

ECONOMIC EFFICIENCY AND THE DISTRIBUTION OF PROPERTY
RIGHTS TO EXHAUSTIBLE NATURAL RESOURCE RENTS

By

Oliver Scott Goldsmith
Associate Professor of Economics
Institute of Social and Economic Research
University of Alaska

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In recent years the economic rents accruing to nonrenewable energy resources have been growing at a dramatic rate. A question of continuing interest is who should be the beneficiary of those rents. Generally the question is analyzed from a national or international perspective, but the regional perspective is becoming increasingly important as nonrenewable energy resource discoveries become concentrated on public lands in a few western states, and the monetary stakes in the question of distribution continue to grow.

This paper investigates the implications for regional and federal economic efficiency of different ownership rights to the economic rents of nonrenewable energy resources. The focus is upon different groups publicly owning the property right. The main conclusion of the paper is that in a federal system it is difficult to allocate the property rights to nonrenewable natural resource rents between the local and the federal government in such a way that economic efficiency as defined either for the local region or the national economy is attained.

I.

In neoclassical economics the ownership of the economic rents which are the residual returns to scarce factors of production are immaterial to the efficient production and allocation of resources in the economy. This idea has been extended to the rents accruing to nonrenewable resources as well. For any given ownership pattern for the rents, an efficient allocation of economic resources can be identified both within a time period, and through time.

This proposition applies for both private and public ownership of the rents. The situation of the smaller OPEC nations demonstrate this point. When their oil reserves were controlled by the large oil companies, a pattern of development and production resulted which maximized the return on factors of production given the profit maximization objectives of the oil companies. Aside from criticisms of monopolistic practices, the resulting patterns were economically efficient.

When these OPEC nations obtained the property right to the majority of the economic rents from production of their own petroleum, there was a shift in both the pattern of production of petroleum and consumption of the rents. It has been relatively easy for the new property owners, the OPEC nations and their citizens, to identify in theory efficient strategies of production and consumption over time to maximize their welfare.

This welfare maximizing problem is straightforward; and although the solution is computationally complex, it is simple in theory. For a given population, the resource rents should be utilized in such a fashion as to maximize the discounted present value of per capita consumption. Alternative uses of the rents are various forms of investments and spending programs. Difficulties with making this problem operational arise from the question of the proper discount rate to apply to future consumption relative to the present, the empirical question of the rate of return on various types of investment, and the question of parameter values describing the interrelationships among the important economic variables. An example of an attempt to structure such a problem is a recent investigation of the optimal investment strategy for the petroleum revenues of Iran. The objective is to maximize the nonpetroleum capital stock (consumption capacity) at the point in time when the petroleum resource is depleted, subject to a current consumption constraint. The only choice for the resource planner is the proportion of investment each year to be made domestically rather than externally.¹

The production and consumption patterns differ considerably with the change in ownership of the rents, but both can be economically efficient in resource utilization.

II.

Turning to a federal system, the problem is more complex. There are two parts to the rent-ownership question. The first is the division between the private and the public sectors.

Discussions of economic efficiency are not relevant to the determination of the public-private split of the rents as the OPEC example has indicated. From a practical perspective, however, it is relevant for several reasons.² The first two are illustrated by the fact that no matter what a large oil company may do with the cash flow it receives as a result of the windfall profits tax, it will be criticized. On the one hand, it could invest in additional petroleum or other energy-related facilities and, consequently, be criticized for increasing its monopoly power. On the other hand, it could invest in some diversifying asset and would be criticized for wasting economic rents which should be invested in the search to reduce the cost of energy.

Consideration in the determination of a public-private split of the economic rents should include the following points.

1. The public sector costs associated with the development of the resource should be borne by the economic rents generated by production.
2. Economic efficiency requires that no producer or consumer have sufficient market power to affect prices. The accrual of sufficient rents to a single, private firm may create the opportunity for that to occur.

3. An efficiently operating economy will have a target rate of capital accumulation. The concentration of wealth associated with resource rents could change the rate of investment to reduce overall economic welfare.
4. The efficiency of investment and/or consumption as carried out by the private versus the public sector could be different.

These considerations do not offer much guidance for the determination of a fair allocation of rents between public and private ownership beyond establishing a minimum public allocation which is necessary to cover the public costs associated with resource development. But the allocation of funds to cover a real cost is by definition not an allocation out of rents. The other considerations can be dealt with by other means than the division of the economic rents between public and private ownership. For example, excess market power can be avoided by prohibiting investment in energy-related exploration and development.

Consequently, the public-private split question is a distributional one after all of the costs, public and private, have been accounted for.

III.

When the distribution of ownership between different levels of government is discussed for a given public-private split, then economic efficiency arguments become more relevant. Two authors have suggested criteria for determining how the split should be made. Anthony

Scott suggests four allocation criteria for making that decision.³

The first is resource revenues as benefit taxes. This is the idea introduced in the previous section that resource extraction imposes a cost on local governments which must provide goods and services to the business and individuals involved and that a portion of the rents should be allocated to cover those costs. Those goods and services provided by the local government which are attributable to the project generating the rents should be financed out of those rents.

Exhaustibility is the second criterion. Exploitation of the resource will occur over a relatively short period of time with fiscal consequences for the local jurisdiction. Scott identifies two aspects of this problem. The first has to do with the fact that there may be a difference between the planning of resource development and depletion and the planning of public works investment and depreciation. If the public works necessary to exploit a resource will last longer than the period of exploitation and would be unused in the absence of the exploitation, then the project should support not only the costs when it is utilizing the public works but also support the idle capacity of the public facilities.

The second aspect of exhaustibility is the result of outmigration from the region after exploitation has ended. This outmigration imposes a real cost in terms of expansion of public services in those regions into which the outmigrants immigrate. From these aspects of exhaustibility, Scott develops the following very general rule. "A

local jurisdiction's share of total resource revenue should vary directly with the "exhaustibility" of its resource (e.g., the inverse of its expected life), and the durability of the public works (e.g., their expected service life) associated with the exploitation of the resources; and should vary inversely with the proportion of the original population expected to remain, after resource extraction within the jurisdiction."⁴

The third criterion is time preference. Different levels of government may discount the future differently. Scott recognizes that because one level of government has a higher rate of current spending than another it may just be giving private citizens the opportunity to provide for their own future. More importantly he recognizes that it is difficult on efficiency grounds to argue one rate of discount over another unless there is identifiable ignorance or stupidity.⁵

The final criterion is risk aversion. It is recognized that different levels of government may exhibit different capabilities in dealing with risk or preferences regarding risk. There is a potential argument for assigning risky resource revenues to that level of government most able to handle risk in the sense of being able to pool risk. But this would be an allocation criterion for reducing aggregate risk by the choice of rent collector and not for distributing the rents themselves.

In concluding his discussion, Scott finds little in the modern Canadian experience to suggest that the time preference or risk aversion criteria have much applicability to the division of rents. He falls back on the benefit and exhaustibility criteria for allocation of rents.

A more recent attempt to develop an argument for the political division of resource rents has concentrated on the benefit and exhaustibility criteria. Lee Peters argues for a cost-based severance tax and divides the costs into five categories as follows:⁶ (1) Direct costs incurred by state and local governments to assist and facilitate resource development. This really includes both direct costs, such as environmental monitoring and the costs associated with the provision of public facilities in boom towns. (2) Public costs or damages, such as air, water, and land pollution. (3) Future costs which are related to problems of pollution which remain after extraction has been completed, such as the monitoring of uranium mine tailings. (4) Lost opportunity costs, such as the cost of a permanent reduction of an output of an aquifer in the event that a uranium mine changes the water table characteristics. And finally, (5) Asset replacement which "repays the state for the permanent reduction in the value of natural wealth of the state because of the extraction of resources."⁷

The environmental costs, categories (2) and (3), are not specifically characteristic of a nonrenewable resource although recovery of those costs may be most easily done using the device of a severance

tax on rents. The costs of a boom town are equivalent to Scott's criterion of resource revenues as benefit taxes. Lost opportunities are not only associated with the extraction of nonrenewable resources but rather occur daily as a normal outcome of economic decision making and are generally not compensated because they represent something other than the highest and best use of a resource.

Among the cost items only asset replacement is a cost attributable only to nonrenewable resources. Peters likens the extraction of a nonrenewable resource to the permanent reduction of the natural wealth of the state and accepts the idea that it is the state capital stock and should be treated as such by the state. Areas with renewable resources (presumably fishing or agriculture) need not develop new industries with the passage of time as do regions with nonrenewable industries which face the prospect of becoming ghost towns. The capital stock (nonrenewable resources) should generate a return to the region which can be reinvested to produce an alternate tax base of equal value. He mentions one suggestion that the level of this investment be such that the annual income produced by the alternative investments equal the income lost to the state because the resource is no longer being extracted.⁸

The cost attributable to asset replacement under this suggestion is indeterminate. Interpreted literally it is the entire value of the rents and implies the region should receive everything with nothing allocated to the federal government. This would be similar to the

forced withdrawal of all of an individual's savings from a particular bank over a ten-year period at a withdrawal rate determined by the bank. In order to obtain an equivalent return from the savings it would be necessary to invest the total amount, as it was withdrawn and net of the annual earnings on the total, in another bank.

The other problem with this approach is that it assumes there are market constraints on the free flow of investment capital among the states. If this is not the case (and it is difficult to argue that it is), then the alternative capital stock which would be generated in the region as a replacement to the exhaustible resource would have already been in place. That is, if there were really other investments of equal value within the region, they would already have been undertaken. Since they have not, that is some evidence that their rate of return is below the market rate.

We can derive two conclusions from this review. First both authors agree that the various direct costs of the nonrenewable project should be paid out of the rent or through the severance tax. These would specifically include lingering costs which remain after the facility has stopped operating, such as are associated with unused capital facilities which are not fully amortised and continuing environmental pollution. Impact costs would also be included. There is disagreement, however, as to how the "pure" rent should be divided. Peters suggests a large share should remain within the region as its "grubstake" while Scott suggests that the greater the proportion of

the original population who remain after resource extraction, the smaller should be the regional share. The disagreement here seems to arise from differing views on the relationship between the proportion of the "grubstake" which remains in the local jurisdiction and the population remaining after the completion of resource extraction.

IV.

An alternative approach to the question of the proper distribution of natural resource rents is suggested by the literature on economic efficiency and fiscal equalization. The basic idea is as follows: Different regions have different endowments of natural resources which are used in conjunction with labor to produce economic goods consumed privately and publicly. Individuals will locate in the region where their personal welfare, which is a combination of private and public income, is maximized. Because of the declining marginal cost in the production of the public goods with respect to additional population and the rents generated by the natural resources which can partially be used to fund the public goods, per capita taxes will be lower in the more richly endowed regions. Consequently, in-migration will occur, driving down the return to labor (the marginal product of labor) until the sum of the wage rate plus the fiscal residual (public consumption minus taxes) is equal across regions. This results in overpopulation in the resource rich regions from the perspective of global economic efficiency. This is because a shift in workers to the underpopulated region where the marginal product of labor is higher

could result in an increase in total output greater than would be necessary to compensate the movers and those left behind for any increase in their tax burden.

In order to restore Pareto-optimality through a reallocation of population, a tax on the workers in the overpopulated region, used to subsidize the provision of the public goods in the underpopulated region, has been suggested.⁹ A recent paper has gone a step further and argued for the interregional transfer to be made out of the rents rather than a tax on workers because of the ease of implementation of a rental tax.¹⁰

This suggests that the presence of differential rents can, in some cases, result in a nonoptimal distribution of population across regions in terms of national output and, consequently, provide another basis for the suggestion that there is an efficiency argument for the allocation of rents between local and federal jurisdictions.

V.

An alternative approach to the determination of the efficient distribution of rents would be to speculate on the possible or probable actions of a regional government in the utilization of a nonrenewable resource rent. We can compare the resulting economic consequences with a case in which the federal government receives all of the rents which are subsequently used to reduce the taxes of each

individual by an equal amount in every region. This later action could be considered to be globally Pareto-optimal because it is not distorting of the regional distribution of population and, consequently, maximizes welfare.

In reality, most goods and services provided by the state and local government are not "public goods" in the economists' sense of the word. An analysis of the budget of the State of Alaska reveals that including debt service about 88 percent of the budget is directly related to changes in population.¹¹ Furthermore, there is no strong evidence of economies or diseconomies of scale in most goods and services. Thus, it is reasonable to assume that as a region's population increases, the per capita cost of the provision of public goods and services will remain relatively constant. In the absence of economic rents to partially reduce the tax burden on individuals there will be no distortion in the net fiscal balance. Each individual could pay in taxes (if they were properly designed) exactly the amount necessary to cover his own costs of public goods and services.

If there is an economic rent accruing to the local government from a permanent or renewable resource, the rent can be consumed annually without depleting the future stream of rents and can be applied to reducing taxes for public services. The effects of such a policy would be predictable. First because taxes would fall, there would be an incentive to in-migrate into the region. This, in turn, would reduce the marginal product of labor (wage) and raise the price of

goods in fixed supply (land). A new equilibrium would be restored where the cost-adjusted wage plus public services net of taxes was again equal across regions. In the region of interest the wage rate would be lower, per capita taxes would be lower, and the population larger than if there were no resource rents. Aggregate output across regions would be less than the maximum possible because of the difference across regions in the marginal product of labor.

This case will not be Pareto-optimal if the given spatial distribution of resources is not considered to be part of the datum in the consideration of efficient resource allocation. By distributing a portion of the rents to other regions the distribution of population could be altered to raise total output, and the losers (those in the rent generating region) could be completely compensated without making anyone else worse off.

In reality, there seems to be only limited support for such a broad definition for the role of economics and for the economist. Few people would argue that there should be a tax on the good weather in California to reduce the population there and drive down the wage rate in New York, and no one is suggesting that the imposition of the coal severance tax by Montana would reduce aggregate economic output because of an overpopulation of Montana.

Thus, if the property right to the rents is assigned to the local government, there is no reason that there cannot be an optimal level

of aggregate output within the region; but if the property right were distributed among all regions, there would be another, perhaps higher, level of output which would be optimal using a broader definition of what is variable within the problem. If the location of natural resources is part of the datum of the determination of the Pareto-optimal, then any split of the rents may be efficient; but if the location of natural resources is a variable, then the more widespread distribution rents is optimal.¹²

Now return to the case in which the resource rents are nonrenewable. There are four basic things that the government can do with the nonrenewable rents and each will have a different impact on the economy.

1. Distribute the rents as they are collected. This policy insures that distortions resulting in inefficiencies will only last as long as the flow of rents, if individuals have perfect information about the future. During the period of resource production, however, there will be a shift in population towards the resource rich region which, because it is temporary, will have several implications. First, the wage rate will be temporarily depressed which may cause producers to make their locational decisions on the basis of incorrect signals. Second, the excess population and the need for public facilities and services to handle the impact

population will not be coincidental with the labor requirements in the production phase of the resource, but rather based upon the flow of rents from the sale of the resource which may have a longer time horizon. The collection and distribution of these rents after resource-related labor demand has passed results in a negative incentive for labor to migrate out of the region to places where its marginal product is higher. Because the out-migration is inevitable, there is no reason why it should not occur immediately after the labor is not productively employed in the region. Also, the public facilities must be scheduled so that they are coordinated not with the scheduled labor requirements of the facility but rather with the rents received.

These problems could be minimized if the distribution were not contingent upon residence in the region because the excess population would then be minimized. This would be equivalent, however, to assigning the rents to the federal government.

2. Increase government spending programs. This will have the same qualitative effect as a distribution program in terms of increased population and decreased real wage. This is because increased government spending increases the fiscal residual, just as does reduced taxes. (Individuals may view \$1 in reduced taxes as of more value than \$1 of additional

government.) To the extent spending lags the receipt of revenues the inevitable population out-migration is delayed and the inefficient spatial allocation of population persists.

This policy highlights more clearly one of the real resource costs of retention of rents from nonrenewable resources within the region. The average cost of public services may be constant in the region, but this cost may be considerably above the average for other regions. Thus, the provision of additional services to the regional population may be at a much higher cost than would be necessary elsewhere, and the provision of these services would entail a real output loss to society to the extent they were provided to individuals who would eventually migrate from the region.

3. Invest within the region (the Peters argument). In theory this would in itself have no effect because of the fungibility of capital argument. Political pressure, however, would likely result in investment in activities with a rate of return below the market in order to satisfy social objectives other than profit maximization, such as job creation within the region. The result is aggregate overinvestment. Expansion of the capital stock may occur at a faster rate, but the aggregate welfare will be reduced because of the reduced marginal value of investment. The wage rate will

rise in the region as a result of the capital expansion, and this will draw additional migrants into the region. Only when the rents have been completely dissipated through subsidization of below market rate of return investments, will the region contract to its long-run equilibrium level of population.

Interestingly, these three strategies are different forms of welfare maximization according to the principle of people prosperity from the perspective of the current residents of the resource rich region. They are all vehicles by which the public wealth, the rents, can most quickly be distributed to current residents. Ironically, however, these attempts to maximize the welfare of current residents all lead to substantial in-migration which reduces the public wealth of each individual since it must be shared with a larger group.

Thus, not only is any use of the rents which attempts to maximize the welfare of the current residents inefficient from a global perspective, but it is inconsistent because the definition of a resident is changing over time. Thus, there is a strong argument for assigning the property right to the federal government. (On the presumption that it will be distributed more or less equitably across all regions.)

4. Invest outside the region. A final alternative is for the regional rents to be invested outside the region. The investment becomes the tax base of the region in the absence of a natural resource. In this way, the temporary nonrenewable resource will have been converted into a renewable resource, a capital asset, and consequently, a permanent tax base for the region.

The effect of this alternative would be to minimize the inefficiency due to a population shift into the resource rich region. There would be no efficiency loss attributable to temporary migration into the region. In one sense this would also be consistent with and compatible with regional welfare maximization. This welfare maximization is a particular kind of place prosperity notion for the region which is a long-run welfare maximum for a given level of population--but not necessarily those individuals currently residing in the region.

The likelihood of implementation of this type of plan is remote although several states have established permanent funds which ostensibly serve this purpose. To the extent that nonrenewable resource rents are assigned to such funds and invested outside the region, there is no efficiency argument against the rents being the property of the region if the location of natural resources is accepted as part of the datum of the efficient spatial distribution of economic activity. But likewise there is no efficiency argument in favor of a regional property right to the rents.

VI.

In conclusion, the efficiency of different local-federal splits of nonrenewable resource rents depends upon the type of policy the regional government would follow if it had the rents and what the development of the regional economy would be like in the absence of the wealth represented by those rents. On the one hand, if the regional government behaves in a fashion which maximizes the welfare of current residents, then there is an efficiency argument for federal ownership of the property right because it results in a temporary overpopulation of the resource rich area and reduces aggregate output. If the regional government attempts to maximize the long-run welfare of a stable population independent of whether those individuals are current residents or not, then the efficiency argument against regional ownership of the property right is substantially weakened. This is because the resulting population shift associated with the resource is permanent and adjusting that population is arguably outside the scope of economic policy.

Footnotes

1. Homa Motomen, Expenditure of Oil Revenue: An Optimal Control Approach with Application to the Iranian Economy. (New York: St. Martins Press, 1979).
2. We ignore the question of how the property right is established and its possible effect on the efficiency of natural resource production. A severance tax is a common method for the public sector to obtain a portion of economic rents. It is difficult to structure such a tax so that it is not impossible distorting.
3. Anthony Scott, "Who Should Get Natural Resource Revenues?" in Natural Resources Revenues: A Test of Federalism, edited by Anthony Scott (Vancouver: University of British Columbia Press, 1976), p. 8-17.
4. Ibid, p. 13.
5. Ibid, p. 14.
6. Lee Peters, "An Outline for Development of Cost-Based State Severance Taxes," Natural Resources Journal, Vol. 20 (October 1980), pp. 913-931.
7. Ibid, pp. 926.
8. Lee Peters, Ibid, p. 928.
9. Frank Flatters, Vernon Henderson, and Peter Mieszkowski, "Public Goods, Efficiency, and Regional Fiscal Equalization," Journal of Public Economics, Vol. 3 (1974), p. 106.
10. Melville McMillan, "Interjurisdictional Mobility, Fiscal Equalization, and National Efficiency in a Federal Context," mimeo.
11. Scott Goldsmith, "A Generalized Method for Fiscal Impact Analysis of Large Projects Impacting Small Regional Economies," mimeo, 1981.
12. See James Buchanan and Richard Wagner, "An Efficiency Basis for Federal Fiscal Equalization," in The Analysis of Public Output, ed. Julius Margolis (New York: National Bureau of Economic Research, 1970), p. 142.

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