	4.83	5.32	5.38	15.5	2.1	3.22
19 fabric. metal prod	8.37	4.09	6.74	19.2	1.49	2.3
20 industr. mach. & equip.	6.84	5.58	7.27	19.7	1.82	2.88
21 electr. & elctron. equip.	7.26	5.02	6.33	18.6	1.69	2.56
22 motor veh. & equip	3.74	4.51	5.24	13.5	2.21	3.61
23 instruments & related prod	8.32	4.42	7.04	19.8	1.53	2.38
24 misc. manuf. ind	11.9	5.19	6.47	23.5	1.44	1.98
25 transportation	10.2	8.02	7.43	25.6	1.79	2.52
26 communication	4.75	6.14	6.46	17.4	2.29	3.65
27 electric utilities	3.44	5.12	5.82	14.4	2.49	4.18
28 gas utilities	2.27	4.14	4.41	10.8	2.82	4.76
29 oth services	23.2	5.34	10.91	39.5	1.23	1.7
30 trade,eating & drink. pl	23.4	5.15	9.25	37.9	1.22	1.61
31 fin., insur., & real est.	6.78	4.72	4.31	15.8	1.7	2.33
32 govt enterprises	11.3	7.43	11.01	29.7	1.66	2.63

^Per Million dollars of output
*Type I=(Direct + Indirect)/Direct
**Type II =(Direct + Indirect + Induced)/Direct

Source: IMPLAN

Oklahoma: Personal Income Multipliers 1994

	Direct	Indirect	Induced	Total	Type I*	Type II**
1 agri, forestry, & fisheries	0.42	0.09	0.19	0.7	1.22	1.67
2 oth mining	0.37	0.09	0.17	0.63	1.23	1.69
3 coal mining	0.26	0.14	0.15	0.55	1.52	2.09
4 crude petr. & nat gas	0.18	0.12	0.11	0.41	1.67	2.29
5 construction	0.41	0.1	0.19	0.69	1.24	1.71
6 food & kindred	0.13	0.17	0.11	0.41	2.39	3.28
7 tobacco	0.27	0.08	0.13	0.49	1.32	1.8
8 textile mill prod	0.16	0.12	0.11	0.4	1.76	2.41
9 Apparel & oth text prod	0.25	0.09	0.13	0.46	1.37	1.87
10 lumber & wood prod	0.24	0.13	0.14	0.51	1.55	2.12
11 furniture & fixtures	0.33	0.1	0.16	0.59	1.3	1.78
12 paper & allied prod	0.14	0.09	0.08	0.31	1.64	2.25
13 printing & publishing	0.34	0.08	0.16	0.58	1.24	1.7
14 Chemicals & allied prod	0.2	0.13	0.12	0.45	1.65	2.26
15 refd. petrol. & coal prod	0.07	0.13	0.07	0.26	2.91	3.99
16 rubber,plast,leather	0.29	0.1	0.15	0.55	1.36	1.86
17 stone,clay,glass	0.3	0.1	0.15	0.56	1.34	1.84
18 primary metals	0.18	0.13	0.11	0.42	1.69	2.32
19 fabric. metal prod	0.29	0.09	0.14	0.53	1.31	1.8
20 industr. mach. & equip.	0.28	0.14	0.15	0.57	1.5	2.06
21 electr. & elctron. equip.	0.24	0.12	0.13	0.5	1.49	2.04
22 motor veh. & equip	0.2	0.11	0.11	0.41	1.54	2.11
23 instruments & related prod	0.3	0.11	0.15	0.55	1.36	1.86
24 misc. manuf. ind	0.26	0.12	0.14	0.51	1.45	1.99
25 transportation	0.25	0.18	0.16	0.59	1.73	2.38
26 communication	0.22	0.15	0.14	0.51	1.7	2.34
27 electric utilities	0.21	0.12	0.12	0.46	1.56	2.14
28 gas utilities	0.13	0.12	0.09	0.35	1.94	2.66
29 oth services	0.5	0.12	0.23	0.86	1.24	1.7
30 trade,eating & drink. pl	0.42	0.11	0.2	0.73	1.27	1.75
31 fin., insur., & real est.	0.14	0.11	0.09	0.34	1.74	2.39
32 govt enterprises	0.46	0.17	0.23	0.87	1.38	1.9

*Type I=(Direct + Indirect)/Direct
**Type II =(Direct + Indirect + Induced)/Direct

Source: IMPLAN

OKLAHOMA: Direct Employment 1994

Sectors #	Total Employment	Employment without envir activities	Employment in PACE activities	Employment In Envir industry
1	96,997.00	96,904.00	93.00	
2	1,817.00	1,817.00	0.00	
3	458	454	4.00	
4	38,062.00	37,796.00	266.00	
5	129,251.00	129,171.00	80.00	
6	16,368.00	16,295.00	73.00	
7	3	3	0.00	
8	726	725	1.00	
9	8,372.00	8,370.00	2.00	
10	5,329.00	5,315.00	14.00	
11	2,993.00	2,989.00	4.00	
12	4,072.00	3,970.00	102.00	
13	13,641.00	13,588.00	53.00	
14	3,648.00	3,532.00	116.00	
15	5,060.00	5,009.00	51.00	
16	14,346.00	14,251.00	95.00	
17	9,585.00	9,458.00	127.00	
18	5,154.00	5,105.00	49.00	
19	20,759.00	20,651.00	108.00	
20	31,971.00	31,931.00	40.00	
21	10,467.00	10,438.00	29.00	
22	17,295.00	17,242.00	53.00	
23	5,187.00	5,177.00	10.00	
24	4,148.00	4,144.00	4.00	
25	55,530.00	55,409.00	121.00	
26	12,710.00	12,622.00	88.00	
27	6,973.00	6,806.00	167.00	
28	4,886.00	4,872.00	14.00	
29	363,047.00	362,471.00	576.00	
30	108,634.00	108,519.00	115.00	
31	444,816.00	444,165.00	651.00	
32	12,639.00	12,628.00	11.00	
33	0	0	0.00	
34	313,889.00	313,889.00	0.00	
35	16,939.00	16,939.00	0.00	
36	2,899.00	0	-	2,899.00
37	241	0	-	241.00
38	40	0	-	40.00
39	843	0	-	843.00
40	2,357.00	0	-	2,357.00
	1,792,152.00	1,782,655.00	3,117.00	6,380.00

Total Value Added Multipliers

		Direct	Indirect	Induced		Type I*	Type II**
1	Agriculture, forestry,& fisheries	0.65	0.15	0.30	1.10	1.23	1.698996
2	Other Mining	0.65	0.14	0.27	1.06	1.22	1.629423
3	Coal mining	0.41	0.22	0.23	0.86	1.53	2.087026
4	Crude Petroleum & Nat. Gas	0.62	0.22	0.18	1.02	1.35	1.635564
5	Construction	0.56	0.16	0.31	1.03	1.28	1.832600
6	Food & Kindred Products	0.24	0.27	0.18	0.69	2.12	2.863589
7	Tobacco Products	0.48	0.13	0.21	0.81	1.27	1.708175
8	Textile Mills Products	0.23	0.19	0.17	0.59	1.86	2.609276
9	Apparel & Textile Products	0.37	0.14	0.20	0.71	1.37	1.922778
10	Lumber & Wood Products	0.33	0.20	0.22	0.75	1.59	2.261086
11	Furnitures & Fixtures	0.45	0.14	0.25	0.85	1.32	1.885892
12	Paper & Allied Products	0.40	0.13	0.13	0.67	1.34	1.666063
13	Printing & Publishing	0.54	0.12	0.25	0.92	1.22	1.688077
14	Chemicals & Allied Products	0.36	0.20	0.20	0.76	1.57	2.114445
15	Refined Petroleum & Coal Prod	0.18	0.29	0.11	0.58	2.63	3.277858
16	Rubber, Plastics, & Leather	0.44	0.17	0.24	0.84	1.37	1.909910
17	Stone, Clay, & Glass Prod	0.47	0.16	0.24	0.87	1.34	1.845607
18	Primary Metal	0.29	0.19	0.18	0.65	1.64	2.250183
19	Fabricated Metal Products	0.41	0.13	0.23	0.77	1.32	1.868619
20	Industrial Machinery	0.39	0.20	0.25	0.83	1.53	2.162348
21	Electric & Electronic Equip	0.40	0.18	0.21	0.79	1.45	1.989846
22	Motor Vehicle & Equip.	0.28	0.15	0.18	0.61	1.55	2.188442
23	Instruments & Related Products	0.49	0.16	0.24	0.89	1.33	1.820590
24	Misc. Manufacturing Industries	0.45	0.17	0.22	0.83	1.37	1.856591
25	Transportation	0.41	0.27	0.24	0.93	1.66	2.257336
26	Communication	0.47	0.20	0.20	0.87	1.42	1.845967
27	Electric Utilities	0.60	0.12	0.17	0.89	1.19	1.469718
28	Gas Utilities	0.30	0.29	0.15	0.74	1.98	2.478505
29	Trade, Eating & Drinking Places	0.63	0.17	0.31	1.12	1.27	1.769428
30	Finance, Insurance, & Real Estate	0.61	0.19	0.14	0.95	1.32	1.545055
31	General Services	0.61	0.18	0.37	1.16	1.29	1.895418
32	Government Enterprises	0.56	0.17	0.40	1.13	1.31	2.008707

*Type I=(Direct + Indirect)/Direct
**Type II =(Direct + Indirect + Induced)/Direct
Source: IMPLAN

VITA

Ali Bin Hamsa

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