Data Spotlight

April, 2009

Which Infrastructure Project Will Have the Best Impact?

Green Jobs, Part 4

Using input-output analysis, economic base, and fiscal impact modeling to determine the best project.

Last month we considered regional investments that would create jobs (green or otherwise) on the basis of multiplier effects, long-term vs. short-term effects, and the relative cost per job created. ***To review this article, click here.*** *This month we want to turn our attention to understanding infrastructure projects, and how we can evaluate them based on a regional cost/benefit analysis. In this discussion we will be reviewing and applying the concepts of input-output, economic impact, and fiscal impact.*

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1. Review & Introduction

In a previous article we concluded that, given our current economic troubles, it would be best to focus on investments and projects that foster long-term job creation as opposed to construction or infrastructure projects, whose benefits are often limited to quick bursts of low skilled, short-term employment. As a result, we looked at how to apply green or stimulus package spending to create better local industry opportunities.

In this issue we will return to the topic of infrastructure projects, realizing that the economic development of many regions is constrained by things like poor roads, railways, ports, and other out-of-date, inefficient systems. The American Recovery and Reinvestment Act includes a lot of money and provisions (roughly $90- $100 billion) for infrastructure improvements, and if you recall from our first article,[1] many green projects (and their resultant occupations) are related to infrastructure improvements.

So in this article we provide a review of how to assess which infrastructure project will have the best regional impact. *As always, if you need help identifying the impacts of a project please, contact us.*

2. Economic Impact Basics

Whether green or not, how do we measure the impact of infrastructure projects? First, we need to define three terms that will help us properly assess infrastructure projects.

Input-Output (IO) Models

Households, businesses, and governments are intertwined in a complex web of interdependent relationships based on (1) producing, (2) selling, and (3) purchasing goods and services. As a result, an activity in one part of the economy will have far reaching affects on other parts - just like the effect that a drop of water has when it falls into the bucket of water. A primary tool used to measure and explain these relationships is the input-output (IO) model. Input-output models, therefore, indicate how a change in one part of the economy will ultimately affect other parts based on these purchasing and selling relationships.

In addition, we have put together a practical guide to input-output modeling, which is a compilation of various materials we have produced over the past few years. In this guidebook we review many regional development topics, data sources, and techniques which should be helpful in local planning and decision-making.

Economic Base

There are many ways to understand this concept. Perhaps the simplest is that economic base is a description of the industries or other income sources that bring money into a region (rather than merely circulating money already present). The two important concepts that underpin economic base theory are that of **"**basic" and "non-basic" industry. **Basic industries** are those

1 http://www.economicmodeling.com/resources/811_data-spotlight-a-look-at-green-occupations-part-1/

which depend on income from outside the region, thus bringing money into the region. **Non-basic industries** are those which generally sell to residents or businesses already in the region. Economic development theory emphasizes the importance of basic industries as the "pillars" of a region's economy, having much more importance than non-basic industries, which are generally assumed to naturally follow basic industries. Note that many industries are partially basic and partially non-basic.

For more on economic base click here.

Fiscal impact modeling

Fiscal impact analysis is an estimation of the impact of a given project (e.g. a new road) or direct economic change (e.g. layoffs) on public sector revenues and expenditures. The "direct economic change" might be a short-term construction or other new infrastructure project; it might be a new factory, a regional investment in human capital, or a campaign to attract new business and bring about economic transformation. A short- and long-term analysis of regional job and income effects will normally accompany the fiscal impact study.

For more on fiscal impact modeling please contact us.

3. Reviewing the Projects

With these things in mind, let us assess three development projects. In a previous article[2] we told the story of a mayor whose town had just lost a lot of manufacturing jobs. We looked at how to spend federal dollars, aimed at creating green jobs, on retrofitting a manufacturing facility and building a new training facility for a new industry.

This time let's tell a different story from the perspective of a county executive in a rural area. The state has received its share of the "stimulus package" and the governor is looking to allocate the money in several primary areas.

- First, the state is suffering as the result of deferred maintenance on **rural roads**. Poor roads have led to a decreased amount of commerce going through the state. As a result, the governor would like county executives and the department of transportation to submit road improvement projects to fix this problem.
- Next, because of increased global demand for agricultural products produced in the state there is a need to improve some of the **short-line railroads**. This would reduce transportation costs and improve the environment (in terms of reduced energy consumption).
- Finally, because many rural communities are undergoing a transformation from agriculture to more home-based sole proprietorships there is an increased demand and need for better **broadband services.**

The three projects will generate measurable economic benefits. Note, however, that although none of them are "green" *per se*, they all qualify for funding under the American Recovery and Reinvestment Act and thus could actually employ individuals from "green" occupations. The

[2] http://www.economicmodeling.com/resources/1003_which-green-project-is-best-for-your-region/

important thing to note is that once this money hits the local level the dialogue is less focused on the "green" and more focused on the specifics of the regional economy, workforce, labor market needs, and overall impacts.

The next step is to analyze these projects to learn what their impact would be on the area, and if we can, determine which of the three will have the largest impact. In each case we are using EMSI's Economic Impact module, which is a web-based input-output model that can be used for any region (county, ZIP) in the nation.

4. Three Scenarios

Scenario 1 - State Highway Construction

The impact of road improvements can be a little difficult to judge. However, the importance of having good roads should not be understated. In a September 2008 article David Brandon of Site Selection Group LLC, stated that highway accessibility was the No. 1 factor cited by corporate location decision-makers for where new companies decide to locate. Here is a helpful excerpt from the article that states the overall importance of good roadways:

> "Few aspects of an area's competitiveness are more fundamental than its infrastructure systems, and no other infrastructure system exerts a more elemental influence on a facility's location than the complex of highways that will serve it . . . While corporate decision-makers, economic developers, and site selection consultants often overtly concentrate on seemingly sexier location decision factors, highway accessibility is never out of mind. Whether it delivers workers, materials, services, goods, or emergency vehicles — or provides entry to markets and customers — an area's highway system is basic to business operations. Further, the efficiency of that highway system enables informed decisions as to which modes of transport will best achieve a company's time-to-market objectives. Although highway systems are among the least elastic and most expensive and time-consuming to construct, they are also among the most effective at stimulating new investment."

With this in mind we turn our attention to this area's largest road construction need. Last year 25 miles of a 30-mile section of road running between our town and the next was widened from two lanes to four lanes. The remaining 5 miles meanders through a section of the county with several housing developments. The residents in those communities are not thrilled about the prospects of widening the road, and dislike the amount of heavy traffic (including trucking) that rolls by their front doors. As a result the city would like to create a new 5-mile bypass. The reason for this is that most of the accidents on this 30-mile stretch occur in the 5-mile section near the housing development. In addition, once this section is complete, the new bypass will become part of the preferred route between the state's capitol all the way to a resort town 85 miles north. Therefore, improvements to this local road could create more efficient and safer travel for local commuters and a more appealing route for long-distance travelers, and a crucial artery for companies that ship by highway. Preliminary estimates report that a completed four-lane highway connecting all these cities would increase commerce by 20%.

To establish this 5-mile section would require $50 million dollars. With the aid of EMSI's Economic Impact module, we determined that roughly 50 construction jobs would be added to

the 80 currently employed in this industry (in the two-county region). In addition to these "direct job impacts," we determined that road construction in this region has a multiplier of 1.58 - so for every job created another .58 jobs are created in other industries. As a result, the total job creation could be 79 jobs. These jobs would add $3 million in income to the two-county region. However, because construction projects have short term job impacts, these jobs could be lost after the construction phase. What will remain is the increased commerce flow through the community, and more business for gas stations, convenience stores, restaurants, and other recreational industries.

What makes this project green?

An initial observation might suggest that these jobs are not green in any traditional sense. However, the project can rather easily be described as having a number of green outcomes. For instance, environmental engineers would need to be hired for run-off water abatement, and others could be hired to make sure the surrounding region still maintains a high degree of environmental quality post construction. These are green jobs plain and simple. Beyond this, new roads are in many ways more environmentally friendly than older ones. While they handle more traffic, they also help save travel time and fuel, help cars run more efficiently, and reduce wear and tear. Altogether then, there is much about highway construction that can be characterized as green.

Scenario 2 - Railroads

The second project considered is the need for improved freight and short-rail transportation to help local farmers transport their wheat harvests more efficiently to the nearest grain elevator. After years of retrenchment by the local railroads, which have to compete with highways and federally-maintained waterways, our county currently has no rail transportation. With the price of wheat going up, and the worldwide demand increasing, local farmers have been asking for this improvement.

Using EMSI's Economic Impact module, we determined that agriculture makes up 8% of the two-county area's workforce and accounts for 10% of the region's total earnings. It creates $77 million in earnings and $377 million in sales. Since the price of wheat has increased many farmers have improved their practices and purchased new equipment to keep up with demand.

Transportation costs for agriculture run roughly from .8% to 1.5% of final market price demand. As a result, local farmers spend roughly $4.5 million on freight transport to move their wheat to market. Each of the region's 250 farms spend an average of $18,000 per year on transporting wheat to the grain elevators at the inland port located 30 miles away, where it is then barged downriver to various coastal ports for overseas export. But if they could truck their wheat to town and then have it transported to the coastal ports by rail, they could each save 50% in transportation costs. Overall the farmers would retain an extra $9,000 per farmer and $2.25 million would be kept in the regional economy for other uses.

In our case the rail right-of-way already exists. They are just abandoned or downgraded and need to be rebuilt or improved. It will cost $15 million to rehabilitate the short line and invest in an operator to once again run grain trains to mainline railroad connections. Initial estimates

indicate that if the line were rebuilt 5 railroad jobs would be added. The local jobs multiplier for this industry is 2.31, so 12 jobs would be added as a result of this project.

The job impact associated with this re-development work results in a $6.15 million increase in regional earnings.

What makes this project green?
One of the primary reasons most frequently given for short-line railroad improvements is that it takes burdens off the local road infrastructure. It's an overall better long-term investment because railroad maintenance gives you more ton-miles per dollar. This is why there are still rail lines in many areas of the country. In addition, a big point to pay attention to here is how emissions from transportation would be reduced by a factor of two because rail transport has much lower emissions as compared to trucking. So railroads can help to create less road traffic, which leads to less wear and tear, and lower emissions. These are all attributes of a green project.

Scenario 3 - Broadband

Finally, the local economic development council has been trying to attract more companies to the local technology park. There are currently three companies in the tech park, with one more that has expressed interest in moving to the region. The company that has expressed interest is classified under **Physical, engineering, and biological research**. This company's major concern is its need for better telecommunications capabilities, specifically fiber optics.

With the help of EMSI's Economic Impact module, we know there are currently three other companies, one with 20 computer chip designers, another with 60 software developers, and finally 50 at a testing laboratory. If the new company were to locate in the county it could produce and additional 15 jobs and $1 million in earnings and help create another 8 jobs in the economy.

The cost to add fiber optics will be roughly $1.5 million dollars. The companies could see efficiency increase up to 20% with better telecommunications capabilities.

What makes this project green?
The green quality of this project can be seen in the fact that technology companies are naturally a lot "cleaner" than many other industry areas. As the town does things to encourage this sort of business development, it is also encouraging the sort of companies that produce much waste or consume as many goods (e.g. paper products, and electricity will be the primary local inputs).

Results and Analysis

The following tables help us break down all of the costs and benefits associated with these projects. We will score the projects based on job creation, multiplier effects, costs, environmental impacts, economic impacts, fiscal impacts, construction phases, infrastructure lifespan, and other considerations.

	Construction Phase Job Creation	Long Term Job Creation	Multiplier	Construction Cost	Net Fiscal Impact	Construction Phase
1. Road Improvement	79	300	1.58	$50 Million	- 250 K/year	2 years
2. Rail Improvement	25	15	2.31	$15 Million	+ $210 K/ year	1 year
3. Broadband	8	26	1.69	$1 Million	+ $300 K/ year	4 months

continued	Cost Per Job (Construction Phase)	Lifespan	Environmental (Green) Impact	Average Earnings of Job Creation	Average Cost of Living	Complementary Industries	Overall Score
1. Road	$1 Million	12-13 years	-	$15,000/year	$26,000	retail trade	1st for jobs
2. Rail	$3 Million	30 years	+	$54,000/year	$26,000	agriculture	1st for savings, and economic base
3. Broadband	$100 Thousand	8-10 years	-	$41,500/year	$26,000	technology companies	1st for fiscal impact

Road Improvement Results:

- At $50 million the road construction project is by far the biggest and most expensive project.
- The possibility for short- and long-term job creation is at its highest at 79 and 300 jobs respectively.
- The wages directly associated with this project are much lower than the other two. These jobs are associated with things like gas stations and restaurants, which includes a lot of part time workers and lower wage positions. In addition, the wages are lower than the cost of living for the area.
- The cost to create the short term construction jobs is roughly $1 million per job.
- A big point to note is that this project has the potential for a net negative fiscal impact of $250 thousand per year.
- The life span of the road is between 12 and 13 years.
- Road improvement will have the largest impact on the retail trade sector, which has the lowest associated earnings and multiplier effects. Recall from above, we reviewed the concept of basic and non-basic industries. Retail trade, for the most part, is a non-basic industry, which means that it tends to circulate money that is already within the economy.

Conclusion - Road Construction

Road construction is difficult to compare to other projects. While a good road system contributes to regional economic development, they require significant upkeep and maintenance expenditures (e.g. snow removal, fixing potholes, dealing with safety issues, etc.). As a result, while the road project could actually have the largest jobs impact it could also have a net negative fiscal impact on the region and a slightly negative environmental impact based on runoff and increased traffic. However, good road infrastructure begets economic development.

If we are just simply comparing the three projects, road construction has the smallest impact on the basic industries (industries that bring money into the region), and does not add or contribute high wage employment to the region. The biggest issue to consider is the need for the state to have better road systems, which provides many intangible elements that are necessarily difficult to analyze in a purely local context. In addition, new roads tend to be safer, better to drive on, save travel time, and enhance the overall quality of life for the area's residents and businesses.

Short-Line Railroad Results:

- The $15 million associated with repairing the short-line rail road falls between the two projects.
- The possibility for short- and long-term job creation is low compared to the other two at 7 and 25 jobs respectively.
- The wages directly associated with this project are higher than the other two.
- The cost to create these jobs is much higher at $3 million per job.
- The largest impact that will be felt is a significant reduction in costs for agriculture.
- Another big point to note is the net positive fiscal impact of $210,000 per year.
- At 30 years, the life span of the railroad is much longer than the other two projects.
- Railroad improvement will also have a net positive environmental impact based on the fact that emissions from trucking will be decreased by as much as 50%.
- Of particular note is the $9,000 savings that local farmers will experience. This will help keep an additional $2 million in the community.

Conclusion - Railroad

While railroad infrastructure improvements have the smallest job impact, the fiscal impact is positive, and the savings that local farmers would experience is significant. Remember, agriculture drives a considerable portion of the economy and any efficiency created here will tend to have positive spillover effects in the region. Though not as pronounced as with road infrastructure, the presence of a viable railroad can be very attractive to site selectors.

Creating more efficient basic industries will drive and keep more money in the local economy, which has it's own way of creating additional jobs and a more prosperous region. In addition, of the three projects, this is the only one with a net positive environmental impact.

Broadband Results:

- The cost to install broadband is much lower than the other two projects.
- The possibility for job creation and for increased business efficiency falls between the two other projects.
- We gave this project a slight negative score for environmental impacts. This is mostly due to the fact that some excavation would have to occur, which could contribute to runoff. Overall the environmental impact of this work is minimal.
- Construction-phase job creation would be very minimal and short term (only lasting 4 months). The big thing to note is the potential for long-term job creation as a result of new companies growing and expanding in the technology park (26 jobs).
- Most impressive is the fiscal impact associated with this project ($300K per year).
- The wages associated with this project are also above the average cost of living for this community.

Conclusion - Broadband

If the county wants to develop the technology sector and attract and grow industries, broadband is a basic necessity. Another factor to consider is that in rural areas there are a lot of sole-proprietors and home-based businesses. This sort of development could really help out these business owners. The primary costs associated with this development are not necessarily the construction. Many communities place additional tax burdens on the use of such infrastructure, and the county should do a feasibility study to discern how many people would use this service and how much they would be willing to pay. If it is installed and nobody uses or benefits from it than it is a net loss.

Conclusions:

Each project has big upsides offset by several downsides:

- A new highway will contribute the largest number of jobs, but will have a negative fiscal impact.
- Railroads will not contribute many jobs to the region, but could create significant improvements for area farmers, and help reduce emissions. It has a positive fiscal impact.
- Broadband has the largest fiscal impact and the ability to contribute to and broaden the community's economic base, but it will take additional work to actually attract business to the area (e.g. just putting broadband in the ground could be a net loss if there are not enough businesses and households using it).

When states and regions receive investments for improving their infrastructure a basic analysis such as this will help them understand which project will have the best impact. Also, a big thing that communities need to determine is what sort of development they prize the most. (1) Some communities might really want improved roads for improved commerce, while others would prefer to stay small or isolated. (2) Some communities might value better technologies, while others feel like those sort of high-tech ventures are not the best fit at the moment. (3) Still other communities might want to maintain a focus on agriculture, while others need to consider moving the economy's economic base toward growing and more stable industry sectors.

These factors can be quite complicated and a thorough review of regional economic trends, demographics, labor markets, and other market forces is highly advisable before decisions are made. For further reading please check out our Input-Output Guidebook,[3] which will take you through many of the topics and definitions provided in this paper.

Finally, in light of green jobs it is important to remember that many of the projects being characterized as "green" are closely associated with infrastructure projects. From our previous examples the road project most likely could not be characterized as green. However, there are aspects to the other two that could be characterized as green as well. For instance, a significant reduction in emissions, and the desire to see more rail transportation could raise the green status of this project. In addition, while broadband is not green, the high-tech building projects that result from this investment could be green. For more about green jobs please consult our previous articles and Green Jobs Part 3 - Green Pathways.[4]

To ask questions or conduct such analysis for your region, please contact us.

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[3] http://www.economicmodeling.com/resources/1204_input-output-guidebook-a-practical-guide-for-regional-economic-impact-analysis/

[4] http://www.economicmodeling.com/resources/1082_data-spotlight-green-pathways/