Economic Multipliers and Local Economic Impact Analysis

David L. Kay
Cornell Local Government Program
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Introduction

- ◊ *Superhospital Study Projects $28-million Annual Gain*
- ◊ *Power Project Would Employ 700, Have a Huge Economic Impact*
- ◊ *University Study Shows California Parade To Be Economic Gem*

Headlines like these recent real-life examples are prized by project promoters and business boosters. They often appear when advocates for private sector projects are seeking public support. The dollar figures featured in the stories are large, even "huge". They signal to readers both economic importance and political significance. Sometimes, the strategic "don't mess with me" subtext is revealed to readers even more explicitly, as in *Fearing Cuts, U Of W System Plays Its Highest Card; It Offers Data On Its Economic Impact On The State.*

An economic multiplier lies behind nearly all such headlines. Multipliers turn large dollar impacts into even larger ones. They do this because they translate *project or industry-specific* effects into *economy-wide impacts*.

The impacts associated directly with a specific project or economic activity are the starting point of any impact analysis. Known or planned project expenditures are a typical example. Called "direct effects", they are nearly always the most important data to estimate well in any impact analysis. To estimate longer term economy-wide impacts, a number known as a multiplier is literally multiplied by the direct effects. If, as happens more often than it should, a well-estimated multiplier is multiplied against a poorly measured direct effect, error is merely compounded.

Direct impacts are often substantial to begin with. All multipliers are greater than or equal to one. Total estimated impacts are therefore always greater than or equal to direct spending impacts.

As computing and data advances have decreased the cost of generating multipliers, economic impact studies incorporating multiplier analyses have proliferated. Citizens, elected officials, journalists, planning commissioners, neighborhood organizers, business persons and many others concerned with economic growth and development can benefit from a basic understanding of multipliers and their uses and abuses. Those who understand will be better prepared to separate the useful wheat from the promotional chaff of economic impact study reports. They should be better prepared to ask the questions that will help them go behind the "gee whiz" headlines.

Economic Multipliers

As already suggested, an economic multiplier is a number used to estimate economy-wide impacts of industry-specific economic changes. Multipliers are generated from numerical or statistical models of a national or regional economy. Using models, multipliers can be calculated for every industry sector in the economy. A multiplier is always greater than one because it is a ratio that is calculated by dividing a) the estimated *total effect* resulting from a given economic "shock" to the economy by b) a necessarily smaller partial effect, namely the direct project- or activity-specific effect.

Each multiplier can be thought of as an empirical, quantified measurement of the strength of the economic linkages between a given industry or economic sector and the rest of the regional economy. Each multiplier is a concise summary of this relationship as averaged across all firms in an industry. The greater the extent of the linkages, the greater the size of the multiplier. The greater the multiplier, the greater the economy-wide dollar or employment impact of any given stimulus to one industry or sector of the economy.

Final Demand Changes, Multiplier Rounds, and Leakage

There are at least three key concepts that must be understood to understand what lies behind most multipliers.[1] The first is the concept of an economic stimulus through a *change in final demand*. The second is the notion of a *chain of spending and respending* that is set into motion by an initial economic stimulus. The third is the notion of *"leakage"* from a local economy.

"Final demand" refers to the sales of economic goods and services to purchasers who are the ultimate users or consumers of these products. The demand is "final" as opposed to "intermediate". In other words, the goods and services are valued in and of themselves rather than for their usefulness in the economic production of new goods and services. Final demand is the critical conceptual starting point for an economic impact analysis; without it, there would be no intermediate demand. Examples of sources of changes in regional final demand include:

- ◊ increased demand for locally produced "exports" by foreigners and non-local domestic consumers alike,
- ◊ consumer decisions to spend more on local products rather than on savings or long term investments,
- ◊ consumer decisions to buy more locally produced goods that were formerly imported from other regions,
- ◊ government decisions to spend more locally, for example by increasing local purchases of weaponry, spending more on education, or more generally by increasing local spending on public sector programs and services.

Note that the changes in final demand listed above are associated with *newly increased* spending on locally produced products. Some studies fail to recognize that the impact will be very different, and much less, if the apparent "new" spending is actually spending that has simply been redirected from one industry to another.

When final demand changes a kind of *chain reaction* of economic events is triggered. The initial stimulus of new spending sets into motion a series of additional spending and respending activities. Most multipliers are used with the presumption that, in a precise mirror image, any decrease in existing final demand sets into motion a whole series of spending contractions. The best way to explain this may be to give an example (using a spending increase).

Assume the overall final demand for locally made ice cream increases significantly, say boosting sales by $100,000 because of a successful national generic advertising campaign for dairy products of all kinds. The local ice-cream manufacturer's receipts then increase, but that is not the end of the money trail. In order to meet the increased demand, the manufacturer will respond by

[1] Most of the comments in this section and indeed article pertain to multipliers calculated from a commonly used class of models called input-output models (more discussion below). For a brief comparison of I-O multipliers with those derived from econometric (statistical regression) or economic base models, see http://www.ku.edu/pri/publicat/multipliers/multipliers.htm and http://www.rri.wvu.edu/WebBook/Giarratani/chaptereleven.htm

increasing production. To do this, the firm will use some portion of the $100,000[2] to buy more inputs in the form of additional goods and services. The additional inputs for new ice cream production will include ingredients like cream, sugar, fruits, and chocolate; paper and ink for more containers; more electricity and water; more labor; perhaps even new equipment; and so on. But again, this is not the end of the money trail. Each of the ice-cream manufacturer's suppliers will respond in similar fashion. As demand for their products increase, so they too will increase their purchases of all the inputs they require for their production processes. Ultimately, the chain of input purchases is likely to reach far beyond the sectors of the economy that are most obviously linked to ice cream production.

Increased purchases of inputs by business firms are not the only way in which the economic stimulus of increased final demand diffuses throughout the economy. People who benefit financially as workers or business owners from increased demand are very unlikely to stash all of their increased revenues unproductively in a cookie jar. More likely, they will spend some or all of that money on a wide variety of new consumer goods and services, not to mention new investments. Depending on their income classes, purchasers of new consumer goods will likely spend across the full spectrum from cookies to cars to piano lessons. Next, as the grocery stores, car dealers, and piano teachers respond to this increased demand, they will in turn increase their own purchases of inputs to their businesses. Moreover, any owners and employees in these businesses will also have additional income or profit to spend on still other goods and services.

At first glance, this cycle of spending and respending seems like it might continue without end. However, this is not the case. The reason can be summarized in the term *"leakage"*. Leakage represents the dollars that are withdrawn from the respending cycle. Insofar as they are not respent locally, the withdrawn dollars do not stimulate further purchases. Starting right at the very first round of spending associated with an increase in final demand, and continuing in all subsequent rounds, a certain portion of the dollars will "leak" out of the economy.

Because of leakage, at each round of spending and respending, the dollar amount respent diminishes. The amount that it diminishes is usually averaged across all rounds of spending and respending and summarized in percentage terms. The mathematical implications of a 40% and 70% average leakage at each stage of the cycle are summarized in Figures 1 and 2.

In the first example, the effects of an initial $100,000 increase in final demand are multiplied two-and-a-half times, such that the sum of $150,000 in respending can be added to the initial $100,000. The multiplier of 2.5 is calculated, again, by dividing the total impacts of $250,000 by the $100,000 direct impact. With 40% leakage, after about a dozen rounds or so there is little or no additional economic impact. In the second example, with 70% leakage, it can be seen that the amount of spending, the multiplier, and the number of rounds of spending and respending are all notably lower.

A small amount of leakage may indeed end up in a cookie jar or under someone's mattress. However, leakage more importantly is associated with other sources including:

- ◊ other forms of long term saving and nonlocal investment
- ◊ increased tax payments

[2] Note that firms with the goal of profits would, aside from certain complications like those having to do with long term investments, have to spend less than the full $100,000 on new inputs. Part of what happens in the production process is that new value gets added to the raw material inputs as they are combined: the ice cream manufacturer will sell the ice cream at a price that exceeds the amount paid for all the ingredients. This "value-added" differential is the source of compensation for labor (e.g. as wages and salary), owners (e.g. as profits and rents), and government (e.g. taxes).

- ◊ spending on goods and services that are not produced locally, (e.g. domestic and foreign imports)

While it is true that some of what is termed leakage here may eventually be respent locally, this is not likely to be immediate or automatic. If such spending does occur, it would generally be considered a new increase in final demand.

The latter source of leakage – nonlocal spending – is often the most critical, for reasons that are at least partly self-evident: new money that is injected into a small local economy is relatively likely to be spent outside that economy where it has no further local impacts.

Determining the boundaries of the economy to be studied is, therefore, a crucial decision. There is unfortunately not a generalized clear criterion for establishing appropriate boundaries. But it must be understood that the scope and complexity of the economy matters a great deal. A single city or county, especially in a rural area, is much more likely to experience high levels of leakage. This is because, compared to a state or nation, most "small" economies are more dependent on the need to buy many goods and services produced outside its boundaries. For this reason, it is nearly always but not necessarily true that multipliers for small geographic areas are smaller than for larger ones.

In fact, a couple of the more likely errors behind exaggerated economic impact reports pertain to misunderstandings of the role of geographic boundaries. One is the misapplication of a large area multiplier (state and national multipliers are usually more easy to get at low cost, in any event) to a small area model, like a county. Another is the failure to account for the fact that new consumer spending that is associated with one new project in a regional economy (a retail mall, for example) may be partly or even fully counterbalanced by reduced consumer spending at existing, competitive facilities within the same region.

There is another more technical reason that determining boundaries is important. This is the fact that it is very difficult to get good information on an industry by industry basis on the amount of leakage for substate areas. Despite the importance of this information for multiplier calculations, most regional economic models must rely on estimates rather than measurements of leakage. These estimates are likely to be more reliable for larger areas.

Multipliers, Input – Output Models, and SAMs

Although the term multiplier sometimes has other meanings, as suggested previously the majority of good impact studies depend on economic multipliers that are derived from a class of economic models known as input-output or I-O models. I-O models depend upon a massive underlying survey-based set of descriptive financial accounts. These double entry bookkeeping accounts are national and economy-wide. They track the flow of funds associated with every industry's purchases of inputs from, and sales of outputs to, every other industry. From this starting point, an I-O model can distill the value of every input each industry requires to produce a unit of each industry's output.

Figure 1. Illustration of Multiplier Rounds and Leakage Effects with $100,000 increase in Final Demand and 40% Leakage

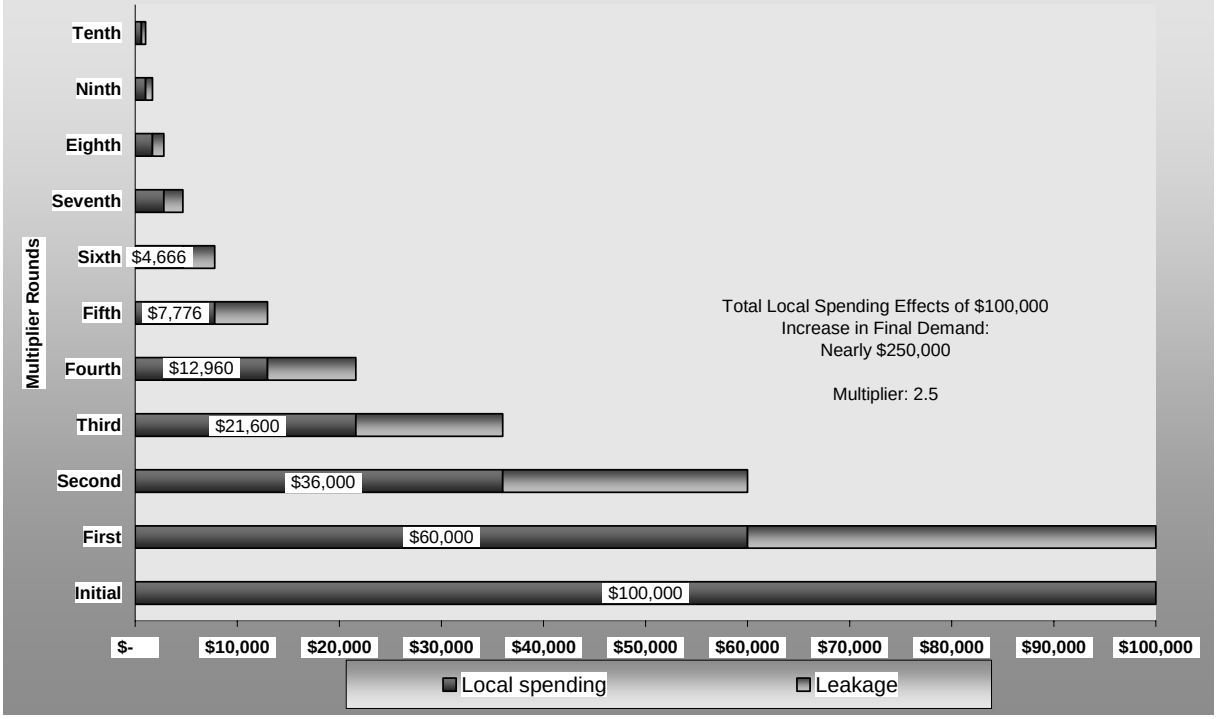
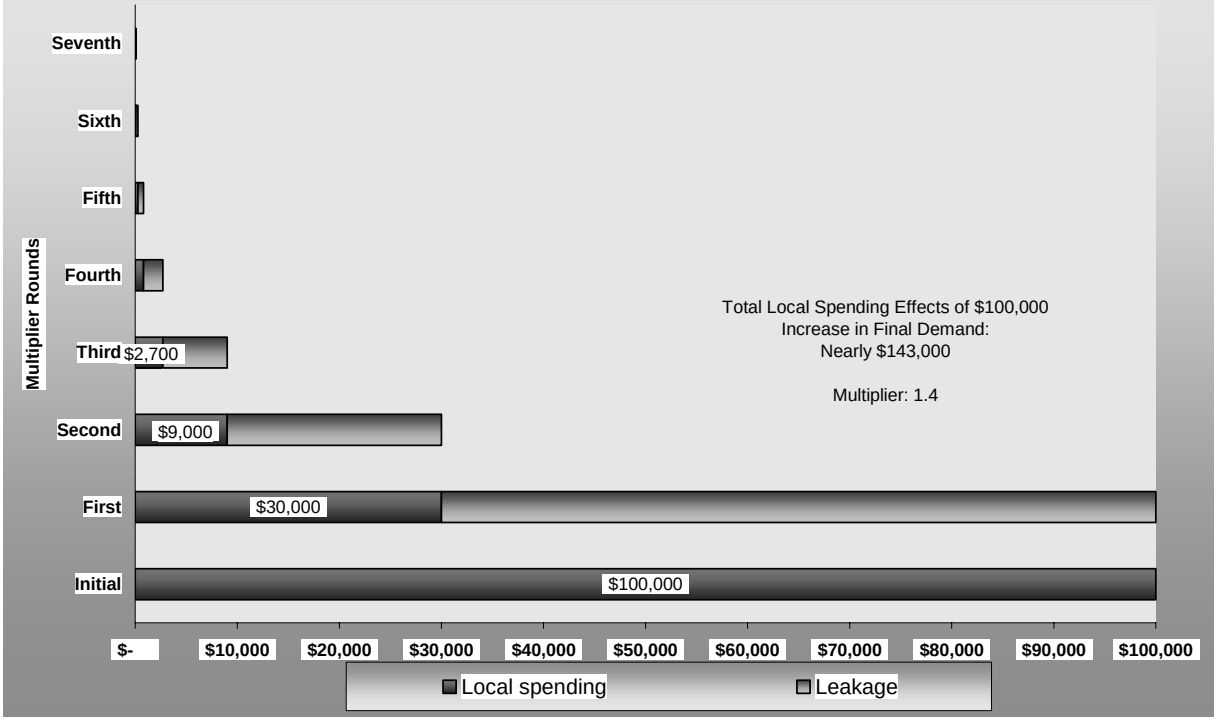


Figure 2. Illustration of Multiplier Rounds and Leakage Effects with $100,000 increase in Final Demand and 70% Leakage



The input-output relationships, it is important to note, are based on the average production technology in use at the time the I-O surveys were assembled. I-O models, and the use of the multipliers derived from them, are therefore most likely to be valid when analyzing economies in which production technology has not been transformed dramatically and rapidly. Because of the expense associated with collecting data on input-output relationships, almost all subnational I-O models, and the multipliers derived from them, are based on local weightings and adaptations of key data found in the national input-output accounts.

The scope of basic I-O analysis can also be expanded to a so-called "Social Accounting Matrix" or SAM. SAMs incorporate a fuller set of accounts than industry to industry transactions alone. SAMs track the flows of funds among and between industry sectors and all other economic sectors *including government and consumers – the social accounts*. SAM accounts can be used to generate SAM multipliers.

Multipliers and a Metaphor for the Economy

A rough metaphor may be useful in understanding multiplier impacts and a community's economy. Imagine a local economy as a pinball machine. Economic impacts (point scores) accrue after increased final demand injects new money (a pinball) as a direct impact into the economy (pinball machine). Total economic impacts (total scores) are greater when the money (ball) can be kept in play longer. The greater the number and density of local businesses and industries (bumpers and flippers), the easier it is to multiply the direct impacts and sustain the respending cycle (keep the ball in play and scoring) before it "leaks" from the system. (For a "rain barrel" metaphor of a community economy, see http://www.oznet.ksu.edu/library/agec2/l775.pdf).

Many Kinds of Multipliers

One of the reasons references to multipliers can be confusing is that there are a number of different kinds of multipliers that can be calculated. Multipliers often vary in their metric or denominator (e.g. output, jobs, income). I-O multipliers also vary in the assumptions they make about the relationship between increased worker and investor incomes and consumer spending behavior. Finally, when an I-O model is expanded beyond interindustry relationships to include social accounts, several kinds of SAM multipliers can be generated depending on which additional sectors are formally included in the model of the local economy.

Different Metrics: Output, Employment and Income Multipliers

There are many possible metrics in which the multiplier ratio between the economy wide total effects and the initial direct effects of any given change in final demand can be measured. As long as there is a straightforward relationship between the change in final demand and the measure of interest (e.g. pounds of carbon dioxide emissions), a ratio between total and direct effects in that metric can be calculated. However, three multipliers are most common. (For more, see: http://www.ku.edu/pri/publicat/multipliers/multipliers.htm, http://www.uaex.edu/Other_Areas/publications/HTML/FSCDD-6.asp)

An *employment multiplier* summarizes the number of total jobs in the economy that will be created for each new job created directly by a given increase in final demand. An *output multiplier* represents the total value of new sales that will be stimulated in the economy for each dollar increase in final demand. And the *income multiplier* indicates the total amount of new income that will be generated for each dollar of income earned by workers in the industry directly affected by the increased final demand.

To use each of these multipliers in measuring economy-wide impacts, the multiplier would be multiplied by the direct effects of the project translated into the appropriate metric (jobs, dollars of final demand, income). Assume, for example, it is determined that a $50,000 increase in final demand for range-fed cattle leads to an increase in 1 job in that industry on average (direct impact). The national jobs multiplier for the range-fed cattle industry is about 3. Thus, economy wide impacts for every new job supported by increased demand for range-fed cattle will be 3*1= 3 jobs.

Any one of these multipliers is as valid to use as any other. The choice of which to use depends upon what issues are being studied and what metrics are of greatest salience to the intended audience. These three kinds of multipliers are often calculated before others because they tend to have high political salience.

Multipliers Accounting for Respending of Increased Income

When increased final demand triggers the spending/respending cycle, wages and profits in the affected industries increase. Some multiplier calculations treat these increased returns to labor and capital as leakage from the economy, and don't consider their impacts any further. So-called "Type I" multipliers account only for the "indirect" effects of respending associated with industry purchases of inputs from other industries. The multipliers are calculated by dividing the direct plus indirect effects by the direct effects.

However, other multipliers include estimates of additional "induced" effects. The induced effects are associated with consumer spending of increased incomes. These multipliers vary slightly among themselves according to the spending behaviors they assume consumers follow when they receive increased income. The multipliers are calculated by dividing the direct plus indirect plus induced effects by the direct effects. Because this class of multipliers includes all direct and indirect effects as well as the induced effects, these multipliers are necessarily larger than their Type I counterparts.

While there may be special analytic reasons for focusing in on industry purchases alone, in most economic impact studies it will make sense to use the larger and more comprehensive multipliers that account for induced impacts as well.

SAM Multipliers

SAM multipliers are in some ways similar to induced multipliers. Both account for the reinjection into the local economy of certain kinds of earnings associated with increased production. However, whereas induced multipliers focus on spending by household consumers, SAM multipliers can be more inclusive. They can account either separately or collectively for the respending of the earnings or revenue receipts of employees, business owners, landowners, stockholders, government, corporations and other entities that. claim some part of the ultimate value that is added to a commodity above the costs of its inputs. SAM multipliers are calculated from the SAM accounts discussed above that capture the complete set of money exchanges between industry, government, and households.

SAM multipliers that account only for the respending of households reflect the same essential dynamic as induced multipliers, but they differ in the way they are calculated. Because of the difference, household-only SAM multipliers tend to run slightly smaller than induced multipliers. On the other hand, SAM multipliers that include household and government or other spending can be significantly larger than induced multipliers.

Size of Multipliers – Beware of Huge Multipliers

Table 1 reports the size of multipliers, averaged across all industries derived from the MIG IMPLAN input-output model for the nation as a whole, New York state, and one small area example of an upstate New York county (100,000 population). The table is consistent with the tendency of small area multipliers to be comparatively small themselves. Note that the average multiplier for the single county is in no case as large as 2. The average multiplier for New York state is no case as large as 2.5.

This does not mean that larger multipliers calculated for states or state subregions are necessarily erroneous or misleading. However, it does suggest that small area multipliers that are 3-5 or larger should be scrutinized and interpreted very carefully. They may as easily reflect special circumstances as error.

Perhaps, for example, there are extraordinarily strong local linkages between an industry and other parts of the local economy. However, sometimes the special circumstances are just that, namely special. The relationship of a few small start-up companies may, in a given instance, reflect current reality but be unlikely to provide any good information about how the local industry would respond if faced with significant increases in final demand. In this case, there are some background assumptions in the models that generated the multipliers (e.g. that fundamental production relationships and prices remain unchanged within the range of increase in final demand) that may be violated. In any event, an extra effort to understand why certain multipliers are extra large is likely to be worthwhile.

Table 1. Average Type I, Induced, and SAM Multiplier Values for the United States, New York State, and a New York County with a Small City

	United States	New York State	County With a Small City**
	Average Multiplier Value for all Industries		
Type of Employment Multipliers			
SAM - All households and governments	5.69	2.49	1.70
SAM - Households Only	4.27	2.05	1.55
Induced Effects	4.66	2.20	1.66
Type I Multipliers	2.65	1.56	1.30
Type of Output Multipliers			
SAM - All households and governments	3.25	1.74	1.50
SAM - Households Only	2.68	1.59	1.41
Induced Effects	2.87	1.67	1.49
Type I Multipliers	1.88	1.34	1.23
Type of Value Added* Multipliers			
SAM - All households and governments	4.74	2.31	1.78
SAM - Households Only	3.70	2.02	1.64
Induced Effects	4.01	2.15	1.75
Type I Multipliers	2.41	1.61	1.39

*VA includes income (employee compensation, self-employment income), investment returns and profit, and indirect business taxes like excise and sales tax

**Tompkins County NY; county approximately 100,000 population

Source: IMPLAN, 1998 data

Where do Multipliers Come From?

Perhaps the most common source of multiplier use historically was from a literature search: analysts borrowed multipliers calculated in another study and used them in a "similar" context. However, as the cost of calculating region-specific multipliers has decreased, an increasing number of private consultants, regional economists at universities, economic development and planning agencies, and other government analysts have the capacity to base their impact studies on more appropriate multipliers. All depend on access to regional economic models.

Some models are not made widely available. However, as noted in a recent study for the US Department of Transportation, there are "a wide range of commercially available... models that can be used… They range from the relatively inexpensive and fairly simple U.S. Department of Commerce, Regional Input-Output Modeling System (RIMS II)1 to the moderately priced and more complex Minnesota IMPLAN2 input-output model. One may also opt for the most sophisticated and expensive integrated input-output-econometric model currently available for analysis of this type developed by Regional Economic Modeling, Inc. know as REMI3."

Many if not most of the impact studies cited in the press are based on one of these sources. A broad comparison of each option is beyond the scope of this paper. However, for more online information on RIMS II see http://www.bea.doc.gov/bea/regional/rims/; for more on IMPLAN see http://www.implan.com; for more on REMI see http://www.remi.com/, and for some comparative information see:

> http://www.cefa.fsu.edu/econimpact.pdf and
> http://www.implan.com/KnowledgeBase/DisplayArticle.asp?KBID=20030

For further information on multipliers or impact analyses in New York and Pennsylvania, and for possible contacts in other states, please contact David Kay (dlk2@cornell.edu).

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U.B. comments: see also:

1. http://www.nesungrant.cornell.edu/cals/sungrant/events/upload/sungrant_2007conf2_Kay-pdf.pdf
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