

**THE IMPACT OF OIL AND GAS PRODUCTION AND
DRILLING ON THE OKLAHOMA ECONOMY**

for

COMMISSION ON marginally PRODUCING OIL AND GAS WELLS

by

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Introduction

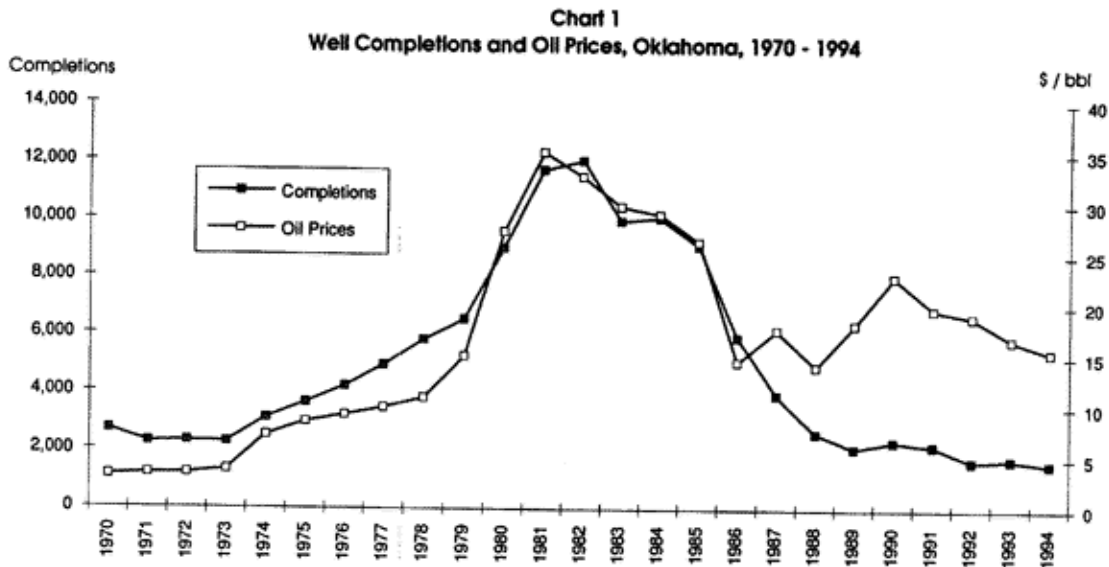
The oil and gas production and drilling industry is an important source of employment and income for Oklahoma households and an important source of revenue for state and local government. This study estimates the economic impact of oil and gas production and drilling activities in 1994 on the Oklahoma economy.

Recent Experience In Production And Drilling Activity, 1990-1994

Declines in oil and gas production and drilling in Oklahoma have been substantial since 1990, reflecting a continuing pattern of downsizing of this sector. This section presents a brief overview of the changes in oil and gas production between 1990 and 1994 and their direct impact on Oklahoma employment and earnings.

Drilling Activity

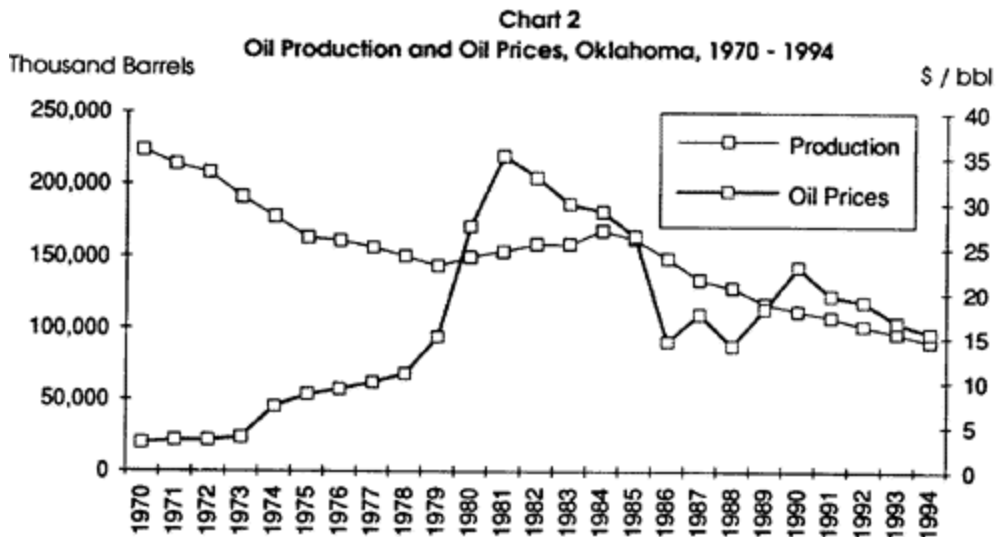
Drilling activity, whether exploratory or in-field drilling, produces economic impacts in terms of jobs and income for Oklahomans. However, discoveries of new sources of oil and gas are critical to the long-term prospects of oil and gas production in Oklahoma. Unless reserves consumed in current production can be replaced by new discoveries, long-term prospects for the oil and gas production sector are severely hampered. Depressed oil prices and volatile natural gas prices contributed to declines in Oklahoma drilling activity from 1990 to 1994 as shown in Chart 1. The active rig count for the period showed a decline of 15.8 percent, though a slight upturn occurred during the last years of the period. In addition, drilling statistics supplied by the Oklahoma Corporation Commission show that the number of oil wells drilled and completed in Oklahoma fell by more than half from a total of 870 in 1990 to 401 in 1994.



The number of gas wells drilled and completed from 1990 to 1994 also fell but at a much slower pace, declining about 14 percent from 780 in 1990 to 671 in 1994. A comparison indicates a tendency toward drilling more gas wells in Oklahoma than oil wells. The number of exploratory gas wells rose from 36 in 1990 to 53 in 1994 compared to an increase from 20 to 31 oil wells during the same period.

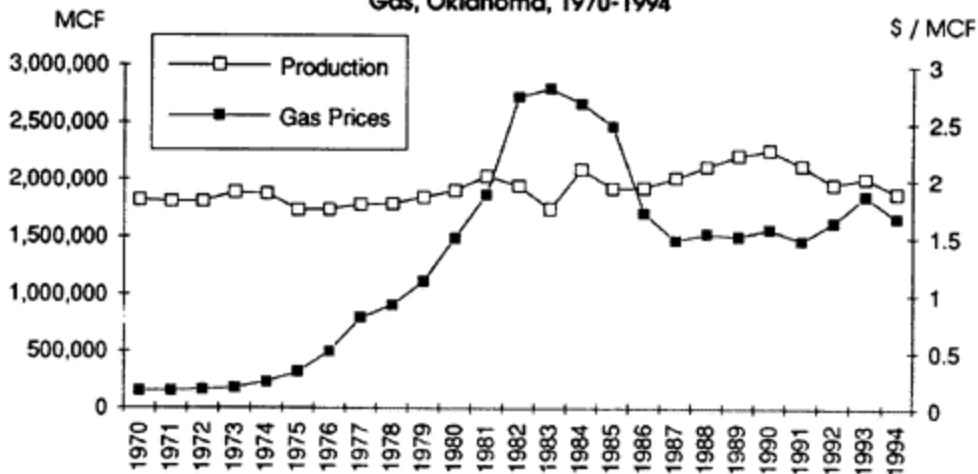
Oil and Gas Production

Chart 2 illustrates oil production relative to oil prices between 1970 and 1994. As the chart indicates, production of oil and condensate in Oklahoma continued to decline between 1990 and 1994, failing almost 19 percent from a 1990 total of 112.3 million barrels to 90.9 million barrels in 1994. The average price of oil purchased at the wellhead also fell by more than \$7 dollars during the period, a 32 percent decline from \$22.95 per barrel in 1990 to \$15.51 per barrel in 1994.



As shown in Chart 3, production of natural gas and casinghead gas also experienced significant declines between 1990 and 1994. Total gas production fell from a total of 2.263 billion MCF in 1990 to a 1994 total of 1.889 billion MCF, a 16.5 percent decline. While gas prices have fluctuated over the period there has been a modest overall net increase of 6.2 percent from \$1.57 in 1990 to \$1.67 in 1994.

Chart 3
Production of Natural and Casinghead Gas and Relative Price of Gas, Oklahoma, 1970-1994



Employment And Employees' Earnings

The declines in oil and gas production have direct and immediate impacts on employment and earnings. Figures from the U.S. Bureau of Economic Analysis show a marked decline in total employment in the oil and gas sector, falling 12.3 percent from 79,258 in 1990 to 69,503 in 1994. By contrast, Oklahoma total employment rose 6.7 percent during the same period. Consequently, oil and gas employment as a share of the state's total employment was down from 4.8 percent in 1990 to 3.9 percent in 1994. Employment in the oil and gas sector as measured by wage and salary employment also fell during the period. Wage and salary employment in the sector was 411,774 in 1990 before falling 20.7 percent to 33,120 in 1994 while wage and salary employment for the state rose 6.5 percent. Similarly, employee earnings in the oil and gas sector fell 8.9 percent from a total of \$1.47 billion to \$1.34 billion in 1994.

Total Impact Of 1990-1994 Declines

The impact on the Oklahoma economy attributable to the decline in oil and gas production activity consists of much more than the direct jobs, production, and earnings losses. Because oil and gas production purchases inputs from many sectors, businesses in diverse portions of the Oklahoma economy are affected when production falls. In addition, consumer expenditures fall as employees are laid off and self-employed income drops. These declines in household expenditures have negative affects on retail sales, particularly purchases of big-ticket items such as housing and automobiles.

The total impact of the 1990-1994 declines may be estimated by use of input-output multipliers. Once the decline in output is figured, multipliers are applied to determine the ripple effects on output, employment, employees' earnings, and value added. For example, the total value of oil and gas output fell \$823,868,000 from 1990 to 1994, measured in 1993 dollars. Measuring the change in output in constant 1993 dollars is

important since the multiplier effect depends on the magnitude of changes in the quantity of physical output (barrels or cubic feet). Thus, a change in the value of production from one year to the next simply due to higher prices would generate no economic impact in the input-output model; the same quantity of inputs would be required since the physical quantity of production did not change.

Applying multipliers to the \$828,860,000 drop in production results in the following estimates of the impact on the Oklahoma economy from 1990 to 1994:

- \$1.485 billion in output,
- \$324 million in employees' earnings,
- 15,598 jobs (including self-employed),
- 889.5 million in value added,
- \$13.2 million in state personal income taxes,
- \$9.2 million in state sales taxes, and
- \$7.7 million in local sales taxes.
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To be sure, the Oklahoma economy performed well overall during the 1990-1994 period, generating a net increase of 84,446 wage and salary jobs. Thus, the total impacts of oil and gas production declines were not enough to generate a net drop in Oklahoma economic activity. However, growth of the Oklahoma economy from 1990-1994 would have been much more impressive if not for the losses generated by declining oil and gas production.

The Method Of Economic Impact Analysis

The economic impact of an industry on a local economy consists of direct, indirect, and induced impacts. Direct impacts are the immediate effects of new hiring and spending in the industry providing the good or service. Using the construction industry as an example, the jobs to fill new positions within the construction firms and the resulting payrolls are examples of the direct effects of new construction spending. Indirect impacts are the effects that occur in other sectors as a result of the new purchases made by the construction sector. For example, to construct a new building, the construction industry purchases inputs from a variety of other industries including electrical wiring, plumbing and heating equipment, fixtures, furniture, and carpeting. Thus, the new higher level of spending supports new hiring and spending in related industries. Induced effects are brought about by the increased consumer spending owing to the initial direct and indirect effects. In brief, the new jobs created in the construction sector create additional employment in industries that supply materials to the construction sector. And, new spending by workers in their roles as consumers creates even more jobs.

Multipliers used in this study were calculated from an input-output model constructed for the Oklahoma economy. The particular model is called IMPLAN, a system developed by the U.S. Forest Service and now maintained by a private firm in Minnesota. IMPLAN is widely used by economists to measure local economic impacts. Economists at Oklahoma

State University recently used the IMPLAN system to measure the effects of spending for higher education on the Oklahoma economy.

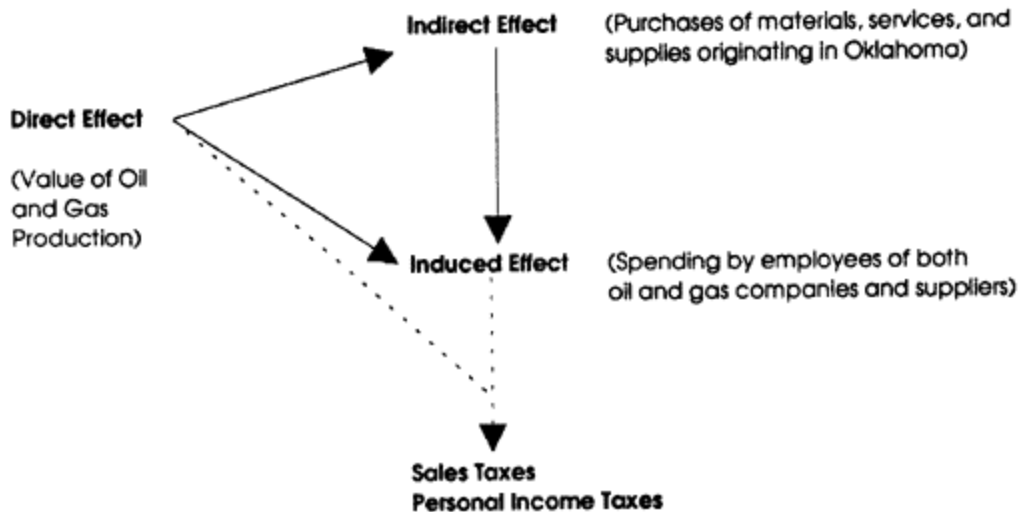
Impacts Of Oil And Gas Production And Drilling

An economic impact can be divided into three components: direct effect, indirect effect and induced effect. The direct effect consists of the initial change in final demand that begins the multiplier process. But the direct effect is just the beginning of round after round of economic impacts. Lease operators will need materials, supplies, and services from other businesses in order to produce oil and gas. These suppliers will also need to purchase materials and supplies needed by their businesses, and so on. The sum of these increases in spending for materials, equipment, and supplies from businesses to other businesses is the indirect effect. Finally, wages and salaries paid to workers in the oil and gas production sector and drilling sector and their supplier industries generate household expenditures for items such as housing, food, and utilities. This is the induced effect.

As personal income rises households spend more on housing, food, transportation, clothing, entertainment, and other items. This increased demand for goods and services causes private firms to increase output and demand additional goods and services from their suppliers. Again, leakages from the spending stream cause the round-by-round expansion to diminish and eventually come to a halt. The IMPLAN Input-Output Model for Oklahoma assumes that households purchase the same mix of goods and services as does the average U.S. household. This assumption simplifies the analysis greatly, allowing use of national data collected for household purchasing patterns. Similar data for Oklahoma households do not exist.

During the round-by-round expansion process greater income and sales taxes are generated by increased employees' earnings and additional household expenditures. Figure 1 summarizes the mechanics of the input-output model. Production of oil and gas (the direct effect) requires the purchase of inputs by the oil and gas sector from the industries shown in Table 1. These industries, in turn, increase production and demand greater quantities of goods and services from their suppliers, and so on. The effects of spending diminish from one round to the next due to leakages from the spending stream. Leakages include spending on foreign imports, domestic imports (goods and services produced in other states), profits, and indirect business taxes. Of course, the smaller the leakages the greater the multiplier effect.

Figure 1: Model of Economic Impact of Oil and Gas Production



Direct Impacts of Oil and Gas Production and Drilling Activity

Oil and gas production and drilling activity generated the following direct--or first round--impacts on the Oklahoma economy during 1994:

- \$4.599 billion in output (sales) of oil and gas,
- \$703.4 million in expenditures for drilling and equipping new wells,
- 69,503 jobs, including the self-employed,
- 33,120 wage and salary jobs,
- 1.892 billion in earnings for self-employed and wage and salary workers,
- \$1,342 million in wages and salaries,
- \$313.5 million in gross production (severance) taxes, and
- \$574.9 million (estimated) in royalty payments to owners of mineral rights.

Distribution of Input Requirements

Table 1 presents estimates of input requirements for oil and gas production and oil and gas drilling activity in 1994. The table shows purchases required from Oklahoma firms for each \$1 million of output in oil and gas production and in drilling activity. These figures are estimated by the IMPLAN system.

Table 1: Purchases of Oklahoma Goods and Services Needed to Produce \$1 Million Output in Production and Drilling		
	(Thousand Dollars)	
Sector	Production	Drilling
Agriculture	10	7,100
Oil and Gas Production	10	2,460
Other Mining	33,950	1,140
Construction	1,470	4,900
New Oil and Gas Wells	0	0
Maintenance and Repair, Oil and Gas Wells	178,210	0
Manufacturing	5,700	83,020
Lumber and Wood Products	0	20,560
Printing and Publishing	1,510	280
Chemicals and Allied Products	860	1,410
Petroleum Products	1,600	20,050
Primary Metals	60	1,160
Fabricated Metal Products	250	6,830
Non-Electrical Machinery	980	17,690
Electronic equipment	260	4,580
Other Manufacturing	180	10,460
Trans., Comm., Utilities	4,950	79,150
Electric Services	3,910	2,400
Retail Trade	60	16,290
Banking and Insurance	1,150	34,850
Property Acquisition and Maintenance	37,620	3,660
Services	2,870	52,600
Business Services	1,090	13,330
Automotive Services	1,050	25,780
Repair Services	10	7,470
Legal Services	440	3,290
Consulting and Research	0	0
Other services	280	2,730
Government	120	20

Labor	306,772	322,878
Profit, indirect business taxes, foreign imports, imports from other states	414,628	253,912

In order to produce \$1 million in Oil and gas output, petroleum companies typically spend an estimated \$178.2 thousand for maintenance and repair of oil and gas wells. These figures may be converted into percentages by dividing each figure by \$1 million. Thus, maintenance and repair of oil and gas wells constitute 17.8 percent of input requirements, purchases from other mining industries 3.4 percent, and so on.

As shown in the table, purchases occur from a wide variety of industries within the Oklahoma economy. It should be noted that a large percentage of input requirements for virtually any large Oklahoma industry will be purchased from sources in other states and from abroad. This tendency is due not to any particular defect of the Oklahoma economy but to the gains achieved by specialization and economies of scale in manufacturing geared towards large national and international markets. Imports plus profits (if any) and indirect business taxes (sales taxes) will typically account for 41.4 percent of spending for oil and gas production and 25.4 percent of total spending for drilling activity.

Other major inputs for oil and gas production include Labor, Property Acquisition and Maintenance, Services, and Electric Services. For drilling activity major input requirements include Labor; Transportation, Communication, and Utilities; Banking and Insurance; and Manufacturing.

Total Expenditures By Sector

A large volume of purchases among Oklahoma businesses is initiated by the production of oil and gas and, also, by drilling activity. Table 2 shows the final changes that occurred in each sector in order to support oil and gas production and drilling in 1994. Major expenditures in Oklahoma caused by oil and gas production included well maintenance and repairs (\$769 million), expenditures related to property acquisition and maintenance (\$172 million), transportation, communication, and utilities (\$100 million), electric services (\$20 million), and manufactured goods (\$128 million). Drilling activity in Oklahoma created significant expenditures in the manufacturing sector (\$37 million), transportation, communication, and utilities (\$75 million), banking and insurance (\$3 million), and services (\$14 million).

TABLE 2: Total Impacts of Oil and Gas Production and Drilling Activity on the Oklahoma Economy, 1994 (Million 1993 Dollars)

	Oil and Gas Production				Drilling Activity			
	Output	Earnings	Value Added	Employment	Output	Earnings	Value Added	Employment
Agriculture	\$1.2	\$0.1	\$0.5	26	\$0.4	\$0.0	\$0.2	8
Oil and Gas Production	4,317.5	1,324.5	2,702.3	42,372	0.1	0.0	0.0	0
Other Mining	0.7	0.1	0.3	3	11.8	3.6	7.4	116
Construction	33.2	5.0	10.1	327	8.9	1.3	2.7	87
New Oil and Gas Wells	0.0	0.0	0.0	0	756.8	244.4	409.6	12,842
Maintenance and Repair, Oil and Gas Wells	769.4	279.2	377.6	15,692	2.1	0.8	1.0	43
Manufacturing	128.0	21.4	536.9	566	37.1	6.9	11.1	186
Lumber and Wood Products	2.8	0.5	0.9	30	0.6	0.1	0.2	7
Printing and Publishing	8.2	2.5	4.1	105	2.1	0.6	1.0	26
Chemicals and Allied Prod.	30.5	6.4	10.4	139	2.7	0.6	0.9	12
Petroleum Products	56.1	3.6	9.7	58	13.5	0.9	2.3	14
Primary Metals	1.8	0.3	0.5	10	4.5	0.8	1.2	24
Fabricated Metal Products	7.6	2.3	3.2	68	1.2	0.3	0.5	10
Non-Electrical Machinery	14.4	4.1	5.6	105	10.8	3.0	4.2	79
Electronic Equipment	2.6	0.7	1.1	20	0.7	0.2	0.3	5
Other Manufacturing	3.9	1.0	1.6	32	1.1	0.3	0.4	8
Trans., Comm., Utilities	100.3	36.0	62.6	1,141	75.2	27.0	47.0	855
Electric Services	20.2	4.1	13.4	87	4.1	0.8	2.7	18
Retail and Wholesale Trade	1.5	0.6	1.1	52	0.4	0.2	0.3	15
Banking and Insurance	22.2	5.8	9.7	216	2.7	0.7	1.2	26
Property Acquisition and Maint.	172.2	5.5	12.9	696	22.8	0.7	1.2	26

Services	58.4	20.0	33.5	1,393	14.1	5.0	9.6	432
Business Services	16.0	6.5	12.2	578	10.3	4.2	7.9	372
Automotive Services	10.5	0.9	2.1	68	1.8	0.1	0.4	12
Repair Services	1.2	0.3	0.8	28	0.7	0.2	0.5	17
Legal Services	4.1	1.8	3.4	60	0.5	0.2	0.5	8
Consulting and Research	22.4	8.8	12.2	505	0.0	0.0	0.0	0
Other Services	4.3	1.8	2.7	154	0.8	0.2	0.4	23
Government	7.9	7.4	7.6	268	0.2	0.1	0.1	5
Total Direct and Indirect	\$5,632.7	\$1,709.7	\$3,381.5	62,840	\$936.7	\$291.5	\$509.5	14,726
Induced Impacts		\$564.8	\$1,082.4	32,797		\$191.3	\$366.5	11,108
Total Impacts		\$2,274.5	\$4,464.0	95,637		\$482.8	\$876.0	25,833

Summary Of Results

Estimates of the total impact of oil and gas production and drilling activity are shown in Table 3. Adding the direct, indirect, and induced effects shows that oil and gas production supports:

- 95,600 jobs (including self-employed),
- \$7.454 billion in output (sales),
- \$2.274 billion in employees' earnings,
- \$4.464 billion in value added (gross state product).

The total impacts of drilling activity are:

- 25,909 jobs (including self-employed),
- \$1.556 billion in output (sales),
- \$485 million in employees' earnings,
- \$878 million in value added (gross state product).

In sum, oil and gas production and drilling activity together support approximately 121,500 jobs, \$2.759 billion in employees' earnings, \$9.010 billion in output, and \$5.342 billion in value added.

Table 3: Distribution of Severance Taxes, Oklahoma, Fiscal Year 1994

Collections		Expenditures *	
Oil	94,512,004	→ County road maintenance	6,851,277
		→ General revenue	81,326,394
		→ School districts	6,873,945
		→ Refunded & reserve	2,763,608
Gas	272,408,181	→ County road maintenance	19,155,012
		→ General revenue	80,748,373
		→ School districts	19,219,058
		→ Refunded & reserve	8,582,312
		→ Okla. Teachers Retirement	149,723,591

Source: Annual Report of the Oklahoma Tax Commission, Fiscal Year Ended June 30, 1994, page 17.

* Fiscal Year 1994 expenditures attributable to the severance tax on oil include a balance of \$3,303,219.42 from Fiscal Year 1993. Fiscal Year 1994 expenditures attributable to the severance tax on gas include a balance of \$5,015,351.53 from Fiscal Year 1993 and cancelled vouchers in the amount of \$4,813.06

Impacts On State And Local Tax Revenues

Severance tax revenue is a major source of funding for state government activities, although the reliance of the state government on this source of revenue has declined markedly during the past decade.

More than half of severance taxes were generated by production of natural gas. As Table 4 shows, severance taxes on oil and gas are very important sources of revenue for county road maintenance, school districts, and as funding for expenditures appropriated from general revenue. In addition, severance taxes on gas generated nearly \$150 million for the Oklahoma Teachers Retirement System.

Table 4: Estimated Oklahoma Tax Revenues Attributable to Oil and Gas Production and Drilling Activity, Calendar year 1994

	Tax Revenue (million)
Severance Taxes*	
Oil	\$85.7
Natural Gas	\$185.8
Condensate	\$8.0
Casinghead Gas	\$33.9
Total severance taxes	\$313.5
Personal income tax	\$75.0
State sales tax	\$56.5
Personal consumption	
Drilling (tangible costs)	\$13.6
Workovers and maintenance (tangible costs)	\$13.8
Total state income and sales tax	\$159.0
Local sales tax	
Personal consumption	\$46.0
Drilling (tangible costs)	\$9.7
Workovers and maintenance (tangible costs)	\$9.8
Total local sales tax	\$65.5
Grand Total Tax Revenues	\$538.0
* Severance tax revenue was obtained from the Oklahoma Tax Commission, Gross Production Tax Division, unpublished data	

Although severance taxes are the major source of tax revenue paid by the oil and gas industry, income and sales tax revenues also are considerable (Table 4). Oil and gas production and drilling activity generated an estimated \$102.3 million in state personal income tax revenues, \$81.8 million in state sales tax collections, and an estimated \$51.2 million in local sales tax revenues. Most of the sales tax revenue and all of the personal income tax revenue are generated by earnings to households. Sales taxes attributable to drilling and workover activity occur since approximately 40 percent of spending for these activities consists of items subject to the sales tax.

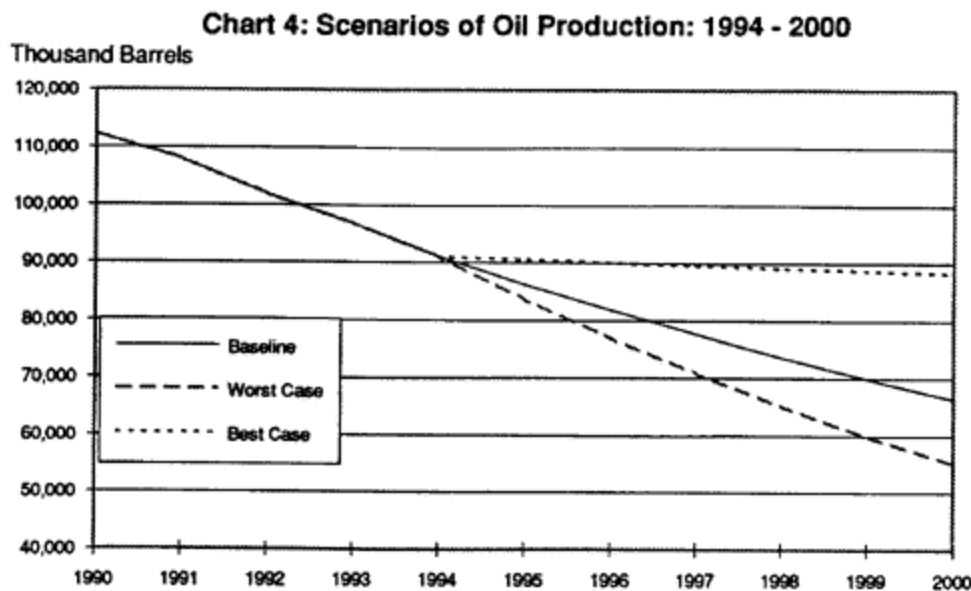
Expectations For 1996-2000

This section presents expected impacts of the oil and gas sector on the state's economy for the period 1996 to 2000. Three separate scenarios will be reported;

- 1) an estimate assuming a continuation of current trends
- 2) a high estimate that assumes some level of recovery in the sector and
- 3) low estimate assuming the sector will decline at a more pronounced rate than actually occurred during the 1990 to 1994 period. These scenarios are not forecasts but rather reasonable expectations based on possible variations in the price of oil and gas.

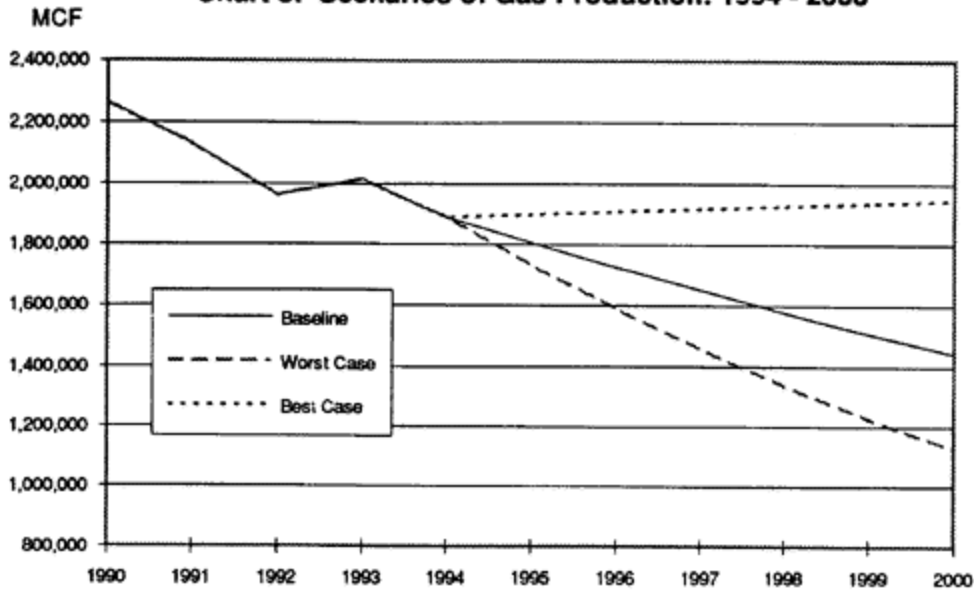
Estimated Changes In Oil And Gas Production And Drilling Activity

Chart 4 presents the three scenarios for changes in oil production over the next six years. Under the baseline assumption, a continuation of current trends with no change in oil prices, oil production is expected to decline by an annual average rate of 5.1 percent between 1994 and 2000 for a total decrease of 24.6 million barrels . If the price of oil undergoes another series of declines, then oil production could fall by 35.8 million barrels or an average annual decline of 8 percent (worst scenario). Under the best scenario, it is expected that future production would stabilize at the 1994 output of 90.99 million barrels per year.



The expected changes in gas production are similar to those for oil. As shown in Chart 5, gas production declines at an annual average rate of 4.4 percent in the baseline scenario given no changes in the current price of gas. This represents a total decrease of 448.4 thousand MCF. Under the worst case scenario, a decline in gas prices, gas production would fall 764.5 thousand MCF.

Chart 5: Scenarios of Gas Production: 1994 - 2000



Appendix A: Estimating Impacts on State and Local Tax Revenues Paid by Households
Household tax payments are estimated as follows:

State Income Tax Revenue = OKPI * OKRATE

Oklahoma Sales Tax Revenue =

$OKPI * (1 - OKRATE - FEDRATE) * 0.5 * OKSALESRAT$

where

OKPI - Oklahoma personal income

OKRATE - Oklahoma personal income tax rate (gross income)

FEDRATE - Federal personal income tax rate (gross income)

OKSALESRATE - Oklahoma sales tax rate (4.5%)

Model income tax statements were estimated for the average household for a wage earner employed in the construction sector. Estimates were calculated for both single and married workers. Total household income was estimated using data derived from the Public Use Microdata Sample (PUMS) for Oklahoma, available from the U.S. Bureau of the Census. Standard deductions were assumed for both married and single workers. Exemptions were assumed to be three for married workers and two for single workers.

The impact on income tax revenues for an average household can be estimated by calculating current income tax liability, then recalculating tax liability after subtracting construction sector earnings. Using this method, the following income tax rates were estimated based on gross income for the average employee.

State income tax liability was estimated by multiplying income by 3.15 percent. Sales tax revenues were estimated by first calculating disposable income, consisting of income less federal and state income taxes. Next, disposable income was multiplied by 0.5, indicating

that only approximately 50% of household spending occurs for goods and services that are subject to the sales tax. Finally, this amount was multiplied by the sales tax rate.

End Note

1 Gross output actually fell by \$1,034,686 from 1990 to 1995, in 1994 prices. However, this figure includes severance tax and royalties as well as production costs. The price relevant to producers is the price of oil less severance taxes and royalties. Consequently, the \$828,868,000 figure is net of severance taxes and royalties.