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Economic Development Policy Makers Beware: Estimating the Job Impact of Public Investment in Bio-fuel Plants

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Abstract

Despite all the hoopla about the green economy and clean tech, skeptics are beginning to ask questions about the projections of job creation from investments in renewable energy and energy efficiency. Since these projections are used to support public investment in “clean tech” firms via tax incentives, economic developers at the state and local level need to know how to assess them. In this policy brief, we examine 16 studies of the economic impact of ethanol plants. First, we discuss what the studies have to say about the economic impact of ethanol plants – why are these plants expected to create jobs and in what ways? We then look at the methods used to estimate the job creation impact of ethanol bio-fuel plants and at the assumptions underlying estimation models. Finally we present a list of questions that public officials and economic developers need to ask in assessing claims for ethanol plant job creation and its utility as a public investment.

Keywords

economic impact studies; ethanol; input-output

The Where and Why of Ethanol Plants

Although there are many types of feedstock for producing biofuels, corn remains the most prominent source for ethanol production. The reasons for corn dominance of the biofuel market are straightforward. Corn producers are an important segment of U.S. agri-business and the infrastructure exists in big corn producing states (concentrated ownership, very large farms, and storage and processing facilities) to make ethanol production a reasonable “add-on” to other corn production activities.ⁱ

Ethanol processing plants are popular investments in the major Midwestern regions producing corn (<http://www.ethanolrfa.org/industry/locations/>). Ethanol production provides another market for corn and raises its price, benefiting the industrial farmers who produce corn. Processing plants are also popular in these states because they are tied to the resources and local advantages of individual communities. In this respect they are preferable to manufacturing companies that make location decisions based on tax incentives. Proximity to corn production, transportation networks, utility providers, and distribution facilities all work to hold an ethanol plant in a community. Because corn is a heavy input that is transformed by processing into a less weighty bi-product (ethanol) it makes sense to locate ethanol plants near corn production locations.

While the most significant job impact of the ethanol plant derives from its internal operations, ethanol production creates jobs throughout the regional economy where the plant is located: on the farms that grow the corn used to make ethanol; in the transport of corn and processed ethanol to and from processing facilities; in the utility companies

that provide electricity, natural gas, and water; in the cattle operations that utilize the spent grain for feed; and in the construction of the facilities and infrastructure needed for plant operation.ⁱⁱ In addition to these new jobs, indirect or “induced” jobs are created in services such as banking, accounting, manufacturing, chemical production, retail, etc.ⁱⁱⁱ

While economic development officials may be interested in a plant’s job creation potential, investors will only build them if they make significant profits. Assurance of a private sector profit usually requires government subsidies for the facilities as well as regulatory initiatives that create a market to increase bio-fuel consumption. The primary purpose of economic impact studies of ethanol plants is to justify government policy to create bio-fuel markets and government investment in facilities that result in profits for private firms (such as Archer Daniels Midland, the largest producer of ethanol in the U.S.).^{iv}

How are bio-fuel plant economic impacts projected?

The sixteen studies analyzed for this working paper included both independent assessments and those conducted by organizations with a financial interest in promoting government subsidies. Studies sponsored by organizations that have a stake in the industry are not necessarily independent since sponsors have a significant interest in economic impact analyses that project positive results. For example, the LECG study, “Contributions of the Biofuels Industry to the Iowa Economy”, sponsored by organizations representing corn producers, shows (on average) job gains from bio-fuel investment of 41.67 indirect or induced jobs for every one job created at an ethanol facility. This compares with a projection of 4.94 jobs in independent analyses.^v

The studies reviewed are based on different assumptions and use different methods, though most rely on input-output models to project job and tax impacts. The majority of

input-output models in the studies examined use federal, county and zip code data compiled by IMPLAN (an acronym for Impact Analysis for Planning), a private firm that specializes in input-output data and modeling. Because IMPLAN models and data are adaptable and relatively inexpensive, they are widely used in economic impact analysis.

Input-output models are accounting frameworks that show how output for each and every regional industry is affected by a one-dollar change in the final demand. These multipliers are established using estimates of sectoral activity for final demand, final payments, industry output and employment for each county in the U.S.^{vi} While the standard accounting framework works well for many conventional industries, it is problematic for assessing the impact of ethanol processing. One reason for this limitation is that the most prominent process for ethanol processing is dry milling.

Economic impact analyses of ethanol plants, however, typically use the older industrial sector of wet-milling to account for the inputs into ethanol processing. While these two industries are similar in many respects, there are a few critical differences, namely, dry-mill ethanol requires more natural gas, and more chemicals, but less electricity and less truck transportation than the older wet-milling.^{vii} As a result of these differences there are problems in estimating various inputs into the industry and in the ultimate reliability of the multipliers produced. This one example demonstrates that the models that are used to project the job impacts of ethanol plants are affected by many individual decisions about which data is used and how it is interpreted. All these decisions affect the model results.

Another important limitation of input-output models to keep in mind when evaluating their job projections is that they use *estimated* data. None of the studies examined used real world data to evaluate projections. Even when looking at existing ethanol plants, evaluators used input-output models to estimate job gains rather than looking at actual

job change numbers. In order to determine the accuracy of model-based ex ante estimates, we need studies of the actual job impacts of ethanol plants. In the absence of studies looking at actual jobs created, policy makers and citizens need to understand that the numbers produced in these studies are only projections. They are not guaranteed and often are highly dependent on factors beyond the control of the ethanol plant operators.

How and why the estimated impacts can differ

Given that these impact analyses are based on models, some differences among the results are attributable to the way the input-output analysis is constructed and to the assumptions used to construct the analysis. For example:

- IMPLAN has to be adjusted to create a dry-mill ethanol industry sector. The way these adjustments are made affects how many jobs are projected for different inputs into the process.
- Construction costs and jobs are sometimes included and sometimes excluded from any operating projections^{viii}.
- Corn being grown for the ethanol plant is sometimes considered a new output into the model although it was already being grown for other markets (feed and food).^{ix}
- New utility jobs with natural gas, water, and electricity are often over estimated because “All three of these...are massive, declining cost industries where the average cost of delivering their respective commodities up to capacity is declining sharply.”^x

- Transportation jobs are often over-estimated, especially in corn-belt states, because corn is already being hauled from farms to mills, livestock feeders or out of state and thus the infrastructure and jobs that are already present would simply switch to ethanol transportation with small increases^{xi}
- Results can differ dramatically depending on how the model calculates the location of expenditures – whether key inputs are purchased locally or imported into the region. If inputs are imported, then local expenditures and their ripple effect on the local economy are lost to the region.
- The opportunity costs of growing corn rather than other crops, such as soy beans, or of using land for other purposes are rarely assessed in the models.

In addition to these decisions regarding the model itself, an empirically important issue for all impact analyses is the accuracy of local purchase versus import assumptions for key inputs. Models results can differ dramatically depending on whether purchases of key inputs are calculated to be made locally or imported into the region, thus resulting in the leakage of potentially local expenditures.

With these constraints and decisions in mind, we can anticipate some major differences in how the economic impact of bio-fuel plants is assessed.

How Do the Studies Differ?

The first difference among the studies, and possibly the most important, has to do with whether the study author presents the assumptions that will be used to construct the model. Without that information, public officials or interested citizens cannot assess

whether the economic impact model is reasonable. Many of the studies are presented as a “black box” with no information given about assumptions or model construction.

For example, Flanders et al.’s study, “Economic Impacts of Ethanol Production in Georgia,” (2007) provides no information about adjustments or assumptions made when using IMPLAN. The authors present a two page description about why input-output models are effective measures of the indirect and induced economic gains from an industry; however, they do not lay out the process they used to develop assumptions in using an input-output model or IMPLAN software.^{xii}

Seven of the sixteen studies we examined did not discuss the assumptions that were made when the researchers used the IMPLAN software. While this does not mean that the studies produced invalid or unrealistic projections, it means that the projections are difficult to evaluate. For example, if public officials examined the sixteen studies analyzed for this working paper, they would find that the projected job multipliers differ significantly: one study arrived at a job multiplier of 73,^{xiii} while another reported a multiplier of 2.8.^{xiv} While there are differences among plant locations that have to be factored into an estimate, a difference of nearly 70 indicates that the projections made in some studies are not reliable. Among the studies we evaluated, the most reliable seemed to set a job multiplier in a range from 2 to 7. A job multiplier of 2 is more likely in rural areas where there are fewer goods and services (including inputs to the ethanol processing plant) that can be purchased locally. A multiplier around 7 is more likely if the plant is located near a metropolitan area where a wider range of inputs can be purchased locally and where there is potential for greater recirculation of dollars spent in connection with the plant.

What Do Economic Developers and Public Officials Need to Take into Account?

- **Local variation:** The impact of an ethanol plant on a local economy is dependent on a wide array of factors that are often overlooked in impact studies. The number of jobs that a given facility creates depends on the size of the plant, the complexity of the local economy, what goods and services are available locally, and how much income is generated locally by the corn price premium provided by the facility.^{xv}
- **Political motivation:** The political motivation behind a report will often determine results or affect interpretation of results. While executive summary of a report may emphasize the positive, those interpretations are not always justified in the more detailed study findings. For example, in the case of the RFA report, the RFA's mission is to "bring together Iowa ethanol and biodiesel producers to foster the development and growth of the state's renewable fuels industry through education, promotion and infrastructure development."ⁱ As state lawmakers debate whether to grant substantial subsidies to ethanol producers, there are millions of dollars on the line for the members of the RFA. So, it is important for policy makers to take political interests and economic motives into consideration when evaluating study results.
- **Property ownership and existing infrastructure:** Although scientists focus on bio-mass potential on the ground, ownership patterns and what farmers do to make money are critical elements determining whether a bio-fuel plant investment is economically feasible. Farmers will not participate in a bio-fuels program unless it has the potential to make money for them. They also assess the long-term and short-term costs of changing what they are doing to grow a bio-fuel crop. Large corn farmers in the Midwest grow corn as their primary commodity crop. Bio-fuel provides them with another market for their product

and has the potential to raise prices. In eastern States, such as New York, where farms are smaller and many farmers are engaged in high value-added crop production, such as organic food, bio-fuel production may not be efficient. Economic developers need to work with the comparative advantages of their own agricultural sector

- **Return on Investment:** If public investment is required to finance a bio-fuels processing facility, economic developers and public officials need to assess whether the investment is likely to pay off for the tax payers. Could tax revenues be used in a more effective way? What are the opportunity costs? For example, investment in marketing and distribution for farmers engaged in high value added food crop production may have a better long-term economic impact than investment in an ethanol plant

Economic impact analyses should never be taken at face value and used to justify public investments. Officials engaged in making decisions about public investment in ethanol production should base their decisions on a deeper understanding of the inputs, methods, and assumptions used in producing job projections and other ethanol-related impacts. Experts on impact analysis exist on almost every college campus and, in many states, in cooperative extension offices. These experts can provide assistance in understanding impact analyses and whether and how to use the results as a guide for policy.

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Notes:

ⁱ This is a source of many inaccurate estimates of ethanol impact. Many studies fail to acknowledge the existing corn agriculture infrastructure.

ⁱⁱ Low and Isserman (2009) p.74-75

ⁱⁱⁱ Swenson (2007). p. 5

^{iv} Cellulosic ethanol plants exist in the U.S. but are not profitable

^v Swenson (2007)

^{vi} Lindall and Olsen (1999)

^{vii} Low & Isserman (2009) p. 79.

^{viii} Swenson (2007) p. 7

^{ix} Low and Isserman (2009) p. 80

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- ^x Swenson (2007) p. 3
^{xi} Swenson (2007) p. 4
^{xii} Flanders et al. (2007)
^{xiii} Urbanchuck (2008).
^{xiv} Low & Isserman (2007)
^{xv} Low & Isserman (2007)