Impact Mitigation in Western Energy Boomtowns

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BOOMTOWNS are not new to the American West, but their reappearance in the late 1960s has launched the first effort to better understand and mitigate the impacts of rapid growth. Although boomtowns are located throughout the intermountain West, Wyoming's recent history provides the best indication of what energy development has meant to the rural West. Two of the most highly publicized boomtowns, Rock Springs and Gillette, are in Wyoming. During the 1960s, agriculture was Wyoming's leading industry, and, with natural population increase barely offsetting out-migration, the state's population grew from about 330,000 to only 332,000. Despite lean times for agriculture during most of the 1970s, Wyoming's population had grown to 470,000 by early 1980, an increase of 41 percent. The growth surge, including the growth of several boomtowns, was due almost exclusively to higher prices for oil, gas, coal, and uranium. Towns such as Gillette and Rock Springs more than doubled in population. Environmental legislation encouraging the use of low-sulfur western coal was also a factor in the upsurge. Mining is now Wyoming's top source of income, with agriculture a distant third.

Many view the price of such growth as unacceptably high. Industry is concerned because it feels that rapid growth is likely to have produced the combination of high wages and low productivity present in many parts of the region. Government appears to see boomtowns as a cause of social problems and as a factor increasing the cost of developing domestic energy resources. The social problems are by themselves a major political issue. Higher production costs reduce domestic energy production, which increases the United States's reliance on foreign sources of energy. Social scientists, aware of the unfavorable light in which many people view the boomtown phenomenon, have undertaken a respectable quantity of research in such areas as how to lessen the impact of rapid growth. The purpose of this paper is to assess the contribution of some of this research.

Assessing impacts and suggesting aid for the boomtown's problems generally involve several distinct steps. The planning process begins with data collection in an attempt to predict the nature and timing of major impacts. Thus, I will examine the data collection efforts of various researchers first in this paper. The following section considers the general characteristics of three classes of impact projection models. Accompanying social problems, which are especially difficult to quantify accurately in a model, are discussed separately. Costs of impact mitigation obligate us to decide how much impact mitigation effort to supply, as is discussed in a later section. Local government revenues which do not always respond to the increased demands of rapid growth when and where needed and funding problems (front-end financing and jurisdictional mismatches) are the subjects, respectively, of other sections. Finally, some attention is given to the issue of impact prevention and to factors which influence the intensity of the boom and thereby affect the level of most impacts of rapid growth.

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Impact Projection Models

Successful mitigation of rapid growth impacts must begin with a timely, reliable, and detailed projection of the extent of growth. Numerous computerized models (such as BREAM, SEARS, ATOM3, NMED, COALTOWN, BOOM1, REAP, UPED, TAMS, RIMS, SEAM, and NED, to name a few) have been developed for, or adapted to, that purpose. A detailed examination of each is not within the scope of this analysis. Instead, an assessment of the applicability of three general types of models to boomtowns is conducted here. The models represented by the acronyms above and others which have been or are currently being developed for boomtowns are driven by input-output (I-O), economic base (EB), or econometric submodels.

Economic base and input-output models are similar in many respects. EB models provide less detailed economic projections than I-O models and thus necessarily limit the accuracy with which the model's other endogenous variables are predicted. On the other hand, the EB model parameters are more easily estimated and updated. Proponents, without exception, faithfully admit the restrictive nature of the assumptions inherent in I-O and EB models, but only a few authors explicitly recognize the serious flaws of I-O and EB when applied to projections of boomtown impacts.[1] The constancy of multipliers and technical coefficients is the major shortcoming of I-O and EB when the study area in question is not experiencing net growth, but the constant coefficient assumption is completely inappropriate when, by definition, rapid growth is causing major changes in the economic structure of a region. One very desirable characteristic of a projection model is that it be able to predict those structural changes.

The static nature of I-O and EB models is also a problem. They are unable to provide any information about the adjustment process as a region moves through the various stages of energy development. The availability of such information is important because construction of a project, not its operation, is likely to be the cause of the lion's share of any negative impacts which occur. The adjustment process, not the new equilibrium conditions, causes most of the negative impacts. In the view of Fisher, Krutilla, and Rice, the inability of I-O models to shed any light on the dynamic adjustments occurring in boomtowns is "a final—probably fatal—disadvantage."[2]

One particularly important dynamic adjustment not captured by impact projection models is the early indirect effect of rapid growth on local service industries. According to Jurado, higher wages paid by the energy industry induce job switching which, on average, claims about 30 percent of the original employment of the local service sector.[3] Thus, in the early stages of rapid growth, service employment and consequently the availability of services are cut (an important negative impact) just when the demand for those services is rapidly increasing. Eventually, higher wages bring in new workers to fill vacancies in both the energy and local service industries. However, rapid growth also attracts new businesses to the boomtown. So, in the early stages of rapid growth local businessmen find themselves in a losing battle for workers, and later they may be unable to compete for customers with the larger national franchises.[4] An increase in the size of business establishments is regarded as an improvement by some, but the pre-boom members of the local business community view it as a negative impact. It would certainly be desirable to capture at least the effect of job-switching on the supply of local services in an impact projection model and perhaps also to track changes in establishment size.

Inasmuch as regression coefficients are also constants, the problem of fixed parameters also exists for econometric models. Bender admits that the assumption of constant economic structure implied by fixed slope coefficients is a significant limitation of his COALTOWN econometric model.[5] That criticism also applies to other boomtown econometric models.

Other features of the typical projection model deserve some mention. A complete model includes subcomponents to project fiscal, economic, demographic, and residential location formation. Typically, the employment demand projection of the economic submodel is reconciled with the labor supply projection of the demographic submodel through in- or out-migration. The actual force inducing the migration, namely, wage differentials, is not included either as an input or as an output of most models. The COALTOWN model of Bender and the disequilibrium model proposed by McNown[6] are exceptions. Knowledge of future wage rates would help public and private decision-making agents. In addition, explicit inclusion of wage rates in the models would probably improve their accuracy. For boomtowns, the wage rate is probably the major equilibrating force and as such should be included both exogenously (initially) and endogenously in any model.

Workers at western energy projects have been known to commute very long distances. That commuting greatly complicates any impact mitigation effort because it is difficult to determine where additional services and public improvements will be needed. According to Murdock, Wieland, and Leistritz, the gravity model, a traditional and reasonably reliable location tool in urban settings, does not do so well in the rural West where boomtowns are found.[7] In their study of boomtowns in Montana, North Dakota, and Wyoming, gravity models explained only 85, 65, and 20 percent, respectively, of variability in settlement patterns. The results for Wyoming suggest that forces not captured by a gravity model are important in the rural settings of boomtowns and deserve careful study in any modeling effort.

An infrequently mentioned problem of boomtown models is the timing of the modeling effort. If pre-boom data are used, parameters such as multipliers, technical coefficients, and regression coefficients are rendered largely obsolete by structural change which occurs as rapid growth proceeds. Unfortunately, using data from time periods when rapid growth has already begun will not solve that problem. Once the boom is under way, the economy is no longer in equilibrium, and biased estimates of model parameters result. For example, the calculated EB multiplier will be much smaller than its true value. The first immigrants to an energy development area are basic sector employees. In addition, high wage rates paid by the energy project draw many local residents away from their nonbasic, service jobs. Jurado demonstrated that 55 percent of new energy industry workers were local residents who had left nonbasic jobs, resulting in an initial 30 percent decline in total nonbasic employment.[8] In the short run, both effects result in substantial growth in the number of basic employees relative to the number of nonbasic employees, which in turn causes a temporary drop in the apparent, but not the actual, EB multiplier. In fact, through induced import substitution, growth is likely to cause the true EB multiplier to rise. That increase will be reflected in the data only after nonbasic employment has had some time to catch up to demand.

The shortcomings of such models when used to project impacts of rapid growth may be so serious that the usual approach which regrets then forgets the distortions which result from wholly unrealistic assumptions will not do. Two related lines of research appear to be in order. One is a theoretical and empirical evaluation of existing projection models. Such an evaluation may be difficult to accomplish. Many model proprietors, having invested large sums to develop and implement a model, may be reluctant to release documentation for fear of being discredited and sent back to the drawing board. A second approach, which also involves difficulties, is the development of a capability to make endogenously adjustable the parameters estimated with pre-boom data as structural changes make adjustments necessary.

Anticipating Social Service Demand

Social problems are, in general, not explicit outputs of computerized projection models. However, to plan properly and to fund mitigation measures, changes in the incidence of a wide range of social problems must anticipated. A substantial number of studies (including Kohrs, Gilmore, and Gilmore and Duff) have claimed to document serious boomtown-caused social problems, but a closer look reveals very little reliable data to back up the claims.[9] A recent survey and analysis by Moen concludes that much of the apparent increase in social problems is due not to any increase in the actual per capita rate, but instead to more existing problems becoming public.[10] Problems become more public because new services bring out problems which had previously been untreated. More incidents are observed because low-quality housing causes people to spend more time in public places. On the basis of an analysis of crime data, Brookshire and d'Arge could not conclude that boomtowns are worse off than other communities of similar size.[11] A literature review and probing investigation by Wilkinson and colleagues concludes that "the assumption that energy development causes social disruption in western communities is based on undocumented assertions, questionable interpretations of evidence, and superficial analyses."[12] Basically, they found that early studies were long on talk and short on documentation, while later studies relied heavily upon the early studies to reach their conclusions. Wilkinson does not assert that rapid growth produces no social disruptions, only that no scientifically collected data exist to prove causation or even strong correlation. Our knowledge about the relationship between boomtowns and social problems is practically nonexistent. The existing research on boomtown social problems does at least provide a number of leads for research. Those leads should be investigated, with an emphasis on scientific data collection efforts.

How Much Impact Mitigation?

Even if all impacts are known in advance without error, the question of how much of each of the various mitigation measures to apply is a difficult one. The population of a boomtown usually rises to its peak sometime during construction of the energy project, then declines to a new equilibrium level consistent with the operation of the project. The post-boom population is higher than the pre-boom population. Many necessary mitigation measures, such as investment in municipal infrastructure, are long-lasting. What population level should long-lasting investments and other expenditures be designed to serve? The problem is to weigh a deterioration in the level of per capita municipal services during the period of rapid growth against the high costs of excess capacity in the post-boom period.

Clearly, the optimal expenditure level is the one which equates marginal investment costs and benefits. Investment costs are easily measured, but benefits are not. Cummings and Schulze have argued that workers' wage demands are inversely related to per capita municipal infrastructure (PCMI) and that foregone wages are a good measure of the benefits of increasing PCMI.[13] Cummings, Schulze, and Mehr collected data on publicly owned buildings, machinery, and equipment used for general government, recreation, streets and roads, water and sewage, and public safety (police and fire) for 26 western boomtowns for the period 1970-75.[14] They found a statistically significant inverse relationship between PCMI (as defined by the data described in the preceding sentence) and the per-employee wage level, namely that a 10 percent decrease in PCMI is followed by a 0.35 percent increase in wages. Thus, there is clearly an optimal investment level. Subsequent research by Merrifield shows that foregone wages probably provide an underestimate of PCMI investment benefits.[15] Additional PCMI not only reduces future wage payments but also appears to improve worker productivity greatly, primarily by reducing the rate of turnover. Because of the data collection effort required, extending and updating the work of Cummings, Schulze, and Mehr along the lines suggested by Merrifield would be expensive. However, the resulting knowledge would be quite valuable. In a single boomtown, Rock Springs, Wyoming, higher-than-expected worker turnover and hence lower productivity, along with high wages, cost industry $72 million.[16] If better knowledge of additional PCMI benefits were available, millions of dollars could have been saved in Rock Springs alone. The stage is set for major advances on this important question, waiting only for someone to step forward to underwrite the research effort.

Front-End Financing

Without the funds to make the needed investments, the projection of impacts and planning of mitigation measures is but an interesting exercise. Getting funds when needed is the subject of this section; getting them where needed is discussed in the next.

It is desirable to have the optimal level of municipal infrastructure and other service capabilities in place before rapid growth begins. Unfortunately, several factors make that quite difficult. A major problem is uncertainty that the energy project will actually be built. Lack of communication and cooperation between industry and community leaders has often left the community in the position of either being totally unprepared for growth by having done nothing or being stuck with large unused capital improvements and massive unserviceable debt because the anticipated project was cancelled at the last minute. As that dilemma has proved to be costly to local governments and industry, communication between the two has improved and thereby reduced, but by no means eliminated, the problems stemming from uncertainty.

Another major problem is the combination of constitutionally mandated bonding limits and the fact that a new project is not added to the tax base until completion. Thus, a local government's taxing and borrowing power does not increase until long after funds are most urgently needed. A wide range of strategies to make the availability of funds more timely has been suggested by authors like Lee.[17] Other important works include Leistritz et al.; Gilmore et al.; Fisher, Krutilla, and Rice; and Bronder et al.[18] Means to provide adequate front-end financing range from state and federal government grants and loans to new taxes and pre-payment of taxes.

Some early would-be solutions to front-end financing problems have been found to be unconstitutional in some states. One very attractive (to local governments) funding mechanism which is having increasing difficulty surviving court challenges is the impact tax. The impact tax is an attractive mechanism because it answers the demand by long-time residents for growth to pay its own way. An impact tax is any tax or user charge directly related to the impact of the energy project, for instance, sewer and water hookup fees for new housing. Thus, the burden of the tax falls most heavily, perhaps exclusively, on new residents. It is because of its selectivity that many courts have found it to be unconstitutional. Some states have also found some forms of tax prepayment to be unconstitutional, ruling that prepayment represents an attempt to circumvent constitutionally mandated limits on local government indebtedness. These setbacks and others have forced state and local governments to reassess their funding strategies.

Although legal and political barriers, not a dearth of ideas, are now the most formidable front-end financing problems, there continues to be room for new financing innovations. Some new mechanisms, as yet untested, have been suggested by Lee.[19] They include temporary debt-service assistance to local governments by state governments or the energy industry, a state municipal bond guarantee program, and state-owned municipal bond banks. Perhaps as government finances tighten at all levels, some of these mechanisms will be tested.

Jurisdictional Mismatches

In the preceding section, an implicit assumption was that the impacted jurisdiction would, at least eventually, add the impact-causing energy project to its tax rolls. Unfortunately, that is frequently not the case. Quite often workers locate in an incorporated municipality, while the project is located in an area outside the city limits. The so-called jurisdictional mismatch between cities and counties is among the most difficult problems faced by energy development regions. Sometimes the mismatch is even more serious, such as between Sheridan, Wyoming and Big Horn County, Montana. The large Decker coal mine is in Montana, while most workers live in Sheridan.

Again, the major problems are political and legal. Solutions that have been tried include a shift by local governments to more varied sources of revenue. Collections from user charges and sales taxes replace property tax revenues as the dominant source of funds. Revenues from sales taxes and user fees are more responsive to changes in population.

Another mechanism to match spatially the impacts and tax revenues generated by growth is the creation of special districts which include the energy project and all affected municipalities. Proceeds of a mill levy are allocated to the individual municipalities on the basis of population impacts. If the establishment of the special district is politically feasible, the district can work well once the energy project is completed. A noteworthy example of a special districting scheme for collecting and allocating tax revenues has been in operation in the Minneapolis–St. Paul metropolitan area for eight years and has survived a court challenge.[20] Some of the lessons learned from the Twin Cities experience could perhaps prove useful in the western energy boomtown setting. It's worth looking into.

Unfortunately, when applied in combination with some front-end finance strategies, the special-district concept is limited by the weaknesses of predictive models discussed earlier. Advance allocation of funds on the basis of impacts is difficult and perhaps politically infeasible, unless done on the basis of an accurate, reputable impact projection.

The Growth Rate and Peak Population

The rapid increase in population and labor force during the energy project's construction phase, and the subsequent decline in both upon completion of the project, are the cause of many negative socioeconomic impacts. Although the magnitude of negative impacts is often directly related to the speed at which construction proceeds and the size of the peak construction labor force, very little attention has been given to the factors which prompt such swift and intense activity. According to Brookshire, Ives, and Schulze, interest rates, the sensitivity (elasticity) of labor supply to wage changes, and the available (or unavailable) amenities in the project area are among the most important factors in determining the nature of construction plans.[21] Most energy projects are financed either with borrowed money or at the expense of other potentially profitable investments. Hence, firms attempt to set the size of the labor force so that the marginal cost of having funds tied up while the project is being built is equal to the marginal cost of construction. In other words, the cost of the lower average productivity of a larger work force (increasing marginal costs are assumed) is balanced with opportunity cost savings from bringing the project into production sooner. Thus, partial equilibrium analysis suggests that the higher the relevant interest rate, the higher the elasticity of the supply of labor with respect to the wage rate, the smaller the rate of increase in marginal costs (with increases in the size of the work force), and the greater the lack of amenities, the larger will be the peak construction labor force.

Clearly, the various levels of government have sufficient leverage to use those factors to take some bang out of the boom. Many public investments directly affect the level of amenities. Loan guarantees or direct government financing of the energy project could provide the energy firm with a lower relevant interest rate. The possibilities are numerous. Before a possibility can become a policy, however, two questions must be answered: Are the results suggested by partial equilibrium analysis consistent with the outcome of a general equilibrium analysis? Is the policy cost effective? In other words, do the expected benefits of reducing the growth rate and peak population justify the cost of the policy? Both questions suggest major research opportunities.

Too Little Analysis

The preceding discussion attempts to provide the reader with a brief overview of our ability to assess the impacts of rapid growth and to apply appropriate mitigation measures. In some areas it is clear that our knowledge has not progressed very far. In the case of impact projection models, it appears that we may be using algorithms with which we are familiar from other applications even though, without significant modification, they may not be appropriate for boomtowns. The effort to identify social problems has relied too heavily on conjecture and impression and too little on scientifically collected and analyzed data. We continue to struggle in an information vacuum when it comes to decisions about the appropriate level and mix of impact mitigation measures to fund. Theoretical constructs and a research strategy have been outlined that would identify the optimal public investment level, but the task of gathering and analyzing the relevant data is not yet under way. Strategies for coping with the temporal and spatial dimensions of funding problems are fairly well developed, but because of legal and political constraints the demand for new financial innovations remains strong. Public policy so far seems to have concentrated on impact mitigation rather than prevention, even though factors which appear to affect the eventual magnitude of impacts can be influenced by government. Research must establish the probable effects of particular contemplated impact prevention measures and determine if the policies will be cost effective.

This paper has suggested that much more remains to be accomplished than has been in the 15 or so years since western boomtowns reappeared on the American scene. Its intent is to challenge a number of disciplines to study the problems and needs which it identifies. The appropriate research effort is large, but the stakes are high. Better knowledge of problems created by rapid growth and the capability and commitment to deal with them can trim millions of dollars from the energy industry's labor costs and minimize the social disruptions associated with rapid growth. With lower production costs and fewer social problems, more energy resource deposits can be profitably extracted. That would increase the nation's energy self-sufficiency.

FOOTNOTES

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