
NATURAL RESOURCES JOURNAL

Volume 17
Issue 2 *Spring 1977*

Spring 1977

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RESOURCE TAXATION, TAX EXPORTATION AND REGIONAL ENERGY POLICIES

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In recent years there has been a renewed interest in the theory of fiscal federalism by public finance analysts. This interest is easy to understand, for regions which are diverse in resource endowments, geographical characteristics, and political and administrative organizations, raise important questions regarding the efficiency and equity of differing federal structures. However, when this diversity is coupled with a crisis of significant proportions, and the respective regions have differing views as to a solution to the crisis, the examination takes on an added dimension—conflict. The recent "energy crisis" exemplifies such a situation in the United States, for in the search for national energy independence, the states possess the potential to take different positions on the crisis, especially those states endowed with energy resources.

Of course, even without the energy crisis, there are a number of alternative economic goals that a state might attempt to achieve and there are various alternative public policies, both expenditure and tax, which could be used to attain these objectives. Moreover, it is possible that states with similar economic conditions and similar objectives might find it desirable to form a federation for the purpose of pursuing common economic objectives; the individual states in the region might be better off if their fiscal policies were in harmony than if they each pursued independent policies.

The purpose of this paper is to analyze energy policies and natural resource taxation for the states in the Rocky Mountain Region. The paper will make specific reference to coal. The current and potential future coal situation in the Region provides an excellent case for the examination of alternative state economic objectives and provides a basis for the analysis of various public policies that can be used to attain the objectives. Of the eight states in the Region, as defined by the U.S. Bureau of Census, six are net exporters of coal—Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming. Although the six states accounted for only 11 percent of the nation's coal production in 1974, over 42 percent of the nation's reserves are located in

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these states. Moreover, coal production in the Region has increased very rapidly in the 1970's and Rocky Mountain coal is desirable because of low mining costs and low sulphur content. Therefore, the potential exists for rapid expansion of the coal industry in the six Rocky Mountain states.

Among the six states there is disparity in terms of current levels of production and coal reserves. Further, coal exports as a proportion of production vary widely among the states. Finally, there is considerable disparity regarding the relative importance of the types of state and local coal taxes among the states as well as the relative burden of coal taxation.

The paper is focused on taxation rather than public expenditure policies as the primary means of attaining state objectives. Since production of coal occurs in the private sector, aside from environmental controls and state mine safety laws, the major policy instruments available to state and local governments are on the tax side. There have been few investigations of the role taxation plays in states' objective functions, and still fewer examinations of taxation of natural resources and the implications for achieving state objectives.[1]

Among the alternative state objectives considered in the analysis, maximization of tax exportation subject to a state budget constraint is a reasonable possibility. A number of recent studies have investigated interstate tax exportation and have attempted to measure the extent of tax exportation.[2] The evidence suggests that states will use taxes which are easily exported.

The first section of this paper sets forth the basic analytical framework. Alternative state objectives are identified and evaluated and the implications of their adoption are examined for three model states within a region facing different demand and supply conditions. Two different tax cases are considered: severance taxes and severance taxes combined with property taxes.

The second section describes the current coal situation in the Rocky Mountain Region regarding production, distribution and taxa-

1. An interesting study of the natural gas industry was conducted by Russell and Toenjes, *National Gas Producer Regulation and Taxation*, Mich. St. U. Pub. Util. Paper (1971). However, the Russell and Toenjes paper had a more narrow perspective in that it focused only on the severance tax in a regulated industry. As will be demonstrated in this paper, natural resource taxation policies cannot be derived through an analysis of a single tax.

2. *See* McLure, *Commodity Tax Incidence*, 17 NAT'L. TAX J. 187 (1964); McLure, *The Interregional Incidence of General Regional Taxes*, 24 PUB. FINANCE (1969); McLure, *Taxation, Substitution and Industrial Location*, 70 J. POL. ECON. (1970); Hogan and Shelton, *Interstate Tax Exportation and States' Fiscal Structures*, 26 NAT'L. TAX J. 553 (1973).

tion. The final section is focused on regional energy policy issues. More specifically, the rationale for coal severance taxes and property taxes is analyzed assuming alternative objectives for the states in the Rocky Mountain Region and taking into account the states' different demand and supply conditions.[3] One important issue is whether the states should harmonize coal severance taxation. A corollary issue is the role of coal property taxation. As this paper will demonstrate, decisions regarding severance taxation and property taxation cannot be made independently.

A MODEL OF REGIONAL INTERACTION

A. State Objectives

We begin by hypothesizing objectives which have been specified in the literature and which seem to have at least some political viability.[4]

1. Maximize intrastate consumption:

This objective would attempt to have as much of the coal as possible consumed within the boundaries of the state. The underlying goal here, of course, is to use the natural resource to foster regional development by encouraging the industrial use of coal within the boundaries of the state. However, given the uses of this particular energy resource in the industrial process, in both a static context and in a dynamic regional development context this objective would not appear especially appealing; for given current environmental constraints and the present state of gasification technology, the state would be in the position of having to attract industries dependent on large quantities of electricity or coke.

2. Maximize total revenue:

This objective would mean that the state's tax policy would attempt to maximize the combined private and public revenue from the natural resource. Some authors have suggested that this goal is a politically viable alternative since it is a proxy for economic activity.[5] However, given the technology of coal mining, much of the private return will accrue to private individuals residing outside of the state and, therefore, this objective would be politically questionable.

3. The severance tax is a tax on the production (extraction) of energy and natural resources.

4. *See* Russell and Toenjes, *supra* note 1; Hogan and Shelton, *supra* note 2. Underlying the analysis in this paper is, of course, a political foundation. However, other than occasional mention, the political process itself will not be analyzed.

5. *See* Russell and Toenjas, *supra* note 1.

3. Maximize tax revenue:

Under this objective, the state would attempt to use the natural resource taxes in order to maximize the revenue to the state, regardless of the tax incidence. This behavior with regard to the coal tax would logically be part of a more general attempt to maximize overall tax revenue.

4. Maximize tax exportation:

Under this objective the state attempts to use the natural resource as a vehicle for exporting the tax to other states. Once again, such behavior on the part of a state would be part of a more general attempt to export taxes.

In order to examine the implications of these objectives, we will hypothesize three different states within a region facing different demand and supply conditions.

a. State A:

State A is characterized by having both large intrastate and interstate consumption of its coal, with the interstate market being the relatively larger market. Its production relative to the national market is significant.

b. State B:

State B is characterized by having a small (in relative terms) total production, with the intrastate market being the larger of the two markets.

c. State C:

State C is characterized by being an importer of coal in order to satisfy intrastate coal demands.

Each of these three cases is specified in Figures 1-3.[6] In Figure 1, interstate demand is shown as D_X, intrastate demand is shown as D_D, and total demand, which is the horizontal summation of the interstate and intrastate demand curves, is depicted as D_T. The State supply curve is shown as S. The initial equilibrium quantities in the respective markets are Q_D, Q_X, and Q_T.

Figure 2 shows the intrastate market to be the relatively larger market for State B, with the total market, once again, being the horizontal summation of the two markets. Initial equilibrium quantities are again Q_D, Q_X, and Q_T respectively.

Figure 3 shows the situation in which State C faces an intrastate demand function of D_D and has a state supply function of S, and

6. These figures are drawn under the assumption of long-run competitive market conditions. Furthermore, in order to simplify the analysis, linear demand and supply functions have been assumed.

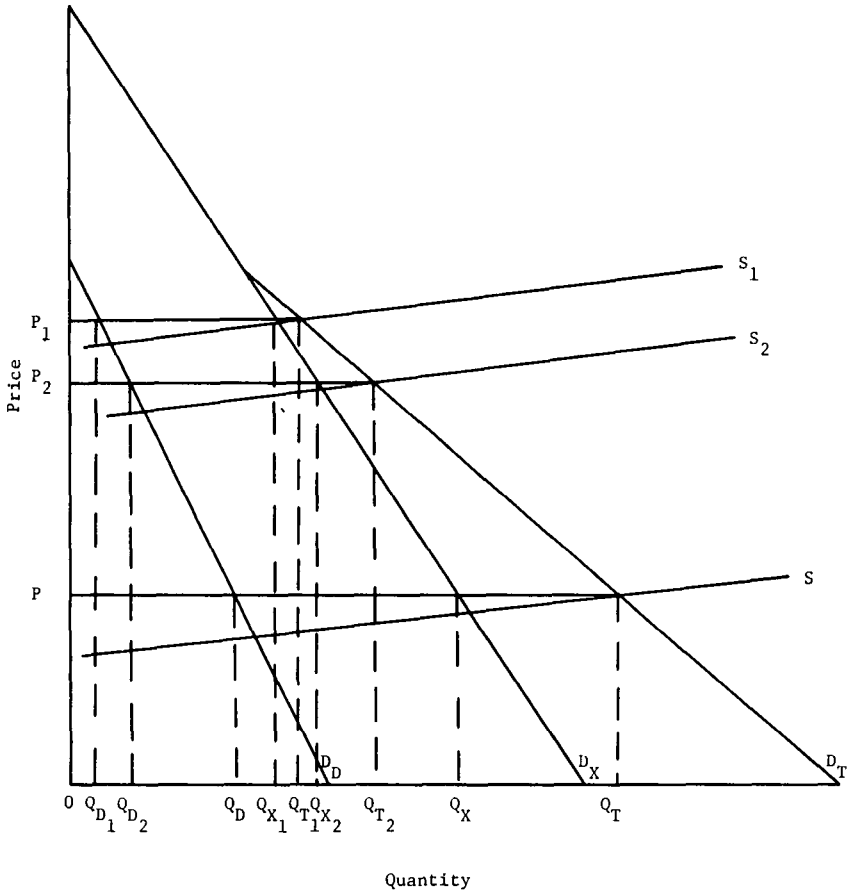

FIGURE 1

Demand and Supply Conditions: State A

given a national price of coal of P, supplies Q_D from intrastate sources and imports from other states $Q_D - Q_T$.

B. Models of State Behavior

Since objectives (iii) and (iv) appear to be the most viable in terms of a state policy towards coal, we shall concentrate on examining the implication of their adoption. We shall do this by formally stating alternative objective functions.

1. Maximize tax revenue (independent tax bases)

A state which is attempting to maximize tax revenue from all tax

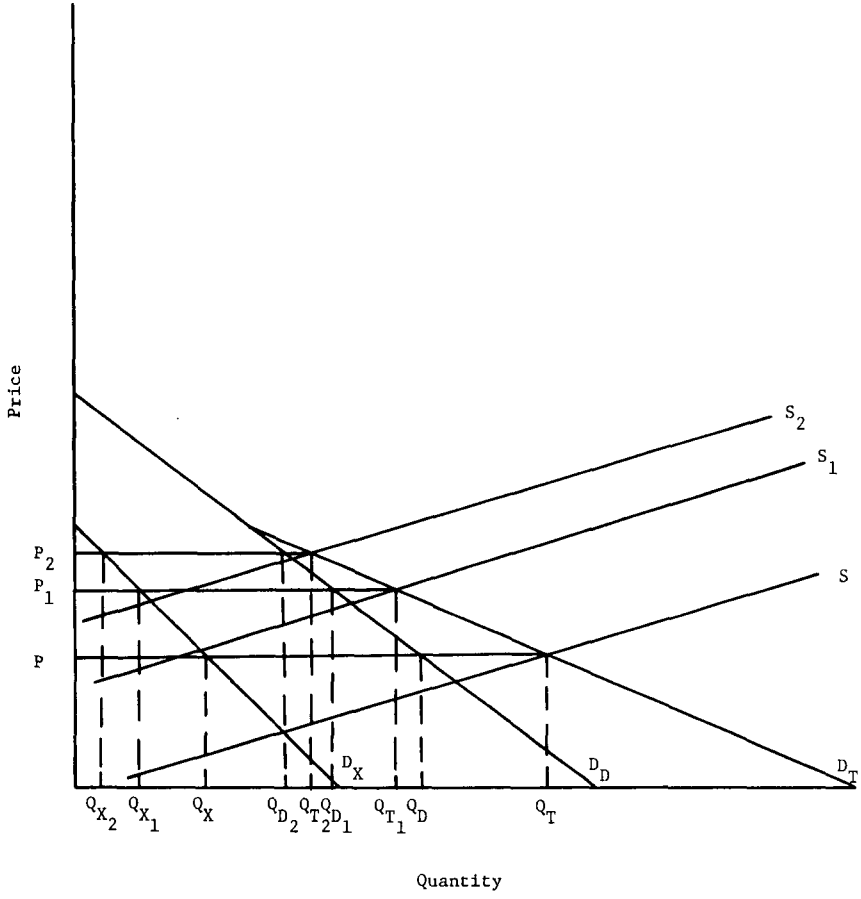

FIGURE 2

Demand and Supply Conditions: State B

sources may be viewed as having an objective function of the following form:

$$\text{Maximize: } R_1 = \sum_{i=1}^{n} r^i B^i \qquad (1)$$

with the variables defined as follows:

R_1: the state's objective function;

B^i: the ith revenue base. The B^i base is assumed to be a function of

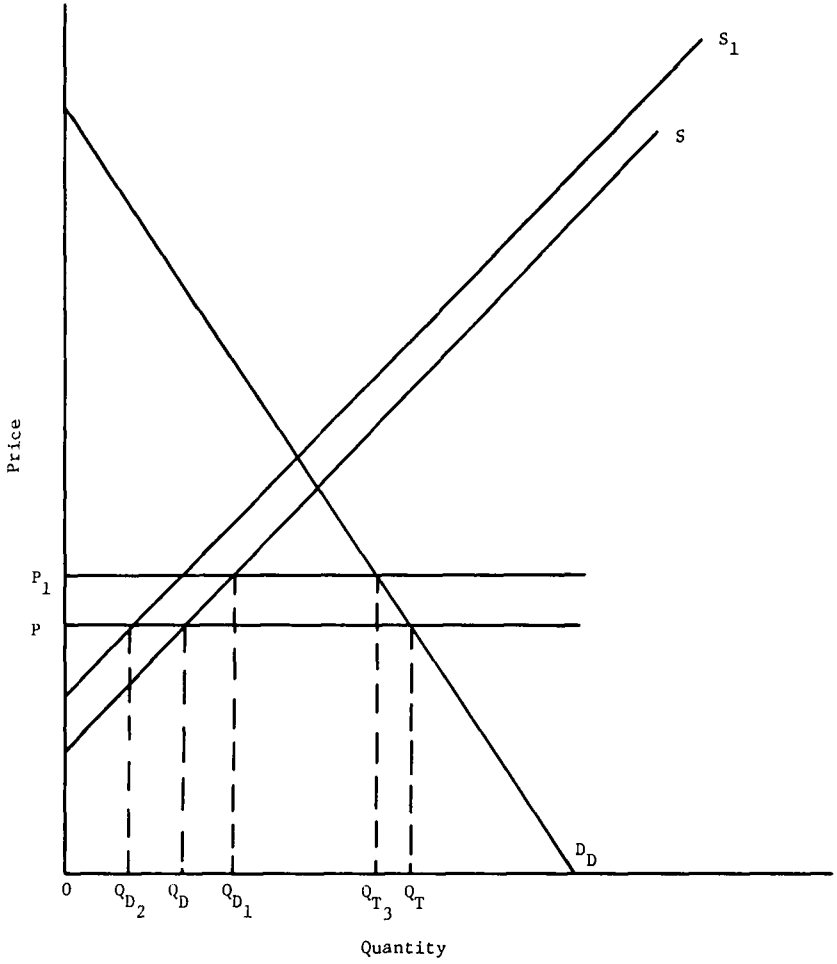

FIGURE 3

Demand and Supply Conditions: State C

r^i, e.g., $B^i = B^i(r^i)$ and furthermore, $\frac{\partial B^i}{\partial r^i} < 0$; that is, an increase in the ith tax rate reduces the ith tax base.

r^i: the ith tax rate associated with the ith tax base.

The state's objective function then can be stated as attempting to maximize the revenue collected from all of the state's tax revenue sources. We are explicitly assuming that the tax bases are independent. Furthermore, we assume that the state taxes only to meet

expenditure obligations as determined in the state's budget. And for analytical purposes, we also shall assume that the state maintains an annually balanced budget. Therefore, we may restate the objective function in terms of a constrained optimization problem.[7]

$$\text{Maximize: } L_1 = \sum_{i=1}^{n} r^i B^i + \lambda(Q_O - \sum_{i=1}^{n} r^i B^i) \qquad (1')$$

where λ is the undetermined Lagrangian multiplier and Q_O is the predetermined expenditures for any given period. An examination of the N tax rate partial derivatives of the first order conditions yields the following not so surprising results:

$$(1-\lambda)\left(r^i \frac{dB^i}{dr^i} + B^i\right) = 0 \qquad (2)$$

for $i = 1, \ldots, N$.

or stating the same thing somewhat differently:

$$MR^i = MR^j, \quad i \neq j \qquad (2')$$

where the MR's represent marginal tax revenues. Therefore, each of the tax rates should be increased until the marginal contributions from all tax sources are equal.[8]

2. Maximize tax exportation (independent tax bases)[9]

A state which is attempting to maximize tax exportation may be viewed as having an objective function of the following form:

$$\text{Maximize: } R_2 = \sum_{i=1}^{N} r^i b^{it} \qquad (3)$$

The variables in this objective function are defined as follows:

R_2: the state's objective function;

b^{it}: the ith reverse base, which includes only that portion of the base which is paid by non-state residents. Again, it is assumed that $b^{it} = b^{it}(r^i)$ and $\frac{db^{it}}{dr^i} < O$;

r^i: the tax rate associated with the ith base.

7. For simplicity, we are ignoring collection costs in this formulation; their inclusion would alter the equilibrium conditions slightly. However, given that most collection costs for major taxes are small in relation to revenue collection, the simplification is justified.

8. In this formulation, we know, of course, that $\lambda = 1$. We are assuming that the total revenue requirements are such that all the MR^i's are greater than zero.

9. This model has been more fully developed and tested for general state taxes in Hogan and Shelton, *supra* note 2.

The constrained objective function appears as follows:

$$\text{Maximize } L_2: \sum_{i=1}^{N} r^i b^{it} + \lambda(Q_O - \sum_{i=1}^{N} r^i B^i) \qquad (3')$$

where, once again, λ represents the undetermined Lagrangian multiplier, Q_O is the predetermined budgeted expenditures, r^i is the ith tax rate associated with the ith tax base B^i. The tax base B^i is the combined base of state and non-state tax revenue sources; $B^i = b^{it} + b^i$.

Solving for λ in the first N equations of the first order conditions yields the following:

$$\lambda = \frac{b^{it} + r^i \frac{db^{it}}{dr^i}}{B^i + r^i \frac{dB^i}{dr^i}} \qquad (4)$$

with $i = 1, \ldots, N$.

The numerator can be looked at as the marginal revenue from the exported taxes and the denominator represents the marginal revenue from both bases. This equation tells us that the state should structure its taxes so that, for all taxes, the ratio of the marginal contribution from out-of-state residents to the total marginal contribution should be equal for all taxes.

C. *Geometric Interpretation of Maximization Goals and the Severance Tax*

The effect of increasing the severance tax can be demonstrated geometrically by turning to Figures 1-3. The tax shifts the supply curve upward and to the left, from S to S_1, resulting in a smaller quantity being supplied from the intrastate supply, e.g., Q_T to Q_{T_1} in Figures 1 and 2 and Q_D to Q_{D_2} in Figure 3.

In pursuing the goal of maximizing tax revenue, a state would increase the tax rate until the equilibrium price is in the elastic portion of the total demand curve. The exact amount of the tax increase would depend upon the relative demand and supply elasticities.[10] The resulting distribution of the tax burden between intra-

10. The reason the optimum tax would mean an equilibrium price and quantity in the elastic portion of the demand curve is essentially the same reason a monopolist will always operate in the elastic portion of his demand curve.

state and interstate markets depends upon the relative position of the respective markets.[11] In Figures 1 and 2 this objective is shown by a shift in the supply curve from S to S_2, with the resulting equilibrium price and quantities being P_2 and Q_{D_2}, Q_{X_2} and Q_{T_2}.

Pursuing the goal of maximizing tax exportation would lead the state to adopt a tax which would equate marginal costs to marginal tax gain, but in this situation, the decision is made in terms of the interstate demand curve. The price decision in terms of the interstate demand curve dictates, in turn, the equilibrium price and quantity relationship along the total demand curve. In Figures 1 and 2 this objective is shown by a shift in the supply curve to S_1 from S, with the equilibrium price and quantities being P_1, and Q_{D_1}, Q_{X_1} and Q_{T_1}.

Figures 1 and 2 indicate that pursuing a goal of maximizing tax exportation leads to a higher tax than the alternative goal of maximizing tax revenue in State A but not in State B.

However, a determination of which tax policy will lead to a higher tax depends upon the relative position and elasticities of the intrastate and interstate demands. In general we may observe that the more dominant the interstate market, the tax exportation goal will lead to higher severance taxes than the goal of simply maximizing total tax payments.

D. State Objective Functions and Interdependent Tax Bases

To this point, the analysis has ignored an important problem in natural resource severance taxation, the interdependence of the property tax and the severance tax. This interdependence can be critical for developing a state or regional policy towards natural resource taxation.

It is clear, that the *ad valorem* property tax will have the opposite effect from a severance tax on the state supply curve, for "it will encourage the owners to mine out from under the tax."[12] In other words, the tax will change the profit stream over time and make current production relatively more attractive than future production. In terms of our figures, the effect of the tax is to shift the supply curve to the right during any given time period. Therefore, depending upon relative elasticities and time preferences, the effect of the sever-

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11. The elasticity of the total demand curve at any given price is the weighted sum of the individual demand curves at that price. The weights are the respective proportions of quantity to total quantity.

12. H. GROVES, FINANCING GOVERNMENT 315 (5th Ed. 1958).

ance tax can be offset, to some degree, by the property tax. Stated somewhat differently, the severance tax has the tendency to reduce the quantity supplied at any given market price and the property tax has the tendency to increase the quantity supplied at any given market price.

We are now in a position to return to our basic models and formally state the implication of interdependence.

1. Maximization of tax revenue (dependent tax bases)

We shall assume that the relationship between the two taxes is as follows:

$$B^i = B^i(r^i, r^{i+1}), \text{ with } \frac{\partial B^i}{\partial r^i} < 0, \ \frac{\partial B^i}{\partial r^{i+1}} > 0$$

and

$$B^{i+1} = B^{i+1}(r^{i+1}), \text{ with } \frac{dB^{i+1}}{dr^{i+1}} < 0.$$

The terms B^i and r^i refer to the severance tax base and rate, and B^{i+1} and r^{i+1} refer to the property tax base and rate. Our assumption then is that the property tax rate affects the base of the severance tax, but that the property tax base is functionally independent of the severance tax during a given period.[13] As one would expect, maximizing expression (1′), we once again attain an expression for λ which is equal to one, to which we can give the same interpretation: each of the tax rates should be increased until their marginal contributions are equal, inclusive of the contribution of the effects of the property tax on the severance tax.

2. Maximize tax exportation (dependent tax bases)

We shall continue the dependence assumptions made in the previous analysis of tax maximization and dependent tax bases. We may therefore maximize expression (3′). Solving for λ in the first order conditions, we derive the following expression:[14]

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13. Actually, one would expect a functionally dynamic dependence, i.e., we would expect the property tax base in this period to depend on the severance tax rate in the preceding period. However, if the rate of extraction is small in relation to the base, then the dynamic aspects of the problem can be ignored.

14. In deriving this ratio, it was assumed that the property tax rate in this period does not affect the property tax base in this period, i.e., $\frac{\partial b^{i+1,t}}{\partial r^{i+1}} = 0$ and $\frac{\partial B^{i+1}}{\partial r^{i+1}} = 0$.

$$\lambda = \frac{\left(\frac{b^{it} + r^i \frac{\partial b^{it}}{\partial r^i}}{b^{i+1} + r^i \frac{\partial b^{it}}{\partial r^{i+1}}} \right)}{\left(\frac{B^i + r^i \frac{\partial B^i}{\partial r^i}}{B^{i+1} + r^i \frac{\partial B}{\partial r^{i+1}}} \right)} \qquad (5)$$

This expression, which is symmetrical to (4), states that the ratio of the exported bases over the ratio of the total bases should be equated for all taxes.

E. State Interaction

Table 1 sets out the severance tax policy goals which would likely be pursued by the three model states given what would appear to be reasonable initial equilibrium demand elasticities.[15] It is assumed that State A's initial equilibrium intrastate demand (ϵ_D), interstate

TABLE 1

State Objectives and Tax Policies

State	*Current Equilibrium Conditions*	*1. Maximize Intrastate Consumption*	*2. Maximize Total Revenue*	*3. Maximize Total Tax Revenue*	*4. Maximize Tax Exportation*
A	$\epsilon_D < 1$ $\epsilon_X < 1$ $\epsilon_T < 1$	Zero tax	Increase tax until $\epsilon_T = 1$	Increase tax until $\epsilon_T > 1$	Increase tax until $\epsilon_X > 1$
B	$\epsilon_D > 1$ $\epsilon_X > 1$ $\epsilon_T > 1$	Zero tax	Reduce tax	Small tax increase or small tax decrease	Small tax increase or small tax decrease
C	$\epsilon_D > 1$ $\epsilon_X > 1$ $\epsilon_T > 1$	Zero tax	Zero tax	Zero tax	Zero tax

15. The elasticity coefficients specified here are not intended to exhaust the possibilities. For example, by assigning different weights to the ϵ_X and ϵ_D coefficients and assuming different relationships for each, we can change the ϵ_T from greater than to less than one, or vice versa.

demand (ϵ_X), and total demand (ϵ_T) elasticities are all less than one. States B and C, on the other hand, are assumed to face demand elasticities greater than one. Turning to the respective maximization cases, we find that in the first objective function which involved the maximization of intrastate consumption, all three states prefer a zero tax. Pursuing the second objective function of maximization of total revenue, State A would prefer a severance tax increase, State B would prefer a severance tax reduction to perhaps zero and State C would prefer a zero tax. In the case the third objective function, that of maximization of total tax revenue, State A would prefer a severance tax increase, State B would prefer either a small tax increase or decrease and State C would prefer a zero tax. Finally, pursuing the objective function of maximization of tax exportation would lead State A to prefer a tax increase, State B to prefer a small tax increase or decrease and State C to prefer a zero severance tax. Therefore, only for objective function 1 is there no clear conflict in policy goals. However, turning to the two goals which seem most reasonable for coal, a potential conflict arises between the states. In almost all severance tax policy decisions, State C will be in conflict with States A and B. And as our analysis indicates, States A and B will be in potential conflict. However, as will be discussed, through the use of the property tax, this conflict can be lessened to some degree.

COAL PRODUCTION, DISTRIBUTION AND TAXATION IN THE ROCKY MOUNTAIN REGION

In the preceding section, alternative state objectives were described and the implications for their adoption were examined for three model states within a region facing different demand and supply conditions. Before energy policies can be evaluated for the individual states in the Rocky Mountain Region and for the Region itself, it is necessary to describe the current regional coal situation.

In 1975, coal production in the net exporting states of Arizona, Colorado, Montana, New Mexico, Utah and Wyoming exceeded 77 million tons with a production value, f.o.b. mines, of over $500 million. (See Table 2.)

Coal production in the Region increased rapidly in the first half of the 1970's. Production in 1975 was more than 265 percent of the production level in 1970. Moreover, the regional production level in 1975 was nearly 250 percent of the highest annual production level prior to the 1970's, 1944, ever reported in the *Minerals Yearbook* which records coal production by state beginning in 1929. The greatest expansion during the 1970's occurred in Montana and Wyoming.

TABLE 2

Coal Production, Coal Value and Coal Reserves*

State	Production (Thousands of tons)													Production Value 1975, f.o.b. mines	Reserves 1974[1]
	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	(Thousands of dollars)	(Millions of tons)
Arizona	--	--	--	--	--	--	--	132	1,146	2,954	3,247	6,448	7,199	$ 23,829	350
Colorado	3,690	4,355	4,790	5,222	5,439	5,558	5,530	6,025	5,337	5,522	6,233	6,896	8,274	90,187	14,870
Montana	343	346	364	419	371	519	1,030	3,447	7,064	8,221	10,725	14,106	23,140	104,944	107,727
New Mexico	1,945	2,969	3,212	2,755	3,463	3,429	4,471	7,361	8,175	8,248	9,069	9,392	8,797	47,328	4,394
Utah	4,360	4,720	4,992	4,635	4,175	4,316	4,657	4,733	4,626	4,802	5,500	5,858	7,010	96,598	4,042
Wyoming	3,124	3,101	3,260	3,670	3,588	3,829	4,602	7,222	8,052	10,928	14,886	20,703	23,726	138,085	51,228
Totals	13,462	15,491	16,618	16,701	17,036	17,651	20,290	28,920	34,400	40,675	49,660	63,400	77,146	$500,971	182,611

[1] Known reserves which are economically feasible to mine using existing technology.

*U.S. Dep't. of Interior, Bureau of Mines, *Minerals Yearbook*, vol. 1, 1973 (1975); U.S. Dep't. of Interior, Bureau of Mines, *Mineral Industrial Surveys*, Annual Preliminary Rep.; U.S. Dep't. of Interior, *Coal Reserves of the United States*, Geol. Survey Bull. 1412 (Jan. 1, 1974).

These states accounted for 61 percent of the Region's coal production in 1975 and 49 percent of production value. Although coal production in each of the other four states was fairly comparable, a range of 7 to 8.8 million tons, production value varied widely. Both Colorado and Utah produce high priced metallurgical coal which accounts for the high production value in these states in 1975 as compared to Arizona and New Mexico.

The six states have approximately 183 billion tons of coal reserves which are economically feasible to mine using existing technology. Montana and Wyoming account for 87 percent of the Region's reserves. The 1975 production rate could be sustained for over 2,300 years.

The distribution of each state's production in 1974 is shown in Table 3. The two largest producers, Montana and Wyoming are also the largest exporters, accounting for over 75 percent of coal exports. New Mexico is the largest exporter of coal in the form of electric power. However, 98 percent of the Region's exports is accounted for by coal, vis-a-vis coal in the form of electric power. Montana and Wyoming consume the least amount of coal relative to their production. However, the figures are somewhat deceiving because they are calculated on a net basis. For example, although Colorado coal consumption is about 97 percent of production, Colorado exports metallurgical coal and imports coal for electric power generation. In 1974 Colorado's coal exports amounted to 55.5 trillion B.T.U.'s and imports were 50 trillion B.T.U.'s.

Including the net importing states, Idaho and Nevada, coal exports and coal exported as electric power net amount to nearly 46 percent of coal production in the Rocky Mountain Region. Excluding the two net importing states, the corresponding share is 56 percent.

There is considerable diversity in the coal tax structures of the six exporting states. Four of the six states have severance taxes: Colorado, Montana, New Mexico, and Wyoming. However, severance taxes in Colorado and New Mexico account for a very small share of taxes paid by the coal industry. The Colorado and New Mexico coal severance taxes generated only $50,000 and $261,000, respectively in FY 1976 as compared to $29 million in Montana and $2.8 million in Wyoming.[16] The state and local coal tax laws are summarized for each of the six states in Table 4.

Although all six states have a property tax in the sense that a local

16. J. Wead, *The Incidence of State Severance Taxes on Coal and the Distribution of Revenues Derived from Such Taxes*, 26, The Council of State Governments, Lexington, Kentucky, July, 1976.

TABLE 3

Coal Production, Exports, and Consumption, 1974[1]

State	Coal Production[2]		Coal Exports (net)		Coal Exported as Electric Power (net)		State Consumption[3]	
	BTU's (Trillions)	Tons (Thousands)	BTU's (Trillions)	Tons (Thousands)	BTU's (Trillions)	Tons (Thousands)	BTU's (Trillions)	Tons (Thousands)
Arizona	141.8(100%) (11.1%)	6,539	75.4(53.2%) (11.1%)	3,447	0(0%) (0%)	0	66.4(46.8%) (11.9%)	3,062
Colorado	162.0(100%) (12.7%)	8,124	5.5(3.4%) (.8%)	276	0(0%) (0%)	0	156.5(96.6%) (27.9%)	7,849
Montana	255.7(100%) (20.0%)	16,429	241.0(94.3%) (35.5%)	15,484	.2(.1%) (.5%)	11	14.5(5.7%) (2.6%)	933
New Mexico	176.6(100%) (13.8%)	9,938	35.5(20.1%) (5.2%)	1,998	23.2(13.1%) (60.1%)	1,303	117.9(66.8%) (21.1%)	6,637
Utah	148.1(100%) (11.6%)	6,214	49.4(33.4%) (7.3%)	2,073	0(0%) (0%)	0	98.7(66.6%) (17.6%)	4,141
Wyoming	393.4(100%) (30.7%)	23,144	272.2(69.2%) (40.1%)	16.014	15.2(3.9%) (39.4%)	892	106.0(26.9%) (18.9%)	6,238
Gross Totals	1280.0(100%) (100%)	70,388	679.0(53.0%) (100%)	39,322	38.6(3.0%) (100%)	2,206	560.0(44.0%) (100%)	28,860
Rocky Mountain Region (net)[4]	1280.0(100%)	70,388	571.2(44.6%)	33,079	13.2(1.0%)	754	695.6(54.3%)	35,848

*Based on information contained in reports by R. Kidman, *1974 Rocky Mountain Energy Flow Patterns*, Informal Report LA-6107-MS, Los Alamos Scientific Laboratory, Los Alamos, N.M., (September 1975).

[1] Details may not add to totals because of rounding.

[2] Includes coal available from storage. Therefore the 1974 production figures shown in this table are slightly higher than the 1974 production figures shown in Table 2.

[3] Includes conversion and line loss from electrical generation and field and transportation losses. Consumption equals production minus exports.

[4] Export and consumption totals for the Rocky Mountain Region do not conform to gross totals for the six states because of imports. For example, coal imports (net) by Nevada (97.7 trillion BTU's) and Idaho (10.1 trillion BTU's) account for the difference in the two figures for coal exports. The six states listed plus Nevada and Idaho comprise the Rocky Mountain Region.

TABLE 4

Summary of Coal Tax Laws as of July 1976*

State	*Severance Tax*	*Property Tax*	*Income Tax*	*Sales Tax*	*Special Taxes*
Arizona	None	60% of estimated present value of gross revenue minus production and distribution costs times mill levy	Graduated income tax, from 2½% on $1,000 to 10½% on more than $6,000	2½% of gross receipts	None
Colorado	7/10 of one cent per ton	30% of property value times mill levy (property value is determined by different methods by different counties)	5% of net income	3% of gross receipts (coal used for industrial purposes is exempt)	Annual license tax 500 tons or less $10 500-1,000 tons $25 more than 1,000 tons $50
Montana	Surface–30% FOB mine price (less production taxes) underground–4% FOB mine price (less production taxes)	Surface–45% FOB mine price (less production taxes) times mill levy underground–33 1/3% FOB mine price (less production taxes) times mill levy	6¾% of net income	None	Resource indemnity trust fund, $25 plus ½% of gross value (minemouth value) over $5,000
New Mexico	½ of 1% of market value less royalties and expenses of hoisting, crushing and loading	300% of net production value (average of 5 years) times mill levy	5% of net income	4% of gross receipts	Natural resource excise tax of ¾ of 1%. Also, electrical energy tax of $.0004 per KWH; tax credit on electricity consumed in-state; legal status pending
Utah	None	26% of net receipts (average for five years) times mill levy	6% of net income	Coal is exempt from sales tax	$5 per acre on all claims and leases
Wyoming	4% of gross value less production costs (loading, crushing and washing)	100% of gross product times mill levy; also, ad valorem taxes on surface improvements	None	3% of gross receipts (coal used for manufacturing purposes is exempt)	Graduated severance tax, 1974–4/10%, 1975–8/10%, 1976–1 2/10%, 1977–1 6/10%, 1978 and after 2%; will expire when taxes collected total $120 million

**State Tax Guide, Statute Summaries, By Taxes, By State*, CCH, (2d. ed. 1959) (plus Report Letters); phone conversations with appropriate officials of the various states.

mill levy is imposed on a taxable base, only Arizona and Colorado have conventional property taxes. In both states the tax base is the present value of estimated gross revenue from the mine over its life minus production and distribution costs. In the other four states, a production tax is used in lieu of a local property tax.

All of the states employ an income tax except Wyoming. Two states, Arizona and New Mexico, use a sales tax or gross receipts tax which applies to coal sold as an intermediate good. The sales taxes which exist in the other states apply to coal only at the retail level. Finally, some of the states have special taxes which apply to the coal industry. For example, New Mexico has a natural resource excise tax. New Mexico is attempting to impose an electrical energy tax which includes a tax credit on intrastate consumption but the legal status of this tax is in question. Wyoming has a special severance tax which will expire when tax revenues total $120 million.

A FY 1976 hypothetical tax bill study conducted by Leonard Bronder indicates that there is considerable variance in the relative importance of the various coal taxes in each of the six states.[17] In Montana, the severance tax accounts for over 70 percent of all state and local taxes paid by the hypothetical surface mining company Bronder used in his analysis. In Wyoming, the corresponding share is 41 percent. In Colorado, Arizona, Utah, and Wyoming the property tax is most important, accounting for 87 percent, 75 percent, 73 percent, and 59 percent of total state and local taxes paid by the hypothetical company, respectively. The corresponding proportions in Montana and New Mexico are only 27 percent and 20 percent. Again, the property taxes in Arizona and Colorado are conventional property taxes while in the other four states annual production is the tax base. The gross receipts tax is the most important coal tax in New Mexico, accounting for over 50 percent of all state and local taxes paid by the hypothetical coal firm. In Arizona, the gross receipts tax accounts for over 20 percent of coal taxes paid by the hypothetical firm. The state income tax is not a major tax on the coal industry relative to other taxes in any of the six states. According to Bronder, the income tax is most important in Utah, Colorado, and New Mexico accounting for only 27 percent, 14 percent, and 12 percent of coal taxes paid by the hypothetical firm, respectively.

Three recent hypothetical tax bill studies indicate diversity in the tax burden on the coal industry in the six states. The results of the three studies are summarized in Table 5. The taxes are shown on a

17. L. Bronder, *Taxation of Surface and Underground Coal Mining in Western States*, Western Governor's Regional Policy Office, Denver, Colorado (1976).

TABLE 5

Comparison of Hypothetical Tax Bill Studies
(Tax per ton)*

	Loomis[1]	*Bronder*[2]		*West Va. Research League*[3]
		Surface	*Underground*	
Arizona	$ .49	$ .46	$1.48	--[4]
Colorado	.09	.16	.45	$ .25
Montana	1.51	1.48	1.55	.62
New Mexico	.16	.26	.90	--[4]
Utah	.08	.09	.23	.44
Wyoming	.47	.43	1.36	1.00

*M. Loomis, *Coal Taxes Paid in the Rocky Mountain States,* Wyo. Mining Ass. (unpublished report, 1975); L. Bronder, *Taxation of Surface and Underground Coal Mining in Western States,* Western Governor's Regional Energy Policy Office, Denver, Colo. (August, 1976); *A Comparison of State Tax Burdens Imposed Upon the Coal Industry, West Virginia and Selected States,* West Virginia Research League, Inc. (1975).

[1] 1975 severance, property and special taxes only; assumes production of 5 million tons per year, value for tax purposes $21,250,000, surface mine operation.

[2] 1976 state and local taxes; assumes production of 9.2 million tons surface mine and 4.99 million tons underground mine.

[3] 1974 state and local taxes; assumes underground mine which produced and sold 1.2 million tons.

[4] State was not included in the analysis.

per ton basis which of course does not take account of differences in the value of the coal produced in each of the six states. However, even if the taxes were adjusted to account for value per ton or B.T.U.'s, the disparity would remain. The major criticism of hypothetical tax bill studies is that they assume homogenous production functions for all firms.[18] Despite this methodological weakness, the three studies combined provide impressive evidence that there is wide variance in the coal tax burden among the six states. It is not possible to compare the results of the three studies because of different tax years, different taxes; e.g., Loomis includes only severance, property, and special taxes, and different characteristics of the hypothetical mining firm. The Bronder study, which is based on the FY 1976 tax year and includes all state and local taxes, indicates that Montana is the highest coal tax state followed by Arizona, Wyoming, New Mexico, Colorado, and Utah.

REGIONAL ENERGY POLICIES

Three different model states were described in section one based on different demand and supply conditions. State A was character-

18. *See* Zubrow, *Some Difficulties with the Measurement of Comparative Tax Burdens* 160, Nat'l. Tax Ass'n., Proc. Fifty-Fourth Ann. Conf. (1961).

ized as having significant coal production relative to the national market with the interstate market being larger than the intrastate market. Montana and Wyoming are the coal producing states which most closely resemble State A. They are the major coal producing states in the Region, the interstate market is dominant and they have the largest coal reserves. State B has relatively small total production and the intrastate market is the larger of the two markets. Colorado, Utah, and New Mexico most closely resemble State B. Their production levels are considerably lower than those of Montana and Wyoming and the intrastate market dominates. On the basis of markets Arizona could be placed with Montana and Wyoming because the interstate market is larger. However, Arizona has been classified with Colorado, Utah and New Mexico because the level of coal production is comparable to these states and because the interstate market, although larger, is not dominant. The sizes of the interstate and intrastate markets are comparable. Finally, State C was characterized as being an importer of coal to meet intrastate coal demand. Nevada and Idaho resemble State C.

One major policy issue is whether it is in the best interest of each of the six coal exporting states to act as a tax exporting cartel and impose uniform severance taxes. Of course, the answer to this question depends on the incidence of the tax and the price elasticity of demand and supply facing the individual states. Assuming the supply curve is not perfectly elastic, and given demand elasticities, it is apparent that the severance tax is partially shifted forward in the production process and is partially shifted backward to the owners of the factors of production, including the mine owners. Regarding demand, recent estimates of coal price elasticity for the Rocky Mountain Region suggest that demand is inelastic.[19] Price elasticities for the individual states were not explicitly derived. However, it is possible to make reasonable assumptions regarding the state coefficients. One would expect that, in general, the states resembling State A will have more inelastic demand coefficients than the states resembling State B because they have a larger share of the national market. Therefore, given the regional demand coefficients, it is reasonable to assume that the price elasticity of demand facing the states in Group A to be inelastic and the states in group B to be elastic or near

19. Estimates made by the U.S. Fed. Energy Admin. (Div. of Energy Systems, Modeling & Forecasting) for the Rocky Mountain Region are as follows: 5 year, to 1980–(−.459); 10 year, to 1985–(−.552); and 15 year, to 1990–(−.556). These data are unpublished. For a discussion of the derivation of the national coefficients *see* FEA, NATIONAL ENERGY OUTLOOK, app. C, C4-C10 (1976). The states included in the region for the purpose of making the estimates are Montana, Wyoming, Utah, Colorado and Idaho.

unitary elasticity. It would follow then that states in group A should be able to effectively use the severance tax to achieve tax exportation objectives because they are operating in the more inelastic portion of the demand curve. On the other hand, the states in group B will not be able to impose as heavy a severance tax because of their demand elasticity coefficients. Therefore, a federation of the exporting states developed for the purpose of maximizing regional tax exportation through severance taxation would not be expected to remain stable.

Assuming that the states in group B wish to maximize tax exportation they will have to rely relatively more on true property taxation and relatively less on production taxes than the states in group A. The incidence of the property tax will fall on the owners of the mine in the form of a reduction in the capitalized value of the mine. Of course, the property tax cannot be exported unless the coal mining company is owned by out-of-state residents.

If the objective is to maximize tax revenue, in some cases a combination of severance (production) and property taxes is desirable. Again, however, the states in group A would be expected to utilize higher severance taxes and place less reliance on property taxes because demand is more inelastic. On the other hand, the states in group B will not be able to utilize the severance tax as effectively because they face more elastic demand. It is clear from the model which depicted tax base dependence, that the states in group B will choose a combination of property taxation and severance taxation. The relative dependence will be determined by the equilibrium price elasticity faced by each state. If the state is operating in the elastic portion of the demand curve, it must place greater reliance on property taxes. As indicated by the model, in equilibrium, for each state the marginal contribution of each tax will be equal.

It is interesting to note that the tax policies of the state in group A should generate fewer political problems internally because of the ability of these states to place greater reliance on the severance tax. The incidence of severance taxes is diffused while the burden of coal property taxes falls on the owners of the mine.

The states in group C cannot rely on the severance tax to maximize tax exportation because they are coal importers. Their only choice is to employ property taxation for either state objective.

SUMMARY AND CONCLUSIONS

The central issue of this paper is whether a "taxing cartel" is a feasible alternative for the states in the Rocky Mountain Region. The

major focus has been on coal production and the severance tax. Of course, a taxing cartel is similar to a regular cartel of sellers when examining an individual member's behavior relative to other members' behavior; for if side payments or penalties are not permitted and market conditions are not compatible with the objectives of the cartel there will be a tendency for the participating parties to alter or avoid the terms of the agreement and any federation will be unstable.

Four possible objectives were considered which a state might pursue, but only two of the objectives seemed reasonable or likely, constrained total tax maximization and constrained tax exportation. Furthermore, the paper described three model states which roughly correspond to the types of states in the Rocky Mountain Region.

After relating the conditions which exist in the Region to the models developed in the paper, it was predicted that any taxing cartel agreements developed in the Region utilizing only the severance tax are likely to be unstable. Further, the analysis demonstrates that the smaller coal producing states in the Region must rely more heavily on the property tax rather than severance taxation to achieve their objectives. Finally, the coal importing states must rely totally on property taxation for either state objective. An examination of the coal tax structure in the states comprising the Rocky Mountain Region suggests that some states have tax policies which are consistent with maximization of tax exportation taking into account the demand conditions facing the respective states, e.g., Arizona and Montana.