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Features

THE ECONOMIC IMPACT OF SHALE GAS DEVELOPMENT ON STATE AND LOCAL ECONOMIES: BENEFITS, COSTS, AND UNCERTAINTIES

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ABSTRACT

It is often assumed that natural gas exploration and development in the Marcellus Shale will bring great economic prosperity to state and local economies. Policymakers need accurate economic information on which to base decisions regarding permitting and regulation of shale gas extraction. This paper provides a summary review of research findings on the economic impacts of extractive industries, with an emphasis on peer-reviewed studies. The conclusions from the studies are varied and imply that further research, on a case-by-case basis, is necessary before definitive conclusions can be made regarding both short- and long-term implications for state and local economies.

Keywords: economic impact; shale gas development; extractive industries; hydraulic fracturing, fracking

The combined technologies of horizontal drilling and hydraulic fracturing have made it possible to extract large amounts of natural gas from the Marcellus Shale, which underlies portions of five states in the Northeast. Many commentators have assumed that shale gas exploration and development in these states will be enormously beneficial to the state and local economies. While externalities, both positive and negative, are commonly experienced along with the direct

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activities of extractive industries, the negative externalities and the overall net benefits are often overlooked in economic impact studies. Examples of negative externalities in connection with shale gas development include water, air and land contamination; related public health impacts; wear and tear on roads and other infrastructure; and costs to communities due to increased demand for services such as police, fire, first responders, and hospitals.

An understanding of economic impacts in the Marcellus Shale region can be enhanced by a wider knowledge of boom-bust cycles, the resource curse, and extractive industries generally. In an effort to investigate both the potential net benefits to state and local economies and how policymakers may evaluate them, this article offers a summary review of research findings and makes suggestions for further research that would be necessary to adequately analyze the net economic impact of shale gas development. It also offers a preliminary look at some economic measurements in the Barnett Shale play in Texas that are not often mentioned in relation to shale gas development. The first section provides a brief critique of some of the industry-sponsored, non-peer-reviewed studies, and it is followed by a summary of peer-reviewed literature and non-industry-funded studies that are relevant to extractive industries such as shale gas development. The final section discusses some of the costs and uncertainties inherent in any economic assessment of shale gas development.

STUDIES FUNDED BY INDUSTRY

Numerous studies have been prepared by and/or funded by the gas industry [1-6]. They generally conclude that there will be large, positive economic impacts to both states and local communities. These studies primarily highlight benefits such as employment, income, and tax revenue growth. Kinnaman [7] has reviewed several of these industry-sponsored studies and observed that they are not peer-reviewed. He has raised a number of concerns about the industry-sponsored studies, and concluded that due to unrealistic assumptions regarding windfall gains to households, location of suppliers and property owners, and the methodology used, the estimates of economic benefits in the industry-sponsored studies are very likely overstated. Any economic activity, including shale gas development, will generate some level of state and local economic revenues and provide some number of state and local employment opportunities, but policymakers should recognize that the estimated gains in revenues and employment are probably exaggerated in the industry-funded studies and the long-term economic impact may be far different than expected. In addition to the points made by Kinnaman [7], the estimates in these studies may be further overstated if overly optimistic gas reserve and production assumptions were used. There have been widely differing estimates of Marcellus Shale gas reserves from various sources, including academicians and federal government agencies [8]. For all these reasons, it is possible that the net benefits cited by industry-sponsored studies are overstated even before any adjustments are made for negative externalities.

Input-output analysis is frequently used by industry in their efforts to show direct, indirect, and induced economic impacts of shale gas development [1-3]. Using this technique, the industry-funded studies have captured some of the likely benefits of shale gas development, including the growth of ancillary and other industries. Input-output analysis relies on tables of coefficients that link each industry in a region to all other industries. An input-output matrix shows how much output from each industry is used as input into other industries. In a region where shale gas drilling has not existed in the past, it is impossible to know with certainty what the inter-industry coefficients will be, and "borrowing" them from other regions or industries may result in inaccurate impact conclusions [9].

An important fact to bear in mind when viewing the shale gas experience in Texas and trying to extrapolate it to other states, such as New York, is that Texas is likely to experience greater economic benefits from shale gas development than is New York. Texas has had a well-established oil and gas industry for many years and a labor force with the requisite skill sets. Oil and gas headquarters and main offices are more often in Texas than in New York. Many of the industries that are ancillary to gas exploration and development are also located in Texas, not in New York. New York will have to import skilled labor as well as materials and equipment, much of which is manufactured, managed, contracted for, and maintained in Texas. Economists at the Federal Reserve Bank of Dallas (Dallas Fed) have pointed out that due to the extensive oilfield machinery and energy services located in Texas, the state greatly benefits from oil and gas production throughout the world [10]. In addition, the Barnett Shale is in the Dallas–Fort Worth metroplex, a region that is much more urban than the Marcellus Shale region. The literature indicates that the impact of extractive industries in nonmetropolitan areas may be much different than in metropolitan areas [11]. Economic multipliers tend to be larger in metropolitan areas, such as the Dallas-Fort Worth metroplex, where there are larger populations and greater industrial diversity than in nonmetropolitan areas, such as the Marcellus Shale region of upstate New York [12].

Kinnaman has pointed out that "economic resources necessary to fuel a growing industry would either relocate from other regions of the country or shift from local industries within the region. . . . The IMPLAN model used . . . largely ignores the possibilities of direct spending crowding out other users of the resource" [7]. An additional weakness is the fact that environmental impacts are ignored. Wassily Leontief, who received the Nobel Prize in Economic Science for his model of input-output economics, had himself stressed as early as the 1970s that environmental repercussions and externalities should be incorporated into input-output analysis [13-15]. Leontief recommended that a pollution abatement industry be entered into the input-output matrix, and that the abatement industry be in the business of eliminating pollutants generated by the productive sectors, consumers, and the abatement industry itself. And Wiedmann, Lenzen, Turner, and Barrett stated, "in the last few years models have emerged that use a more sophisticated multi-region, multi-sector input-output framework . . . in order to calculate environmental impacts. . . . Results demonstrate that it is important to explicitly consider the production recipe, land and energy use as well as emissions in a multi-region, multi-sector and multi-directional trade model with detailed sector disaggregation" [16]. The industry-sponsored studies have not addressed environmental repercussions, such as water and air contamination, or externalities such as damage to roads and costs to communities. Unless appropriate adjustments are made, input-output analysis tends to use unrealistic assumptions. Bess and Ambargis [17] and Lazarus, Platas, and Morse [18] discuss some of the limitations of input-output analysis. For example, Bess and Ambargis state, "Regional input-output models can be useful tools for estimating the total effects that an initial change in economic activity will have on a local economy. However, these models are not appropriate for all applications and care should be given to their use. . . . Key assumptions of these models typically include fixed production patterns and no supply constraints. Assumptions about the amount of inputs that are supplied from the local region are also important in these models. Ignoring these assumptions can lead to inaccurate estimates" [17]. There are several additional problems of particular relevance to the application of input-output analysis to the study of shale gas development. For example, while spending patterns in communities with an established drilling industry would probably be different than spending patterns in communities without an established drilling industry, this difference is not reflected. Input-output analysis implicitly assumes that all populations have identical spending patterns. This assumption exaggerates the estimated economic impact if new workers are transient. The gas industry frequently brings in transient workers and houses them in man-camps or rental housing on a short-term basis [19]. Such workers often send their wages to their families living elsewhere, improving the economies in those distant locations, not in the shale region, and thereby exaggerating the estimated economic impact. In addition, input-output analysis assumes "constant returns to scale." This means that the gas industry would get no volume discounts on supplies. This is an unrealistic assumption, and it inflates estimates of industry spending and thus estimates of economic impacts from the industry's activity in the community. Input-output models used in the industry-sponsored studies tend to be static in time, implying that there are no changes in coefficients over time and no allowance for price changes in factors of production such as supplies and labor. The production function is also assumed to be constant. This does not allow for input substitution or changes in the proportions of inputs as technology and/or prices change over time. Input-output models tend to be aspatial, implying that transportation costs are not fully reflected. Transportation costs in gas drilling areas may differ due to differences in availability of and proximity to fresh water supplies and wastewater disposal wells.

In order to produce even somewhat accurate results using an input-output approach, inter-industry relationships must be known. There are several frequently used sources of input-output coefficients that indicate how the input and output of each industry in a given region are related [20, 21]. One cannot know what the true coefficient values are in a case where the industry being studied does not already exist in a region, as is the case for horizontal drilling and hydraulic fracturing in New York State. Even if the input-output coefficients could be known, the technique is of limited use. Input-output methodology estimates the positive impacts on variables such as employment, value added, and tax revenue, but as shown in the above discussion of assumptions, the estimates are often exaggerated; and the methodology does not capture the impacts of environmental degradation or the full costs to communities and society.

STUDIES NOT FUNDED BY INDUSTRY

While studies not funded by the gas industry on the economic impact of shale gas drilling are in short supply, there is substantial peer-reviewed literature on the economic impact of extractive industries generally. There are also some studies that are not peer-reviewed but are not funded by the gas industry. Conclusions from peer-reviewed literature and from studies not funded by the gas industry should be considered in the analysis of shale gas development. The research summary below is categorized into three areas: the resource curse, boom and bust cycles, and socio economics.

The Resource Curse

Research by Sachs and Warner [22, 23] concluded that there is a "natural resource curse," meaning that countries with great natural resource wealth tend to grow more slowly than resource-poor countries. The so-called "resource curse" has been the subject of several literature surveys and the peer-reviewed research indicates that the resource curse holds within the United States, particularly in regions where there was once a strong extractive industry. After reviewing much of the literature, Stevens [24] pointed out that while there has been some disagreement, the evidence appears to support a negative relationship between abundance of natural resources and economic growth. He concluded that there is no simple single explanation of what creates a "blessing" rather than a "curse," and he argued for a case-by-case approach to analysis. His findings indicate that to decrease the likelihood of a "curse," the resource should be developed at a slow pace, thereby improving the chances that the economy and society can adjust and the crowding-out effect may be reduced. Increased diversification is suggested as another way to decrease the "curse" effect. Key dimensions of the resource curse that have been studied include negative impacts on economic growth, prevalence of poverty, and creation of greater conflicts in society. Regional and national impacts may be quite different. Stevens stated, "A final dimension of 'resource curse' is the regional impact of the projects. Thus while the effect at a national level might be debated, because of the heavy local impact of the projects, clear damage is done especially in terms of both the environment and human rights. Meanwhile, the benefits appear to flow to central rather than regional authority. However, this aspect of the 'curse' tends to be neglected in the economics literature" [24].

This dichotomy between benefits to a nation and damage to localities should be studied further in the case of shale gas development in the United States. Industry-funded studies [25, 26] have concluded that there will be large positive impacts on tax revenues and national employment levels, but they have ignored many negative impacts that would be incurred at the local and state levels. In the case of shale gas development, it is likely that policymakers at the state and local levels will have different interests than policymakers at the national level. One question that policymakers at all levels should consider is whether shale gas development, including its exploration, production, and exportation, is worth the costs to the states, communities, and individuals that are directly impacted.

Initial research on the natural resource curse was focused on how it impacts developing nations [22-24]. Such research includes extensive empirical analysis and speculation on what causes the resource curse. While there has been less research on the natural resource curse specific to the United States, Papyrakis and Gerlagh [27] focused on the United States. They concluded that even in the United States, natural resource abundance is a significant negative determinant of economic growth. James and Aadland [28] extended the research to a disaggregated level within the United States, by focusing on counties. Their results show "clear evidence that resource-dependent counties exhibit more anemic growth, even after controlling for state-specific effects, socio-demographic differences, initial income, and spatial correlation" [28].

Headwaters Economics studied county-level impacts and concluded, "counties that were not focused on fossil fuel extraction as an economic development strategy experienced higher growth rates, more diverse economies, better educated populations, a smaller gap between high and low income households and more retirement and investment income" [29]. Peach and Starbuck [30] studied oil and gas extraction in New Mexico and found a small but positive effect on income, employment, and population.

It may be difficult to determine if extraction of a natural resource caused poorer economic performance in an affected region or if the region was already relatively poor or on the path to poverty prior to exploitation of the resource. In two cases that are specific to counties in the United States, and were cited above, James and Aadland [28] and Headwaters [29], attempts were made to control for initial income and other differing characteristics of the areas under study.

Boom and Bust

Extractive industries are known for their boom-and-bust cycles [31], and the bust must be analyzed as well as the boom. Weber [32] focused on the short-term impact of a natural gas boom in Colorado, Texas, and Wyoming and found modest increases in employment, wage and salary income, and median household income. The negative economic consequences during the bust may exceed the positive direct economic impact during the boom. Black, McKinnish, and Sanders [33] studied the coal boom in the 1970s and the bust in the 1980s on local economies in the four-state region of Kentucky, Ohio, Pennsylvania, and West Virginia. They concluded, "for each 10 jobs produced in the coal sector during the boom, we estimate that fewer than 2 jobs were produced in the local-good sectors of construction, retail and services. The spillovers from the coal bust were larger. During the coal bust, we estimate that for each 10 jobs lost in the coal sector, 3.5 were lost in the construction, retail and services sector" [33]. Seydlitz and Laska studied boom-and-bust cycles of the petroleum industry in Louisiana and concluded that improved community economic health is transitory in areas with petroleum extraction, and "improvements can be lost as early as the second or third year after an increase in petroleum activity and will be lost during the bust if not sooner" [34]. They suggest that a diversified economy may help to prevent some of the loss in benefits. Christopherson and Rightor [35] have written about the boom and bust phenomenon as it impacts shale gas extraction, and they suggest that the boom and bust cycle can be controlled by slowing the pace and scale of shale gas development.

Socioeconomics

Peer-reviewed sociology journals have published articles on the socioeconomic impact of extractive industries in the United States, and the results of this research should be considered by policymakers in their assessment of the economic impact of shale gas development. For example, Freudenburg and Wilson [11] analyzed 301 research findings regarding the impact of mining in the United States, and they concluded that adverse conditions are significantly more likely than positive outcomes. They also stated, "the areas of the United States having the highest levels of long-term poverty, outside of those having a history of racial inequalities, tend to be found in the very places that were once the site of thriving extractive industries" [11].

Wilson [36] studied the socioeconomic well-being of mining communities by comparing two communities in the Midwest and concluded that local well-being as a result of mining in a community is influenced by local circumstances such as "levels of economic dependence on mining, the geographic distribution of the workforce, and the options available to the companies to confront changes in minerals price." Wilson's research indicates that different mining communities within the same region of the Untied States can have different long-term employment impacts, and case-by-case research is required.

SOME COSTS AND UNCERTAINTIES SPECIFIC TO SHALE GAS

The relevant peer-reviewed research, as described above, indicates that each extractive industry and its impacts on specific states and locations must be studied on a case-by-case basis. There are many uncertainties regarding the long-term impacts on local and regional economies. Long-term impacts on the number of jobs created, unemployment rates, and income and poverty levels should each be considered. There are likely to be significant local costs, and these must also be considered. As horizontal, high-volume slick-water hydraulic fracturing for natural gas is still in its early stages, it is premature to analyze and attempt to make definitive conclusions regarding the long-term economic impacts of shale gas development in the United States. However, since the Barnett Shale play in Texas has been active for about a decade, some early indications of economic health are emerging. According to the Texas Railroad Commission [37], there are four core gas-drilling counties in the Barnett Shale: Denton, Johnson, Tarrant, and Wise counties. While there are many reasons why economic data and trends in certain counties differ from state-level data, it is interesting to examine unemployment rates, growth in median household income, and the number of people in poverty in these core gas-drilling counties as compared to statewide data. The data indicate that the residents of these counties are not experiencing great economic prosperity relative to the rest of Texas. Data were obtained from the U.S. Census Bureau, Small Area Estimates Branch, and the Bureau of Labor Statistics [38, 39]. For the period from 2003 to 2010, median household income increased by 21.2 percent in the state of Texas, but in the four core counties, median household income increased between 10 percent and 16 percent. And for the same period, the increase in the unemployment rates for the four counties ranged from 1.8 to 2.4 percentage points, a little higher than the increase in the state-level unemployment rate, which was 1.5 percentage points. Finally, the number of people in poverty in the four-county areas increased, in percentage terms, just as much as statewide.

Significant costs that are associated with shale gas development and other extractive industries should be considered in any study of the economic impact of shale gas development. Such costs are often omitted in both peer-reviewed literature and in the industry-funded studies. Kinnaman [7] briefly discusses the implications of social costs and implementation of a tax on negative externalities, which is intended as an incentive to reduce the negative externality and may be used as a source of funds to help mitigate negative impacts. A few of the costs that have not been adequately addressed in the literature are summarized here.

Shale gas development may transform a previously pristine and quiet natural region, bringing increased industrialization to the region in the form of industrial contaminants, heavy truck traffic, and excessive noise. Due to concerns regarding potential water, air, and land contamination, industries that have been vital to some of the communities in the shale region may decline. Industries that are incompatible with high levels of industrialization and potential environmental degradation include agriculture, tourism, organic farming, hunting, fishing, outdoor recreation, and wine and beer making. Each of these industries that rely on clean air, land, water, and/or a tranquil environment is currently important to the shale counties in upstate New York. Kauffman [40] has calculated that the net present value, using a discount rate of 3 percent over 100 years, of natural goods and services from ecosystems in the New York State portion of the Delaware River Basin is $113.6 billion.

Tourism is an industry that has been encouraged in many of the communities on the Marcellus Shale, and Rumbach [41] reported that in 2008, visitors spent more than $239 million in three counties of New York State's Southern Tier, and the tourism and travel sector accounted for 3,335 direct jobs and nearly $66 million in labor income. The Outdoor Industry Association [42] reports that 6.1 million American jobs are directly supported by the outdoor industry and that Americans spend $646 billion each year on activities like camping, hunting, fishing, and snow sports, all of which are popular in the Marcellus Shale region.

Deller et al. [43] analyze economic growth due to tourism in areas with natural amenities that encourage outdoor recreation and conclude that rural areas that can take advantage of such amenities are in a position to expand their local economies. Public fears of water, air, and land contamination due to shale gas development, whether those fears are realistic or not, may forever negatively impact the public perception of the rural areas that currently enjoy tourism dollars. Another related sector of the economy in the shale region of New York centers around retirees and owners of second homes, both of whom may become less enamored of a region when it becomes industrialized. Such potential losses to communities should be reflected in an economic assessment.

Estimating the ignored costs is not a simple task, but there are ways to at least roughly estimate many of the costs that have been ignored to date. Rumbach [41] analyzed the potential impact of shale gas drilling on the New York tourism industry, and his work may assist in attempting to estimate impacts. He points out that tourism brings many non-monetary benefits to the region and its communities, and its amenities improve the quality of life for residents. He states, "Restaurants, shops, parks and outdoor recreation areas, campgrounds, wineries, festivals, museums and other related amenities are beneficial to local residents as well as visitors. These amenities also make a region more attractive for economic investment; they are some of the crucial resources that allow an area to attract economically mobile populations." He questions whether drilling will permanently damage the "brand" of the region as a pristine and picturesque destination. Brand image may also be affected for agricultural products from shale areas. In an open letter on the subject of shale gas development, the president of the Park Slope Food Coop, a very large food coop in Brooklyn, NY, stated, “I guarantee that our members will not want the fruits and veggies that come from farms in an industrial area” [44]. The use of surveys and focus groups may help to estimate the extent of the impact of “brand” image on customers and the overall impact on some of the impacted industries. Probability or risk models, based on the likelihood of contamination, may also be employed. In the case of the impact on hunting and fishing, volume decreases can be estimated using surveys of businesses and customers together with official state data on game animal harvests and creel surveys in areas already experiencing shale gas development. The impact on outdoor recreation and related facilities can be estimated through surveys, attendance records at major facilities, and the loss to businesses that cater to such customers.

Additional costs that should be estimated are the costs to communities associated with increased demand for community social services, such as police and fire departments, first responders, and local hospitals. Such cost increases resulting from gas drilling have taken place in the Rocky Mountains [45, 46], and research from Pennsylvania shows that many municipalities have experienced increased costs [47]. As the shale gas industry imports labor from other states, transient workers will exert additional demand on community services and further upward pressure on costs.

There will be costs associated with traffic congestion and road damage. The heavy truck traffic required for shale gas development is known to cause air quality issues and significant road damage. It was recently reported that the Texas Department of Transportation told industry representatives and elected officials that “repairing roads damaged by drilling activity to bring them up to standard would ‘conservatively’ cost $1 billion for farm-to-market roads and another $1 billion for local roads. And that doesn’t include the costs of maintaining interstate and state highways” [48]. The New York State Department of Transportation made a preliminary statement that “the impacts of Marcellus Shale gas development on State transportation financing needs is likely to be profound. . . . The incremental costs to mitigate Marcellus impacts for the State range from $90 million to $156 million per year. The estimate for costs for local roads and bridges range from $121 million to $222 million per year, some of which may well flow from the State Transportation Budget” [49].

The impact on property values is uncertain and has been inadequately addressed in the literature. On the one hand, increased property valuations of large tracts may be expected due to potential income from gas drilling, and an influx of transient workers will probably increase the demand for and value of rental properties. The net impact on property values, however, is uncertain. Shale gas drilling is taking place in homeowners’ backyards, and such industrial activity and the presence of hazardous materials are in many cases in violation of residential mortgage conditions [50]. Boxall, Chan, and McMillan [51] studied the impact of oil and gas drilling on residential property values in

Alberta, Canada, and found a negative relationship. The authors note that three industry-funded studies did not find a negative relationship between gas drilling and residential property values [52-54]. Again, while the impact on property values is difficult to estimate, there is relevant literature. For example, Taylor, Phaneuf, and Liu [55] used an empirical model to identify the direct impact of environmental contamination on residential housing prices separate from land use externalities. Muehlenbachs, Spiller, and Timmins [56] demonstrated that the risk of groundwater contamination from natural gas extraction leads to "a large and significant reduction in house prices." They further found that "these reductions offset any gains to the owners of groundwater-dependent properties from lease payments or improved local economic conditions, and may even lead to a net drop in prices. . . . To the extent that the net effect of drilling on groundwater-dependent houses might even be negative, we could see an increase in the likelihood of foreclosure in areas experiencing rapid growth of hydraulic fracturing."

Recent reports indicate that obtaining insurance is likely to become increasingly difficult, if not impossible, for properties that may be impacted by shale gas drilling [57]. This will negatively impact property values, as residential mortgages require the property owner to carry homeowner's insurance. A representative of Nationwide Insurance recently stated in email correspondence, "From an underwriting standpoint, we do not have a comfort level with the unique risks associated with the fracking process to provide coverage at a reasonable price" [58]. If available in the future, the cost of obtaining such insurance to protect against the substantial risks inherent in shale gas drilling using hydraulic fracturing techniques may become prohibitively high. This is another example of a cost that is omitted in the research to date. Data on trends in housing sales and prices in existing shale regions should be analyzed in detail to help identify the impact on property values.

Potential public health costs should be reflected in a thorough economic assessment. Multiple researchers have discussed potential negative health impacts that may result from water and air contamination. Various chemicals used in hydraulic fracturing include carcinogens and endocrine disruptors, which are related to serious diseases and birth defects, both involving significant costs. Bamberger and Oswald [59], Schmidt [60], Weinhold [61], and McKenzie, Witter, Newman, and Adgate [62] have investigated health impacts. In the case of humans, such costs can be estimated by measuring health services costs related to specific diseases and the loss of life and decreases in life expectancy. In the case of domestic and farm animals, values may be assigned based on market prices. All these health costs should be estimated using probabilities based on the likelihood of contamination by the various pathways.

An opportunity cost that should be factored into the analysis is the foregone economic development in areas where networks of gas pipelines are constructed.

As buildings cannot be placed on or adjacent to pipelines, shale gas development may cause future construction and economic development to be significantly curtailed [63]. This foregone regional development and the possibility of earthquake damage caused by disposing wastewater into deep injection wells [64] are uncertain costs that may be impossible to measure, but they may become enormous costs to communities in the long-run. Dutzik, Ridlington, and Rumpler [65] have outlined many of the economic costs, made a few suggestions regarding estimation of some of the costs, and shown that communities and states will bear many of the costs.

All potential benefits and costs of shale gas development should be considered during the decision-making process. Some questions that policymakers should ponder, in addition to the basic question of whether there will be net economic benefits to states and communities, are the following: (1) Are the potential benefits to the nation in the form of balance of payments gains from shale gas exports worth the risks to the environment, public health, and local economies? (2) Is the continued development of fossil fuels and their impact on climate change sensible in light of the uncertainty regarding the impacts on public health and state and local economies? One cannot answer such questions until a comprehensive analysis of net economic impacts has been completed. One way to view the net impacts and the many tradeoffs is to think of the benefits and costs to a region or a state as assets and liabilities in the form of a balance sheet for the region. As an example, Figure 1 presents such a balance sheet for New York State.

In conclusion, there are many uncertainties regarding the net benefits of shale gas development on state and local economies. There are sufficient independent research findings on extractive industry impacts to question the claims commonly propounded by the industry, and repeated by the press, that shale gas extraction will bring prosperity to local communities. The preponderance of independent research indicates that long-term prosperity for local communities is unlikely, but far more research is required in order to make a definitive conclusion. Policymakers should insist on unbiased, comprehensive economic assessments of shale gas development for each state and community that may be impacted.

AUTHOR'S BIOGRAPHY

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A Balance Sheet for New York State: What is New York State's Net Equity from Shale Gas Development?

➤ Assets*

Tax Revenue:
- Direct from the gas industry based on future legislation
- Increased income tax based on
  - Royalty income to leaseholders
  - Lease income to landowners

Stimulation of industries based on byproducts of natural gas

Climate benefits from decreases in green house gases from burning shale gas

Indirect benefit to NYS from improved Balance of Payments assuming substantial shale gas exports

Short-term job gains in the gas industry and related industries

Increased spending by leaseholders in New York State

Lower cost of energy as long as it lasts

TOTAL ASSETS **???**

*These are not necessarily comprehensive lists of assets and liabilities. They serve only as examples. Note that where an asset or liability is a future stream of income or expense, discounted present value should be used.

➤ Liabilities*

Tax Revenue Loss:
- Income tax losses by leaseholders who vacate properties and relocate out-of-state
- Income tax losses caused by decreases in tourism and other industries negatively affected by drilling
- Property tax losses caused by negative impact of drilling on property values and financing

Decreased spending by leaseholders if they move out of state, or buy second homes out of state

Human health costs associated with:
- Water contamination from frack fluids and wastewater
- Air pollution from compressors, leaks, gas released at well-sites

Costs due to impacts on animals (domestic, agricultural and game) of water, land and air contamination

Climate costs associated with increases in greenhouse gases from methane leaks and venting

Costs associated with declining quality of life due to the creation of an industrial landscape

Costs associated with declines in tourism industry

Costs associated with declines in organic farming and other agriculture and food manufacturing

Costs associated with declines in outdoor recreation

Costs associated with increased air pollution from increased truck traffic

Costs associated with declines in fisheries and trout fishing industry

Infrastructure costs due to use of and damage to roads and bridges from increased truck traffic

Costs due to declines in numbers of retirees and retirement housing market

Costs due to declines in numbers of second home owners and second home market

Costs due to crowding out (loss of jobs to existing businesses and governments)

Costs to communities due to increased demand for police, fire and first responder services

Social costs associated with the gas drilling industry

Costs to the mortgage industry and housing market, and related declines in property values and property tax revenue

Costs associated with increased homelessness

Costs associated with the postponement of investment in renewables

Opportunity costs due to the prevention of future building and economic development

Costs associated with a long-term bust, characteristic of extractive industries

TOTAL LIABILITIES **???**

NET EQUITY **???**

Is the **Discounted Present Value of Total Assets** minus the **Discounted Present Value of Total Liabilities** a positive value?

This question cannot be answered until a comprehensive risk assessment and economic analysis has been conducted.

Figure 1. A snapshot of one state's net impacts and tradeoffs, formatted as a balance sheet.

NOTES

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