MID-CONTINENT
REGIONAL
SCIENCE
ASSOCIATION

IMPLAN Group LLC

Mid-Continent Regional Science Association
47th
Annual Conference

IMPLAN National User's Conference
11th
Biennial Conference

2016 Conference Proceedings

June 9 - June 11, 2016

Sheraton Charlotte Hotel

Charlotte, North Carolina

Mid-Continent Regional Science Association

IMPLAN Group, LLC.

2016 Conference Proceedings

November 2016

John Leatherman, Compiler

with assistance from

Alana McLain, Research Assistant

Rebecca Bishop, Extension Associate

Department of Agricultural Economics

Kansas State University

Table of Contents

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

USING ENTERPRISE SOFTWARE DATA TO ANALYZE THE ECONOMIC CONTRIBUTIONS AND IMPACTS OF UNIVERSITY PROGRAMS WITH THE IMPLAN MODEL

Dari Duval
Ashley Kerna
George Frisvold
University of Arizona - USA

Abstract: This paper presents a method of assessing the economic contributions and impacts of university programs with IMPLAN using financial data collected through enterprise software systems to create customized spending patterns using a hybrid detailed bill-of-goods approach. When available, financial data on expenditures by schools, departments, or programs can be used to model the economic contribution of universities to a state or regional economy. Disaggregating by funding source enables an analysis of economic impacts resulting from attraction of funds to the university from outside the region or state and expenditure of those funds in the local economy on wages, goods, and services. Disaggregating by expense type allows for a more detailed estimate of expenditures by creating a customized institution spending pattern in an effort to better reflect leakages from the local or regional economy. Three case studies are used to compare the estimates obtained using this method to estimates obtained using a simple analysis by parts. The detailed bill-of-goods approach yielded more conservative estimates in two cases, and a slightly higher estimate in one, compared to the simple analysis by parts. These estimates are likely more accurate because they better capture information on leakages from the local economy. The conditions where the methods produce similar or different estimates are explored.

1. Introduction

Universities and other higher education institutions represent critical pillars of regional economies. In addition to their impacts on human capital and quality of life, university operations employ local workforce, procure goods and services from local and regional suppliers, and garner external funding for research and programs, thereby providing support and stimulus for the local economy.

This study presents a method to assess the economic contributions and impacts of university programs with IMPLAN[1] using financial data collected through enterprise software systems[2]. When available, financial data on expenditures by schools, departments, or programs can be used to model their economic contributions and impacts to a state or regional economy. The ability to disaggregate program expenditures by funding source enables an analysis of economic impacts resulting from attraction of competitively

[1] IMPLAN is a widely-used input-output data and modelling system, originally developed by the US Forest Service, used to estimate the effects of changes in final demand for a good or service on regional economies through backward linkages with suppliers of inputs to production.

[2] Enterprise software is software used by businesses or organizations to manage key operational areas such as finance, human resources, or materials management, and aggregates data across the organization.

awarded funds to the university from outside the region or state and spending of those funds in the local economy on wages, goods, and services. Disaggregation by expense type permits the creation of a detailed customized institution spending pattern that better reflects leakages from the local or regional economy as compared to spending patterns based upon national averages. This analysis uses case studies to compare the estimates generated using these methods, a hybrid detailed bill-of-goods approach, to estimates generated using another common method for assessing the economic contributions and impacts of universities on regional economies, a simple analysis-by-parts approach.

While both methods can be used to assess the contributions or impacts of an entire university, this study focuses on programs or departments within a university. Two of the case studies focus on Cooperative Extension[3] programs, while the third examines a university school / department. This distinction is important because university Cooperative Extension activities often vary considerably depending upon the type of outreach and subject matter. For example, a Cooperative Extension program such as 4H[4] may spend much of its funding on agricultural supplies and building materials. A nutrition education program may spend funds on food demonstration products and public outreach activities. Considering the diversity of programs and activities carried out at universities, when examining individual programs or departments, spending patterns can differ significantly from the university average. This difference can be captured using detailed financial data. Easy access to income and expense data through university enterprise software systems, including the ability to segment data by expenditure type and funding source, affords the opportunity to create customized spending patterns that accurately reflect spending at the individual program level.

2. Background

Estimating the economic contributions and impacts of universities and other higher education institutions presents a unique challenge and there are a number of strategies for estimating the magnitude of those contributions and impacts. According to recommended best-practices by the Association of Public Land-Grant Universities (APLU, 2014), input-output models are most useful in estimating the contributions and impacts of universities through their operations, capital investment, student spending, and visitor spending.

This current analysis focuses on university program or department operations. Part of the benefit of focusing on university operations is that typically there is great deal of information available to use in estimating the university's spending pattern and the magnitude of impacts or contributions is easily quantified using financial data. Analyses that translate program outcomes into economic impacts are much more challenging to perform, considering the cost of collecting data, especially with regard to the diffusion of technologies, research, and other university activities. An example of this type of analysis is an estimate of potential economic impacts of increases in productivity resulting from Cooperative Extension's forestry program in southeastern Oklahoma by Marcouiller, et al (1992). Even so, their analysis presents a hypothetical impact, and not actual observed values.

Many contribution studies confound contributions with impacts. Kirk, et al (2014) distinguish between impacts and contributions – contribution analyses measure gross changes in economic activity while impact analyses measure

[3] Cooperative Extension operates through U.S. land grant universities to "bring vital, practical information to agricultural producers, small business owners, consumers, families, and young people." (NIFA, 2016)

[4] 4-H is a youth development program through Cooperative Extension which provides learning opportunities to children through agriculture, animal husbandry, and more recently, science, technology and other areas of interest.

net changes, excluding activity "that already occurs within the pre-determined geographic area." They emphasize the importance of correctly distinguishing between the two types of analyses in order to maintain credibility. State funds spent on university operations could just as well be spent on other budgetary items in the state that generate their own economic contributions. It is important to distinguish between economic contributions and economic impacts – economic activity that would not have occurred were it not for the institution. According to the Association of Public Land-Grant Universities (APLU, 2014), "economic impact occurs as we segregate activity that is exogenously demanded or funded". Financial data can help isolate expenditures of exogenous funding from public in-state or local funding that would have been spent in the regional economy regardless of the university's presence. Siegfried et al (2007) note that federal research funding usually can be considered as exogenous, generating demand for service exports, and therefore as an economic impact. The method presented in this paper addresses the need to isolate exogenously demanded services and avoid claiming impacts that in actuality represent contributions.

Both economic contribution and economic impact analyses are performed using input-output models, such as IMPLAN[5] or RIMS II[6]. Input-output models use data on inter-industry transactions within a regional economy to model the ripple effects of a final change in demand for a product or service. As final demand increases, inputs to create that product or service are also demanded, both from local and non-local suppliers. That wave of backward-linkages propagates through the economy, eventually dissipating due to leakages through non-local purchases. The models help to estimate not only the output (sales), value added (GDP), and jobs directly created through changes in final demand, but also the economic activity and jobs indirectly supported through that final demand. Both IMPLAN and RIMS II contain (either explicitly or implicitly) information on how industries spend on inputs to create their final products, and these spending patterns reflect national averages. For some industries, inputs to production are similar in all regions, though for others, production practices vary considerably by region.

In this study, we utilize two analysis-by-parts methods for economic contribution and impact analysis. Analysis-by-parts separately models the direct effects and resulting indirect effects of an industry or institution spending pattern, and the direct effects and resulting induced effects of a labor income change. We apply analysis by parts in two ways: in the first we create a customized institution spending pattern using a hybrid detailed bill-of-goods approach, and in the second we use standard IMPLAN institution spending patterns.

The first of the two methods we use is the detailed bill-of-goods approach. According to Swenson (2014), the bill-of-goods approach is the best way to estimate the impact or contribution of universities. The bill-of-goods approach uses information on spending by category or item to create a customized spending pattern for an industry or institution. This is then used to model the indirect effects of the direct change in final demand. This method is helpful when the spending pattern being modeled is not well represented by any particular industry or institution. Financial data on expenditures can be used to inform a bill-of-goods style analysis. Data on specific expenditures can be categorized in accordance with NAICS codes or IMPLAN sectors and then aggregated by sector to create the industry or institution spending pattern. If the zip code of the vendor is available, this can be used to calculate the local purchase percentage (per Swenson, 2014). In the case of IMPLAN, the model will automatically provide estimated local purchase percentages.

[5] See Footnote 1.

[6] RIMS II (Regional Input-Output Modeling System) is a set of input-output multipliers produced by the Bureau of Economic Analysis that can be used to model economic impacts and contributions. Ambargis, et al (2011) provide guidelines on using RIMS II for a bill-of-goods style analysis.

The second method used is the simple analysis-by-parts method (IMPLAN Group, 2015). The technique separately models the direct effects and resulting indirect effects of an industry or institution spending pattern, and the direct effects and resulting induced effects of a labor income change. The IMPLAN model has built-in industry spending patterns and institution spending patterns which can be applied. These spending patterns reflect national averages. For example, IMPLAN provides an institution spending pattern for State/Local Government Education, which averages primary, secondary, and post-secondary public educational institution spending patterns. While industry and institution spending patterns generated by IMPLAN can be modified to reflect differences in local production practices, this study conducts a simple analysis-by-parts and makes no modifications to the IMPLAN-derived spending patterns. Analysis by parts can be useful in creating customized spending patterns for industries and institutions, as we have done in the hybrid detailed bill of goods approach.

Combining the two sets of criteria of local versus non-local income and local versus non-local expenditures (in this case, local refers to within the study area, whether that be county, legislative district, or state), we are able to delineate the distinction between economic contribution, economic impact, and leakages from the economy (Figure 1).

Figure 1. Framework for Economic Contributions, Impacts, and Leakages based on Local versus Non-Local Nature of Income and Expenses

		Expenses	
		Local (In-State Vendors & Employees)	**Non-Local** (Out-of-State Vendors & Employees)
Income	**Local** (State and Local, Formula Funds)	*Economic Contribution*	*Leakages*
	Non-Local (Federal, Foreign, Out-of-State Public & Private)	*Economic Impacts*	*Leakages*

Not all non-local funds create economic impacts. For example, formula funds[7] for Cooperative Extension are allocated annually non-competitively and therefore should only be categorized as economic contributions. So, spending for any one extension activity would otherwise have been spent on some other extension activity in the state. Similarly, we posit that federal funding awarded to state governments and then granted competitively to university and other programs within the state should be considered economic contributions (not economic impacts) of the university or programs, as presented in Case 3 of this study. As mentioned before, economic impacts originate from exogenous demands, and in this case that would include competitively awarded grants and funding from outside the study area.

In the case studies examined, we use the state-level accounting stance in defining the study area. Especially in the case of Extension programs, assessing impacts at the state level is appropriate because Extension specialists operate and program expenditures occur throughout the state for most programs.

[7] Formula funds are federal funds provided to land grant universities based upon formulas established in the four federal Acts governing the funding of Cooperative Extension.

3. Methods

The hybrid detailed bill-of-goods method relies on use of enterprise software that houses financial information for the university. The University of Arizona uses Oracle PeopleSoft, but other common programs include SunGard, Datatel, and SAP (Educase, 2012). Program spending can be accessed by fiscal year, academic unit (instruction, research, or Cooperative Extension), source of funds, and type of expenditure. Even further details on individual purchases can be accessed to see the goods or services purchased and the location of the vendor. This method closely resembles a detailed bill-of-goods analysis proposed by Swenson (2014), which also falls under the framework of an analysis-by-parts. We expand on it by introducing the funding source, and also using the standard IMPLAN institution spending pattern to model indirect costs. Our hybrid approach is implemented through the following steps.

Step 1: Identify type (impact versus contribution) and geographic scope of analysis being performed to determine data needs

The data required to begin the analysis depends upon the type of analysis being performed. In the case of estimating the contribution of a program in a given fiscal year, all program expenditures for the fiscal year would be required. For an economic impact analysis, however, expenditures would need to be limited to only externally funded projects and research. In most cases, federal, foreign, and out-of-state state funding would be considered as externally funded for analyses examining statewide economic impacts. In the case that regional economic impacts were being examined, funding coming from outside the region could be counted as external funding.

Step 2: Identify leakages from local economy

Using the relevant data, leakages from the local economy can be identified in the expenditure data. For example, spending on out-of-state or foreign travel should be excluded from the analyses. If data on individual transactions and vendors is available, expenditures can be narrowed down to only those transactions with local vendors. If no information is available on individual transactions and vendors, the IMPLAN model has built-in estimates of local purchase percentages. Leakages can be modeled either by only including local spending (if the data is available) and later setting the local purchase percentage to 100% in IMPLAN, or by including all expenditures by category and later setting the local purchase percentage in IMPLAN to the appropriate value based upon percentage of in-state or in-region spending. For labor income, if it's possible to know where employees are located (in-state or in-region), only labor income for employees located in the study region should be captured in the model.

Step 3: Convert expenditure categories to IMPLAN industries

Using IMPLAN's built-in industry search function, assign IMPLAN industries by expenditure category. Once again, if individual transaction information is available, it can be helpful in assigning the most appropriate IMPLAN category. Spending on salaries, wages, and benefits should be categorized as labor income. Expenditures on indirect cost sharing should be separated and will be analyzed using an institution spending pattern. The resulting list of expenditures by IMPLAN industry (or commodity) constitutes the new spending pattern that will be applied to program expenditures.

Step 4: Manually apply retail and wholesale margins

Before running the model in IMPLAN, it is important to apply retail margins to the appropriate sectors as IMPLAN will not automatically do this for a custom spending pattern. IMPLAN has available a list of margining patterns by industry which can be used to redistribute the spending on manufactured goods if they are not being counted under a retail

or wholesale category. This will modify the spending pattern generated in the previous step. The resulting spending pattern can then be used to calculate a final spending pattern and percentage of total spending on each industry or commodity.

Step 5: Perform IMPLAN analysis

In previous steps, expenditures should have been categorized into program expenditures, labor income, and indirect cost sharing (if applicable to institution). These three categories of spending will be modeled individually in an analysis by parts.

- Spending on salaries, wages, and benefits[8] – model as a labor income change
- General program expenditures – model as a customized institution spending pattern using percentages generated in previous steps
- Indirect cost sharing / recovery – model using preexisting IMPLAN institution spending pattern; we use State/Local Government Education as a public institution

While program expenditures may vary significantly from a traditional university spending pattern, indirect costs support general university expenditures on administration, facilities, and other support services. An institution spending pattern is therefore an appropriate choice for modeling indirect costs.

Step 6: Reconfigure results to include direct impacts

Once results have been calculated through IMPLAN, it is necessary to rearrange results to include direct impacts again because, when using a labor income change and the institution spending pattern, the direct effects of university operations are not captured. The direct effects generated by IMPLAN should be combined with indirect effects, for the total indirect effects. Induced effects do not need to be modified. The new direct effects should mirror the original values entered into IMPLAN. Labor income will be equal to the labor income change modeled, value added will be equal to the labor income change as well, and output will be the value of the labor income change plus the program spending and indirect cost (if applicable) combined. Total effects can then be recalculated and presented.

In some cases, it may be difficult to know the exact number of direct jobs supported by a program or external research funding. For example, faculty and staff supported by federal research grants are often also supported by state funding, and therefore it is difficult to identify the exact number of direct jobs supported. In the case of programs where there is a clear distinction of who is supported or not supported by specific funding, the direct job impacts can be added to the indirect and induced job impacts for the total job impact, similar to labor income, value added, and output.

4. Case Studies & Results

In this section, we use three case studies to compare the results of the hybrid detailed bill-of-goods approach described above with a simple analysis-by-parts. In the case of the latter, the simple analysis-by-parts uses IMPLAN's State/Local Government-Education institution spending pattern (using IMPLAN's local purchase percentages) for all program expenditures on supplies, services, and indirect costs. A labor income change is used to model all spending on salaries and wages. For reference, we refer to the hybrid detailed bill-of-goods style analysis (described in previous section) as BOG and the simple analysis by parts as ABP.

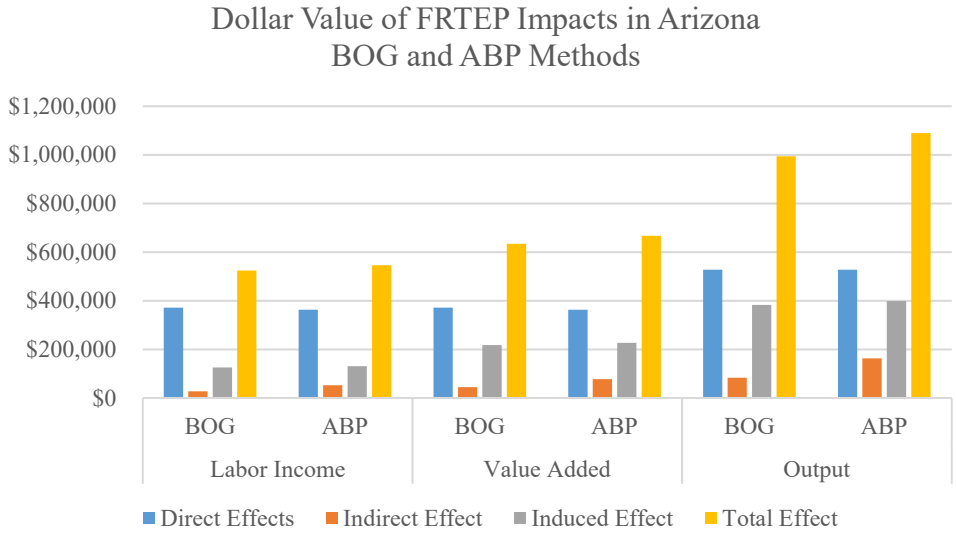
4.1. Case Study I: University of Arizona Cooperative Extension Federally Recognized Tribes Extension Program (FRTEP)

[8] If information can be obtained to estimate the salaries and wages paid to employees living outside the region or state, that labor income leaving the study area should be modeled as a leakage.

The Federally Recognized Tribes Extension Program (FRTEP) is a federal program that supports Cooperative Extension in providing their programs to tribal communities throughout the country. In recent years, more than half a million dollars per year have been brought into Arizona through FRTEP, which supports University of Arizona Cooperative Extension programs in Arizona tribal communities. These external funds not only support faculty and staff in their activities working with tribal agriculture, they also produce multiplier effects that generate additional economic activity in the state. These multiplier effects stimulate additional spending on primarily private sector goods and services. The inflow of funds through the FRTEP program increases economic output in Arizona by nearly $1 million per year, including direct, indirect, and induced effects. This study captures the direct and multiplier effects of the FRTEP program in Arizona. By definition, this analysis is an economic impact analysis since it measures the net change in economic output attributable to Cooperative Extension bringing in federal funds to the state economy.

FRTEP operates on a 4-year funding cycle, therefore program expenditures were averaged over 4 fiscal years and modeled in 2015. Using the average annual spending pattern, the above-described methodology was applied. The BOG approach produced an estimate of $994,173, whereas ABP resulted in an estimate of $1,089,504 in total output, roughly a 9.6% difference.

Figure 2. Comparison of Economic Impacts under the Bill-of-Goods (BOG) and Analysis-By-Parts (ABP) Methods – Federal Recognized Tribes Extension Program (FRTEP) Case Study



In this case, the ABP method estimates greater impacts compared to the BOG approach (Figure 2). This is a result of identifying leakages from the state economy in the BOG approach. The only exception is the case of the direct impact on labor income. The process of categorizing expenditures lead to the inclusion of additional expenditures as labor income which produced a slight increase in direct labor income in the BOG analysis.

The two methods can also be compared in terms of the top industries affected by indirect and induced effects. Both methods generate very similar results in terms of industries affected and

the magnitude of impact (Table 1). The top affected industries are influenced heavily by program spending on salaries and wages which in turn get spent on household expenditures such as rent, mortgage, and medical services. The two major differences in the model results are that the BOG method shows greater impacts to wireless telecommunications carriers and hotels and motels, reflecting specific program spending captured in the customized spending pattern.

This case highlights the importance of understanding the program's operations and context in order to correctly interpret and categorize spending data. In particular, for programs that potentially operate both inside and outside the impact study area, some expenditures may have to be categorized as leakages due to where they're occurring.

Table 1. Top 10 Industries affected by Federal Recognized Tribes Extension Program Spending in Arizona (Indirect & Induced Impacts)

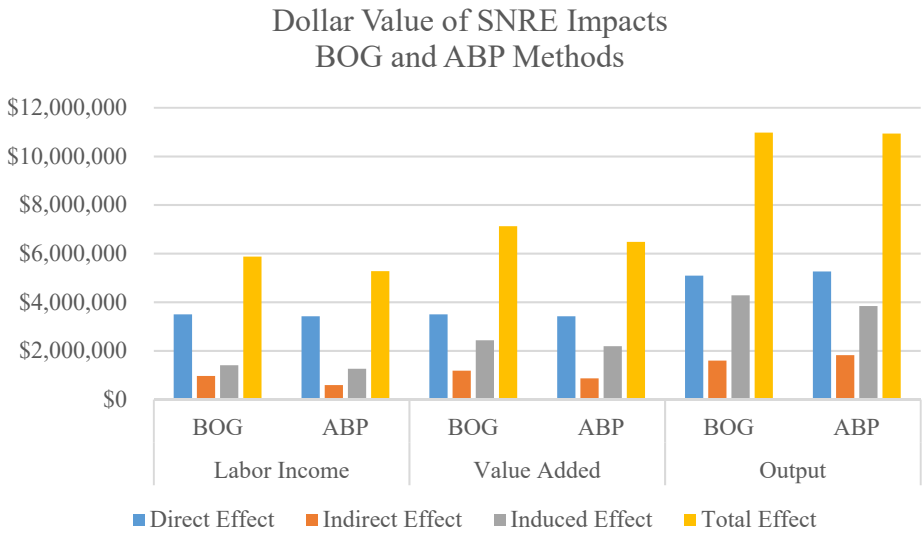
Detailed Bill-of-Goods Approach (BOG)			Simple Analysis-by-Parts (ABP)		
Sector	**Description**	**Output**	**Sector**	**Description**	**Output**
441	Owner-occupied dwellings	$44,128	441	Owner-occupied dwellings	$45,950
440	Real estate	$31,178	440	Real estate	$34,104
428	Wireless telecommunications carriers (except satellite)	$21,842	395	Wholesale trade	$21,063
395	Wholesale trade	$20,601	482	Hospitals	$20,843
482	Hospitals	$20,032	526	Other local government enterprises	$20,534
499	Hotels and motels, including casino hotels	$14,665	502	Limited-service restaurants	$15,270
437	Insurance carriers	$13,963	437	Insurance carriers	$15,087
405	Retail - General merchandise stores	$13,736	49	Electric power transmission and distribution	$14,026
501	Full-service restaurants	$13,711	475	Offices of physicians	$13,200
475	Offices of physicians	$12,686	428	Wireless telecommunications carriers (except satellite)	$12,152

4.2. Case Study II: University of Arizona, School of Natural Resources and the Environment (SNRE)

Research and Cooperative Extension faculty at the University of Arizona's School of Natural Resources and the Environment (SNRE) actively compete with universities and research laboratories across the nation for federal grants to support their research and Extension programs. This federal grant funding supports work on natural resource issues of critical importance to Arizona. Competitive grant funds brought in from outside of Arizona also stimulate the state's economy, generating additional economic impact within the state. Our analysis estimated the impact of SNRE competitive federal grants to Arizona's economy, accounting for both its direct and multiplier effects. This represents additional sales, jobs, and other economic activity generated in Arizona because SNRE faculty out-competed other states for federal research and Extension funds.

This analysis focuses on expenditures made in FY 2014 through competitively awarded federal grants, totaling $5.3 million. Of the $5.3 million, $3.4 million was spent on salaries and wages and the remainder on program/research expenditures. By focusing on externally awarded funding, the analysis is therefore measuring economic impacts.

Figure 3. Comparison of Economic Impacts under the Bill-Of-Goods (BOG) and Analysis-By-Parts (ABP) Methods – School of Natural Resources and the Environment (SNRE) Case Study



The BOG approach produces a slightly higher estimate across the board, including the direct labor income impact. In terms of total output, the BOG approach leads to an estimate of $11.0 million versus $10.9 million by ABP, roughly a 0.4% difference (Figure 3). This is a result of using the detailed expenditure data which enables us to uncover expenditures best categorized as labor income which previously fell under other categories such as subcontracts.

In this case, the top industry affected using the BOG approach is university employment and payroll, a result of the high level of spending on indirect costs by the federal grants (Table 2). The indirect cost rate charged to research projects covers general operating expenditures for the university, which in turn supports additional jobs at the university. Spending on indirect costs is captured as an expense item category along with all others and is modeled without excluding employment and payroll from the institution spending pattern, whereas in the simple ABP, it is customary to remove spending on salaries and wages since it is already modeled through a labor income change. Aside from this major difference, the top industries impacted are very similar. Marketing research and all other miscellaneous professional, scientific, and technical services appears in the top ten industries affected for BOG, reflecting a significant area of expenditure captured in the customized spending pattern that is not reflected in the pre-defined IMPLAN institution spending pattern.

This case shows us the importance of examining line-items expenditures such as contracts that may best be categorized as labor income which, without detailed examination, would otherwise fall under general program expenditures, producing different impacts.

Table 2. Top 10 industries affected by University of Arizona School of Natural Resources and Environment Spending (Indirect & Induced Impacts)

Detailed Bill-of-Goods Approach (BOG)			Simple Analysis-by-Parts (ABP)		
Sector	**Description**	**Output**	**Sector**	**Description**	**Output**
534	Employment and payroll of local government, education	$528,437	441	Owner-occupied dwellings	$441,755
441	Owner-occupied dwellings	$491,846	440	Real estate	$335,579
440	Real estate	$353,184	526	Other local government enterprises	$218,058
395	Wholesale trade	$262,655	395	Wholesale trade	$209,501
482	Hospitals	$222,224	482	Hospitals	$199,549
460	Marketing research and all other miscellaneous professional, scientific, and technical services	$170,831	502	Limited-service restaurants	$152,545
437	Insurance carriers	$155,344	49	Electric power transmission and distribution	$146,877
475	Offices of physicians	$141,051	437	Insurance carriers	$145,505
502	Limited-service restaurants	$130,302	475	Offices of physicians	$126,659
428	Wireless telecommunications carriers (except satellite)	$119,703	428	Wireless telecommunications carriers (except satellite)	$121,694

4.3 Case Study III: University of Arizona Nutrition Network (UANN)

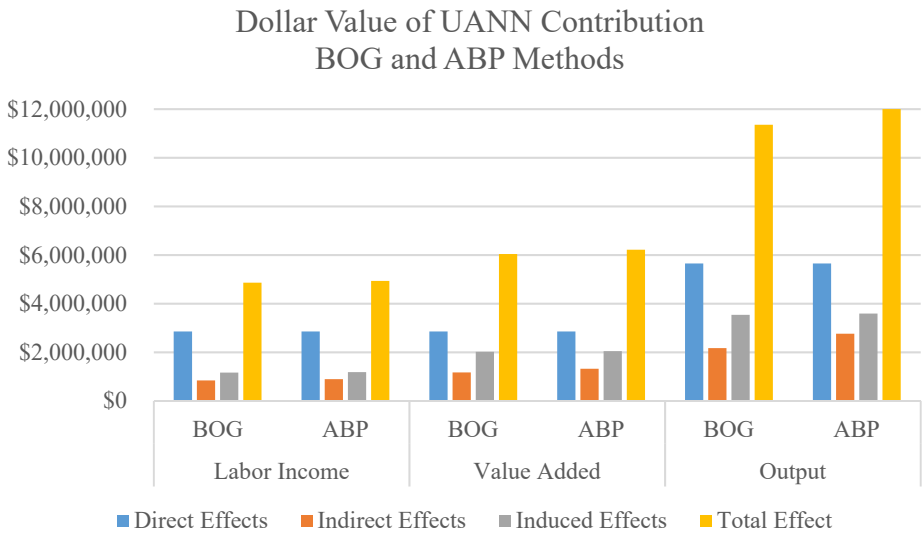
The University of Arizona Nutrition Network (UANN) is a University of Arizona Cooperative Extension nutrition education program that works throughout the state to coordinate and administer nutrition and physical activity education and interventions. Funding for this programming is provided by the U.S. Department of Agriculture's Food and Nutrition Service, with the Arizona Department of Health Services granting funds competitively to local implementing agencies throughout the state. UANN is a local implementing agency for the statewide Arizona Nutrition Network and is a major recipient of this competitive grant-funding.

Though competitively awarded at the state level, UANN spending should not be considered as an economic impact (as detailed in Section 2.1). In FY2014, the University of Arizona Nutrition Network received $5.6 million for program implementation. Slightly more than one-half of this funding was used to employ Arizona residents to deliver the nutrition education programming to SNAP[9] and SNAP eligible participants. The remaining funds were used to cover University of Arizona indirect costs and UANN program operations.

[9] The Supplemental Nutrition Assistance Program (SNAP) is a federal program under the United States Department of Agriculture (USDA) that provides nutrition assistance to low-income individuals and families.

This program has expenditures that differ significantly from a typical university spending pattern. The top three expenditures of the program were (1) educational and promotional materials, (2) sub-contracts with other nutrition education service providers, and (3) food demonstration ingredients, garden supplies, kitchen supplies, and other operating supplies.

Figure 4. Comparison of Economic Contribution under the Bill-Of-Goods (BOG) and the Analysis-By-Parts (ABP) Methods – University of Arizona Nutrition Network (UANN) Case Study



Modeling UANN program expenditures using the BOG method resulted in an estimated output contribution of $11.4 million. Alternatively, modeling using ABP resulted in an estimated output contribution of nearly $12 million (Figure 4), about five percent higher than the BOG estimate. The primary reason for the difference in the results is the leakage that is occurring and is being captured in the BOG approach. As stated previously, a majority of the budget is spent on educational and promotional materials. Currently only 5% of those purchases are from Arizona vendors. This leakage results in a significant decrease in Arizona final demand. The final demand for the BOG approach was $1.5 million and the final demand for ABP was approximately $1.9 million. While there were some sectors that were modified so that the local purchasing percentage was 100% for the region, the sheer magnitude of the expenses for educational and promotional materials dwarfed any positive economic effects from customizing the model for more local purchases.

The top two industries affected, owner-occupied dwellings and real estate, are influenced by induced effects through the labor income change in both BOG and ABP methods. This is also the case for hospitals and restaurants. Households spend their income on rent, mortgages, food, and expenditures like visits to the doctor. In terms of industries affected, where the BOG approach produces different results from ABP is in individual and family services.

Table 3. Top 10 Industries Affected by University of Arizona Nutrition Network (UANN) Spending (Indirect & Induced Impacts)

Detailed Bill-of-Goods Approach (BOG)			Simple Analysis-by-Parts (ABP)		
Sector	**Description**	**Output**	**Sector**	**Description**	**Output**
441	Owner-occupied dwellings	$406,584	441	Owner-occupied dwellings	$412,660
440	Real estate	$378,780	440	Real estate	$347,889
395	Wholesale trade	$202,150	526	Other local government enterprises	$290,641
485	Individual and family services	$196,294	395	Wholesale trade	$210,261
482	Hospitals	$183,541	482	Hospitals	$186,258
526	Other local government enterprises	$160,299	49	Electric power transmission and distribution	$185,249
437	Insurance carriers	$138,989	502	Limited-service restaurants	$165,007
405	Retail - General merchandise stores	$136,727	50	Natural gas distribution	$159,159
502	Limited-service restaurants	$129,463	430	Data processing, hosting, and related services	$157,517
49	Electric power transmission and distribution	$117,240	431	News syndicates, libraries, archives and all other information services	$146,403

This case illustrates how the extent to which a program works with vendors either inside or outside the study area can lead to different results using the two methods. In this example, a major contract with an out-of-state vendor resulted in leakages that were not captured with the simple analysis by parts method.

5. Conclusion

In two of three case studies, the hybrid detailed bill-of-goods approach produces more conservative estimates of program impacts compared to the simple analysis-by-parts. This is a result of having additional information to identify leakages from the state economy through purchases from out-of-state suppliers. In the SNRE case study, the detailed bill-of-goods approach produced a slightly higher estimate as a result of capturing additional labor income previously categorized as subcontracts. The detailed bill-of-goods approach, therefore, could produce an estimate that is smaller, equal to, or great than the simple analysis-by-parts depending on the proportion of local spending by the program and how that compares to IMPLAN's State/Local Government-Education institution spending pattern and associated local purchase percentages. The extent to which the results of the two methods differ is also a function of the proportion of program spending on salaries and wages versus goods and services. Especially in programs that are dominated by expenses on goods and services versus salaries and wages, there could be a greater difference between the two methods. Conversely, for labor heavy programs, so long as the jobs are within the state or region which represents the geographic extent of the analysis, there should not be too large of a difference between the two methods. Assuming most spending on salaries and wages is within-region, both methods will produce the same results for that portion of program spending.

Especially for programs that carry out activities that are significantly different from 'average' education activities, for example, some Cooperative Extension outreach programs, this method offers an opportunity to create an economic impact or contribution estimate that better reflects the program's activities. In the case that carrying out

such an analysis captures leakages through out-of-state spending, it may yield a more conservative estimate of impacts or contributions. In the case that the spending pattern varies significantly from the average State/Local Government-Education spending pattern, the estimates of top industries affected can change as well. Even if the magnitude of impact or contribution is not much different, understanding top industries affected can have important implications for garnering program support and for regional economic development.

While a detailed bill-of-goods analysis can potentially better capture leakages from the regional economy and more accurately reflect the industries being indirectly affected by university operations, it is also a more time-intensive method compared to simple analysis-by-parts. In situations that demand expediency of analysis, simple analysis-by-parts may be a more advantageous approach, especially in the case of analyzing programs that have a high proportion of expenditures on salaries and wages. Both methods provide estimates of impacts and contributions of similar magnitudes, and the estimates are ultimately estimates that depend upon assumptions of the input-output model.

For practitioners, gaining access to enterprise software for purposes of analysis can provide an enormous amount of information useful for quantifying university contributions and impacts. Understanding the structure, coding, and functionality of the database, however, can represent a steep learning curve. Communicating with staff members who manage the systems is helpful to develop the understanding needed to appropriately disaggregate and categorize expenditures and funding sources. Finally, while access to detailed financial data enables quick turnkey analysis, it is best supplemented with contextual information from program faculty and staff to accurately represent the nature of program activities.

References

Ambargis, Z., McComb, T., & Robbins, C. (2011). Estimating the Local Economic Impacts of University Activity Using a Bill of Goods Approach. Bureau of Economic Analysis. The 19th International Input-Output Conference, Alexandria, Virginia, June 13-19, 2011.

APLU (2014). Economic Impact Guidelines. Association of Public Land-Grant Universities, accessed at www.aplu.org/CICEPFramework.

Grajek, Susan, Leah Lang, & David Trevvett (2012). The 2011 Enterprise Application Market in Higher Education. Educause Center for Applied Research. June 2012.

IMPLAN Group (2015). The Basics of Analysis by Parts. IMPLAN Pro Knowledge Base. http://www.implan.com. Accessed May 2016.

Kirk, D., Allen, K., & Shideler, D. (2014). Economic Activity Analyses: The Need for Consensus. Journal of Extension, Vol 52, No 3. Accessed at http://www.joe.org/joe/2014june/comm2.php

Marcouiller, David, et al (1992). Estimating Economic Impacts of Programming. Journal of Extension, Vol 31 No 3. Accessed at http://www.joe.org/joe/1992fall/a6.php

NIFA (2016). Extension. National Institute of Food and Agriculture, United States Department of Agriculture. Accessed at https://nifa.usda.gov/extension.

Siegfried, John, Allen Sanderson, & Peter McHenry (2007). The economic impact of colleges and universities. Economics of Education Review, Vol 26, pp 546-558.

Swenson, Dave (2007). Measuring university contributions to regional economies: A discussion of guidelines for enhancing credibility. Economics of Education Review, 26, 546-558.

Swenson, Dave (2014). Using IMPLAN to evaluate public universities regional economic impacts. Economics Technical Reports and White Papers. Paper 7. Accessed at http://lib.dr.iastate.edu/econ_reportspapers/7.

Appendix A: Impact Results

Case Study I Results: Arizona Federally Recognized Tribe Extension Program (FRTEP)

Table A.1 – Hybrid Detailed Bill-of-Goods Approach

Impact Type	Labor Income	Value Added	Output
Direct Effects	$371,784	$371,784	$527,823
Indirect Effect	$27,149	$44,880	$83,288
Induced Effect	$125,575	$217,687	$383,062
Total Effect	$524,508	$634,351	$994,173

Table A.2 – Simple Analysis-by-Parts

Impact Type	Labor Income	Value Added	Output
Direct Effects	$362,822	$362,822	$527,823
Indirect Effect	$52,576	$77,494	$162,908
Induced Effect	$130,728	$226,618	$398,773
Total Effect	$546,126	$666,934	$1,089,504

Case Study II Results: University of Arizona School of Natural Resources and the Environment (SNRE)

Table A.3 – Hybrid Detailed Bill-of-Goods Approach

Impact Type	Labor Income	Value Added	Output
Direct Effect	$3,504,030	$3,504,030	$5,096,548
Indirect Effect	$965,545	$1,183,651	$1,597,627
Induced Effect	$1,406,610	$2,438,375	$4,283,878
Total Effect	$5,876,185	$7,126,056	$10,978,053

Table A.4 – Simple Analysis-by-Parts

Impact Type	Labor Income	Value Added	Output
Direct Effect	$3,423,152	$3,423,152	$5,268,196
Indirect Effect	$591,213	$870,949	$1,822,898
Induced Effect	$1,263,268	$2,189,885	$3,847,302
Total Effect	$5,277,633	$6,483,986	$10,938,396

Case Study III: University of Arizona Nutrition Network (UANN)

Table A.5 – Hybrid Detailed Bill-of-Goods Approach

Impact Type	Labor Income	Value Added	Output
Direct Effects	$2,855,202	$2,855,202	$5,647,381
Indirect Effects	$839,505	$1,165,454	$2,166,813
Induced Effects	$1,162,440	$2,015,083	$3,540,160
Total Effect	$4,857,147	$6,035,739	$11,354,354

Table A.6 – Simple Analysis-by-Parts

Impact Type	Labor Income	Value Added	Output
Direct Effect	$2,855,201	$2,855,201	$5,647,381
Indirect Effect	$894,707	$1,318,043	$2,758,667
Induced Effect	$1,179,756	$2,045,098	$3,592,882
Total Effect	$4,929,664	$6,218,342	$11,998,930

Appendix B. Top 10 Industries Affected (Indirect & Induced Effects)

Case Study I: Arizona Federally Recognized Tribe Extension Program (FRTEP)

Table B.1 – Hybrid Detailed Bill-of-Goods Approach

Sector	Description	Labor Income	Value Added	Output
441	Owner-occupied dwellings	$0	$28,989	$44,128
440	Real estate	$3,982	$20,148	$31,178
428	Wireless telecommunications carriers (except satellite)	$751	$5,093	$21,842
395	Wholesale trade	$7,208	$13,158	$20,601
482	Hospitals	$9,942	$11,251	$20,032
499	Hotels and motels, including casino hotels	$4,729	$9,041	$14,665
437	Insurance carriers	$2,456	$7,707	$13,963
405	Retail - General merchandise stores	$5,278	$9,158	$13,736
501	Full-service restaurants	$7,039	$7,541	$13,711
475	Offices of physicians	$8,686	$8,451	$12,686

Table B.2 – Simple Analysis-by-Parts

Sector	Description	Labor Income	Value Added	Output
441	Owner-occupied dwellings	$0	$30,186	$45,950
440	Real estate	$4,355	$22,040	$34,104
395	Wholesale trade	$7,370	$13,453	$21,063
482	Hospitals	$10,345	$11,707	$20,843
526	Other local government enterprises	$5,407	$6,573	$20,534
502	Limited-service restaurants	$3,707	$8,641	$15,270
437	Insurance carriers	$2,654	$8,328	$15,087
49	Electric power transmission and distribution	$1,467	$5,347	$14,026
475	Offices of physicians	$9,038	$8,793	$13,200
428	Wireless telecommunications carriers (except satellite)	$418	$2,833	$12,152

Case Study II: University of Arizona School of Natural Resources and the Environment (SNRE)

Table B.3 – Hybrid Detailed Bill-of-Goods Approach

Sector	Description	Labor Income	Value Added	Output
534	* Employment and payroll of local govt, education	$455,825	$528,437	$528,437
441	Owner-occupied dwellings	$0	$324,792	$491,846
440	Real estate	$45,436	$229,926	$353,184
395	Wholesale trade	$90,800	$165,760	$262,655
482	Hospitals	$111,314	$125,970	$222,224
460	Marketing research and all other miscellaneous professional, scientific, and technical services	$98,387	$95,230	$170,831
437	Insurance carriers	$27,706	$86,949	$155,344
475	Offices of physicians	$97,253	$94,618	$141,051
502	Limited-service restaurants	$31,724	$73,939	$130,302
428	Wireless telecommunications carriers (except satellite)	$4,085	$27,704	$119,703

Table B.4 – Simple Analysis-by-Parts

Sector	Description	Labor Income	Value Added	Output
441	Owner-occupied dwellings	$0	$291,715	$441,755
440	Real estate	$43,171	$218,465	$335,579
526	Other local government enterprises	$57,817	$70,282	$218,058
395	Wholesale trade	$72,424	$132,214	$209,501
482	Hospitals	$99,956	$113,116	$199,549
502	Limited-service restaurants	$37,139	$86,561	$152,545
49	Electric power transmission and distribution	$15,361	$55,971	$146,877
437	Insurance carriers	$25,951	$81,442	$145,505
475	Offices of physicians	$87,330	$84,964	$126,659
428	Wireless telecommunications carriers (except satellite)	$4,152	$28,165	$121,694

Case Study III: University of Arizona Nutrition Network (UANN)

Table B.5 – Hybrid Detailed Bill-of-Goods Approach

Sector	Description	Labor Income	Value Added	Output
441	Owner-occupied dwellings	$0	$268,489	$406,584
440	Real estate	$48,729	$246,589	$378,780
395	Wholesale trade	$69,883	$127,575	$202,150
485	Individual and family services	$141,759	$135,857	$196,294
482	Hospitals	$91,938	$104,042	$183,541
437	Insurance carriers	$24,789	$77,795	$138,989
405	Retail - General merchandise stores	$51,995	$90,213	$136,727
502	Limited-service restaurants	$31,519	$73,463	$129,463
475	Offices of physicians	$80,325	$78,148	$116,498
433	Monetary authorities and depository credit intermediation	$40,523	$71,702	$108,333

Table B.6 – Simple Analysis-by-Parts

Sector	Description	Labor Income	Value Added	Output
440	Real estate	$44,755	$226,479	$347,889
482	Hospitals	$93,298	$105,582	$186,258
502	Limited-service restaurants	$40,173	$93,632	$165,007
508	Personal and household goods repair and maintenance	$70,958	$90,701	$113,741
501	Full-service restaurants	$49,532	$53,063	$96,220
469	Landscape and horticultural services	$49,970	$59,361	$92,443
464	Employment services	$44,301	$61,963	$75,035
468	Services to buildings	$29,570	$31,501	$48,426
492	Independent artists, writers, and performers	$20,768	$21,252	$42,689
503	All other food and drinking places	$29,743	$25,086	$42,510

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

THE EFFECT OF THE GREAT RECESSION ON AGRICULTURAL STATES

Anil Giri
Kyle Lovercamp
University of Central Missouri - USA

Sankalp Sharma
University of Nebraska-Lincoln - USA

Abstract: The United States and the world saw one of the worst economic declines at the end of 2007. Due to the crisis more than 7.5 million jobs were lost and the unemployment rate effectively doubled at a national level. However, the increase in unemployment rate was not evenly distributed across the United States. The underlying hypothesis is that predominantly agricultural states are able to absorb economic declines compared to their counterparts. In other words, agricultural states are not hit as hard as other states during economic crises. This paper investigates if that hypothesis is supported by the data using unemployment rate, as the econometric metric, and Ag production value, both absolute and relative, for the top and bottom fifteen agricultural states from 2007 till 2013. The findings of this study suggest that the absolute measure of agriculture production value, agricultural commodities receipts, in itself does not determine the ability of a state to absorb economic downturns. However, the relative measure, Ag commodities receipts as a percent of State Gross Product (SGP), suggests that there is an inverse relationship between the relative measure and unemployment rate. The higher the percentage of Ag receipts the lower the unemployment rate in normal as well as economic decline years. Furthermore, this relationship is even stronger when the measure is above 11%.

1. Introduction and literature review

The United States and the world saw one of the worst economic declines at the end of 2007. The recession, two or more consecutive quarters of negative economic growth, was so severe and was predicted to be so for a while, that it was given a name- The Great Recession, and called the worst economic crisis since The Great Depression. As a result of the crisis, in the United States more than 7.5 million jobs were lost which resulted in doubling of the unemployment rate (Grusky, D. B., Western, B., & Wimer, C. C. ,2011). There have been several investigations into the causes of the economic recession. The underlying conclusion is that there were complex and interlinked factors behind the emergence of the crisis, namely loose monetary policy, global imbalances, misperception of risk and lax financial regulation (Verick, S., & Islam, I. 2010). Among those reasons one which was purged out to be more contributing to the crisis was the subprime mortgages meltdown. One of the primary causes of the subprime meltdown was the structure of securitization as applied to subprime and other non-prime residential loans, along with resecuritization of the resulting mortgage- backed securities (Eggert, K. (2008-2009). Aftermath of the economic recession saw a great deal of analysis and many regulations and laws being passed most notably- The Dodd Frank Act. Congress responded to the crisis by enacting the broadest financial reform, the Dodd Frank Act, to protect the US from another financial crisis and having to call US taxpayers to rescue financial firms again (Merkley, J., & Levin, C., 2011).

However, the fact remains that economic cycles have always prevailed in the United States in the post-World War II era. The other interesting observation in general is that some states are affected more by the downturn in economic growth compared to their counterparts. For instance- unemployment rate, one of the key economic indicators used to measure economic health of a state, for Nevada was 11.5 % (more than 200% increase compared to 2007) for 2009 while for Nebraska it was only 4.7% (only a 1.7 % increase compared to 2007). Authors of this paper could not find any recent research on agricultural states and relationship of unemployment. Majority of the research (Dietz, Robert D., and Donald, 2003; Dietz, Robert D., and Donald R. Haurin, 2003; Elhorst, J. Paul., 2003; Partridge, Mark D., and Dan S. Rickman, 2006) focused on studying heterogeneous unemployment rates in different states to understand the relationship of unemployment and different attributes (characteristics) present in the states- amenities, taxes, crime rate, education, home ownership, residency patterns and migration (both domestic and international).

2. Question

This paper investigates if agricultural states able to absorb economic declines better than their counterparts?

The reason between differentiating Ag states and non- Ag states is because Ag industry complex is unique compared to other sectors. Agriculture as an industry supports all the way from upstream (input suppliers in the supply schedule) to downstream entities (retail shops). Figure 1 shows this relationship with interlinkages.

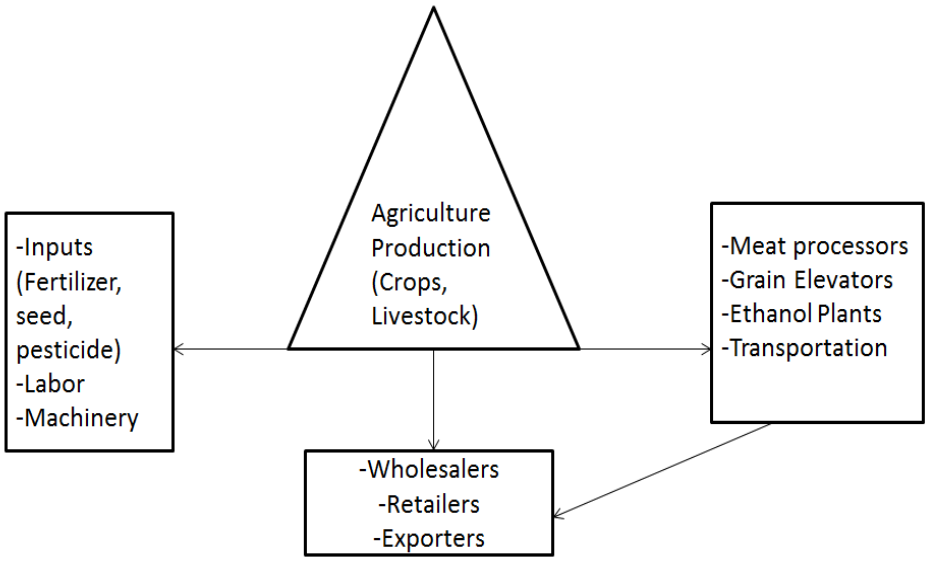


Figure1. Agriculture production interlinkages

Furthermore, agriculture industry also has relatively large multiplier effects compared to other industries. It is generally assumed that Ag states are more resilient and able to absorb economic declines better; however, this hypothesis has not been investigated on the aftermath of The Great Recession.

3. Theoretical Model

Unemployment rate is a function of different sectors (industries). A positive (negative) policy change on one of the sector can cause a decrease (increase) in the size of industry which will result in overall unemployment rate to go down (up). This relationship is shown mathematically in equation 1 and subsequently the first and second order conditions are derived. The model holds true at both national and state level.
Mathematically,

$$F(U) = F(A, M, H, S, C, G, R, O) \quad (1)$$

Where, U is unemployment rate; A is agriculture sector; M is manufacturing sector; H is health care sector; S is service sector; C is construction sector; G is government sector; R is retail trade; and O is other

The agriculture sector itself comprises of two components- livestock and crops.

$$F(A) = F(l, c) \quad (2)$$
$$F(A) = f(c) + f'(c) + f(l) + f'(l) \quad (3)$$

Where, F(A) is the total agricultural contribution (value)
f(l) is the gross livestock receipts
f'(l) is the multiplier effect of livestock production
f(c) is the gross crop production receipts
f'(c) is the multiplier effect of crop production

From 1 and 3, we get

$$F(U) = F((f(c) + f'(c) + f(l) + f'(l)), M, H, S, C, G, R, O) \quad (4)$$

One can purge out the effect of each sector by deriving the first order conditions from equation 1 and setting it equal to zero as follows:

$$\frac{\partial F(U)}{\partial A} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0$$

$$= F'((f(c) + f'(c) + f(l) + f'(l)), M, H, S, C, G, R, O) = 0 \quad (5)$$

$$\frac{\partial F(U)}{\partial M} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (6)$$

$$\frac{\partial F(U)}{\partial H} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (7)$$

$$\frac{\partial F(U)}{\partial S} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (8)$$

$$\frac{\partial F(U)}{\partial C} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (9)$$

$$\frac{\partial F(U)}{\partial G} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (10)$$

$$\frac{\partial F(U)}{\partial R} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (11)$$

$$\frac{\partial F(U)}{\partial O} = F'(U) = F'(A, M, H, S, C, G, R, O) = 0 \quad (12)$$

Second order conditions for agriculture (equation 5) purge out the individual effect of livestock and crop sector.

$$\frac{\partial F(U)}{\partial A \partial L} = F''(U) = F''((f(l) + f'(l)), M, H, S, C, G, R, O)) = 0 \quad (13)$$

$$\frac{\partial F(U)}{\partial A \partial C} = F''(U) = F''((f(c) + f'(c)), M, H, S, C, G, R, O)) = 0 \quad (14)$$

4. Data and Descriptive Summary

For 2010, a year which reflected normal agriculture production, data was collected from the Economic Research Service (ERS) of USDA and states were cardinally ranked based on the receipts for all agriculture commodities. Then, the top fifteen states with highest receipts and the last fifteen states with the lowest receipts were chosen for the analysis. The middle twenty states were not chosen for the analysis there can be no meaningful conclusions drawn from these states.

Furthermore, data on average annual unemployment from 2007, the starting year of the great recession, to 2013 was collected from the Bureau of Labor for the thirty states.

Table 1 shows the state receipts for all Ag commodities and annual unemployment rate for the top fifteen states. For 2010, California had the highest state receipts of more than 38 Billion nominal dollars. The top ten states all had more than 9 Billion nominal dollars in state cash receipts. Washington was the fifteenth state with receipts in excess of 7.6 Billion nominal dollars. It is noteworthy that due to the multiplier effect the actual contribution or value added would be lot higher than the state receipts for each of the states.

The multiplier effects can be observed and estimated from the interlinked industries in figure 1. However, for the purpose of the ranking, it is highly unlikely that the rankings would change much as the multiplier effects are directly dependent on magnitude of the cash receipts. For states which ship large values of commodities there might be slightly lower multiplier effect compared to those who process and add value to the commodities. However, one can be reasonably certain that the same fifteen states would be in the top fifteen lists even if the total value was to be used as the metric.

Table 1. State receipts for all Ag commodities and annual unemployment rate for the top fifteen states.

Ranking	State	State receipts for all Ag. commodities (in thousands)	Annual Unemployment Rates						
			2007	2008	2009	2010	2011	2012	2013
1	California	38,388,218	5.4	7.5	11.3	12.1	11.6	10.2	8.8
2	Iowa	23,891,765	3.7	4.3	6.4	6.0	5.5	5.0	4.7
3	Texas	20,343,148	4.3	4.9	7.6	8.1	7.7	6.6	6.0
4	Nebraska	17,018,675	3.0	3.4	4.7	4.6	4.3	3.9	3.7
5	Illinois	15,907,425	5.0	6.5	10.3	10.3	9.6	9.0	8.9
6	Minnesota	15,526,156	4.6	5.5	7.8	7.3	6.4	5.5	4.8
7	Kansas	14,761,486	4.3	4.7	6.9	7.0	6.4	5.7	5.2
8	North Carolina	9,777,231	4.8	6.3	10.6	10.7	10.1	9.1	7.8
9	Indiana	9,748,067	4.6	6.1	10.4	10.3	9.0	8.3	7.5
10	Wisconsin	9,020,955	4.9	5.0	8.7	8.6	7.7	7.0	6.6
11	Missouri	8,517,439	5.2	6.3	9.3	9.5	8.3	6.9	6.5
12	Ohio	7,984,435	5.6	6.6	10.4	10.2	8.8	7.4	7.3
13	Arkansas	7,965,816	5.3	5.5	7.9	8.2	8.2	7.5	7.2
14	Florida	7,741,348	4.1	6.5	10.5	10.9	9.8	8.3	7.0
15	Washington	7,655,264	4.7	5.5	9.2	9.9	9.1	8.0	6.9
	U.S.	321,195,035	4.6	5.8	9.3	9.6	8.9	8.1	7.4

Table 1 also shows that there is a lot of discrepancy in the unemployment rate among the states. Nine states Iowa, Nebraska, Texas, Minnesota, Kansas, Wisconsin, Missouri, Arkansas, and Washington never touched double digit unemployment rates while remaining states

have double digit unemployment rates for either one or more years. Most notably, California, the number one state has multiple consecutive years with double digit unemployment rate. In fact unemployment jumps from 7.5 in 2008 to 11.3 for 2009- more than 50% increase. This shows that there is no conclusive evidence to suggest Ag states are affected less by economic declines.

Table 2 shows the same variables for the bottom fifteen states. The value of state receipts for Ag. commodities is above one Billion nominal dollars for four states- Maryland, Utah, Wyoming and Delaware. Alaska had the lowest value for Ag commodities at 31 million dollars.

For the annual unemployment rate, it appears that for all states, but Nevada and Rhode Island, the unemployment rate never exceeds double digits for the time period. Nevada as a state relies heavily on tourism and gambling revenues. During the economic downturn it is expected to see higher unemployment as households do not have as much disposable income to spend on recreational activities.

Table 2. State receipts for all Ag commodities and annual unemployment rate for the bottom fifteen states.

Ranking	State	State receipts for all Ag. commodities (in thousands)	Annual Unemployment rate						
			2007	2008	2009	2010	2011	2012	2013
36	Maryland	1,865,558	3.5	4.4	7.1	7.6	7.1	6.9	6.5
37	Utah	1,360,021	2.6	3.6	7.5	7.9	6.7	5.4	4.4
38	Wyoming	1,178,262	2.9	3.1	6.3	6.5	5.8	5.3	4.7
39	Delaware	1,087,278	3.5	5.0	8.3	8.4	7.5	7.2	6.7
40	New Jersey	943,389	4.3	5.4	9.1	9.5	9.3	9.2	8.0
41	Maine	701,784	4.7	5.5	8.1	8.1	7.9	7.5	6.6
42	Vermont	687,979	4.0	4.7	6.6	6.1	5.5	4.9	4.4
43	Hawaii	686,902	2.8	4.3	7.1	6.9	6.8	6.0	4.8
44	Nevada	576,638	4.5	6.7	11.5	13.5	13.0	11.1	9.4
45	Connecticut	553,886	4.5	5.7	8.1	9.1	8.8	8.3	7.6
46	West Virginia	545,369	4.6	4.5	7.8	8.6	8.0	7.4	6.7
47	Massachusetts	492,062	4.7	5.6	8.3	8.3	7.2	6.7	6.6
48	New Hampshire	208,701	3.5	3.9	6.3	5.8	5.4	5.5	5.1
49	Rhode Island	78,390	5.2	7.8	11.1	11.2	11.1	10.4	9.2
50	Alaska	31,341	6.4	6.7	7.7	7.9	7.6	7.1	6.9
	U.S.	321,195,035	4.6	5.8	9.3	9.6	8.9	8.1	7.4

It appears that generally states with high value of Ag commodities see higher increase in unemployment rate compared to their counterparts. The finding is an interesting one and counterintuitive to the generally accepted paradigm that Ag states are affected less by economic declines.

So, in order to investigate the same question, in different light, states were ranked again based on the contribution of agriculture on their Gross State Product (GSP). The reason being that

relative measure of agriculture might lead to better understanding of the changes in unemployment rate rather than the absolute measure. Perhaps, it is the size of agriculture sector relative to the GSP, which is important in absorbing economic declines, and not necessarily the absolute dollar value of the agricultural products being produced in the state. As before annual average unemployment rates were listed for the states for years 2007-2013.

Table 3 shows that when Ag receipts are measured as a percent of GSP seven of the states, California, Texas, Illinois, North Carolina, Ohio, Florida and Washington, do no longer make it to the top fifteen list. The new states which make it to the list are South Dakota, North Dakota, Idaho, Montana, Mississippi, Oklahoma, and New Mexico. It is noteworthy that the number one state from the previous list, California, is no longer in the list and the new number one state, South Dakota, did not make into the previous list. This is because California has the eighth highest Gross Domestic Product (GDP) in the world and there are several other important industries, such as technology and entertainment, which contribute more to their economy compared to agriculture in relative terms to the GSP.

An interesting observation is that there is a wide range when it comes to the contribution of Ag receipts to SGP. South Dakota had the highest contribution of nearly 20 percent while Missouri the fifteenth state on the list had slightly above 3 percent. It is notable that all the states on the list have higher contribution when compared with the national contribution of Ag. receipts to Gross Domestic Product of USA (2.20 %).

Table 3. State receipts for all Ag commodities as a percent of GSP and annual unemployment rate for the top fifteen states.

Ranking	State	Contribution of state receipts to GSP (in percentage)	Annual Unemployment rate						
			2007	2008	2009	2010	2011	2012	2013
1	South Dakota	19.75	2.8	3.1	4.9	5.0	4.7	4.3	3.8
2	North Dakota	19.23	3.1	3.2	4.1	3.8	3.5	3.0	2.9
3	Nebraska	18.56	3.0	3.4	4.7	4.6	4.3	3.9	3.7
4	Iowa	16.88	3.7	4.3	6.4	6.0	5.5	5.0	4.7
5	Kansas	11.54	4.3	4.7	6.9	7.0	6.4	5.7	5.2
6	Idaho	10.68	3.1	5.2	8.8	9.0	8.2	7.1	6.0
7	Montana	8.14	3.6	5.1	6.9	7.3	6.9	6.0	5.4
8	Arkansas	7.57	**5.3**	5.5	7.9	8.2	8.2	7.5	7.2
9	Minnesota	5.71	4.6	5.5	7.8	7.3	6.4	5.5	4.8
10	Mississippi	5.26	**6.2**	**6.8**	**9.7**	**10.3**	**9.9**	**9.0**	**8.5**
11	Oklahoma	4.01	4.1	3.8	6.4	6.8	5.8	5.2	5.2
12	New Mexico	3.77	3.8	4.5	7.7	8.1	7.5	7.1	6.7
13	Wisconsin	3.55	4.9	5.0	8.7	8.6	7.7	7.0	6.6
14	Indiana	3.45	4.6	**6.1**	**10.4**	**10.3**	**9.0**	**8.3**	**7.5**
15	Missouri	3.32	**5.2**	**6.3**	9.3	9.5	8.3	6.9	6.5
	U.S.A	2.20	4.6	5.8	9.3	9.6	8.9	8.1	7.4

Highlighted numbers mean the unemployment rate was higher than national average

Regarding the unemployment rate only two states, Mississippi and Indiana, have double digit unemployment rates for the analyzed time period. This is a significant difference from the previous result (using absolute measure). None of the top nine states see a double digit unemployment rate. Furthermore, when compared with national average, only for 15 years out of 112 years (13.39%) combined for all states, for the time period was the unemployment rate higher than the national average. Out of the 15 years, 13 years came from two states, Mississippi and Indiana, which generally have higher unemployment rate compared to national average irrespective of the economic health. The top nine states never experience unemployment rate above the national average.

Similar to table 3, calculations were done for the bottom 15 states. The results are represented in table 4. From table 4 one can see the list of states have changed. Five states, Wyoming, Delaware, Maine, and Vermont, have been removed from the list. The new states which are included are Florida, Pennsylvania, New York, and Virginia. Another, important observation is that all of the states in the list contribute less than 2.20 % -the contribution of agriculture to the GDP at national level. Furthermore, out of fifteen states 11 states contribute less than 1 % and the range goes from slightly over a percent to slightly above one-tenth of a percent.

Table 4. State receipts for all Ag commodities as a percent of GSP and annual unemployment rate for the bottom fifteen states.

Ranking	State	Ag. commodities receipts as a % of SGP	Annual Unemployment rate						
			2007	2008	2009	2010	2011	2012	2013
36	Utah	1.15	2.6	3.6	7.5	7.9	6.7	5.4	4.4
37	Florida	1.06	4.1	**6.5**	**10.5**	**10.9**	**9.8**	**8.3**	7.0
38	Pennsylvania	1.03	4.5	5.5	8.2	8.4	7.9	7.7	7.0
39	Hawaii	1.02	2.8	4.3	7.1	6.9	6.8	6.0	4.8
40	West Virginia	0.82	4.6	4.5	7.8	8.6	8.0	7.4	6.7
41	Virginia	0.70	3.1	4.1	6.8	7.1	6.5	5.9	5.5
42	Maryland	0.59	3.5	4.4	7.1	7.6	7.1	6.9	6.5
43	Nevada	0.48	4.5	**6.7**	**11.5**	**13.5**	**13.0**	**11.1**	**9.4**
44	New York	0.39	4.6	5.5	8.4	8.6	8.3	**8.4**	**7.5**
45	New Hampshire	0.33	3.5	3.9	6.3	5.8	5.4	5.5	5.1
46	Connecticut	0.24	4.5	5.7	8.1	9.1	8.8	**8.3**	**7.6**
47	New Jersey	0.19	4.3	5.4	9.1	9.5	**9.3**	**9.2**	**8.0**
48	Rhode Island	0.16	5.2	**7.8**	**11.1**	**11.2**	**11.1**	**10.4**	**9.2**
49	Massachusetts	0.12	**4.7**	5.6	8.3	8.3	7.2	6.7	6.6
50	Alaska	0.06	**6.4**	**6.7**	7.7	7.9	7.6	7.1	6.9
	U.S.A	***2.20***	***4.6***	***5.8***	***9.3***	***9.6***	***8.9***	***8.1***	***7.4***

Bold highlighted numbers mean the unemployment rate was higher than national average

Careful examination of Table 5 shows that there were three states, Florida, Nevada, and Rhode Island, which experienced at least one year of double digit unemployment for the time period. Furthermore, for all the years during the time period 27 years out of 112 years (24.11 %) had higher unemployment rates compared to national unemployment rates. Another significant finding is that more than half of the states (eight) had one or more year when they experienced unemployment rates higher than the national average.

In order to investigate the aggregate affect data on unemployment rate and contribution as a percent for all thirty states were complied. Scatter plot from figure 2 clearly shows an inverse relationship between

unemployment rates and Ag commodities receipts expressed as a percent of SGP. In other words, unemployment rate is inversely proportional to the ag receipts as a percentage of GSP (the higher the percentage the lower the unemployment rate). On average it appears that as the contribution of Ag receipts increases unemployment rate declines.

Mathematically, the relationship is:

$$Ag\ as\ a\ percent\ of\ GSP\alpha\ \frac{1}{\text{Unemployment rate}} \quad (15)$$

From figure 2 one can also draw a conclusion with moderate confidence that there is a cut off level in this inverse relationship between Ag commodities value and the unemployment rate. It appears to be the case that the break point of this relationship is at around 11 %. From figure 2, once the Ag commodities receipt as a percentage of GSP increases more than 11 %, one can expect the unemployment rate to be significantly smaller.

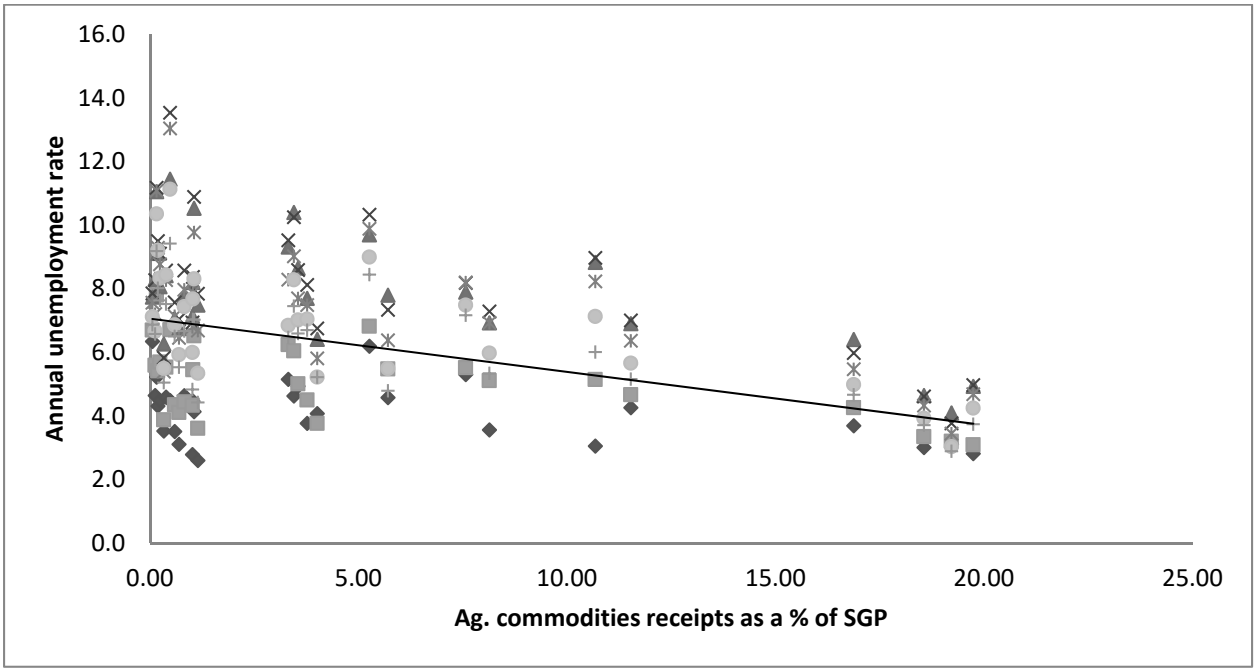


Figure 2. Relationship between Gross State Product (GSP) and annual unemployment rate

5. Empirical model, estimates and results

Consistent with the theoretical model a bivariate regression model was used to find the effect of ag receipts as a percentage of SGP on the unemployment rate for the top and bottom fifteen states. More specifically the empirical model used was:

$$UR = \alpha + \beta A_i + + \varepsilon \quad (16)$$

i= 1 to 4

Where, UR is the unemployment rate

α is the constant

A1 is ag as a % of SGP for all top 15 states

A2 is the ag as a % of SGP > 10%

A3 is the ag as a % of SGP for all bottom 15 states

A4 is the ag as a % of SGP <1%

ε is the error term.

Other variables that effect unemployment rate such as unemployment rate, median household income, population growth rate, rate of growth of economy at state level (measured by growth rate of SGP),etc. were not used since the objective of the paper is to just estimate the effect of Ag. While addition of other independent variables would definitely increase the R-square

and most likely the adjusted R-square the relevant statistics to answer the question is the statistical significance of the independent variable. Any other multi linear regression specification of empirical model would change the results qualitatively but not quantitatively. That means the estimate of the independent variable used in the bivariate model would change but the statistical significance will not change unless the included variable(s) are highly correlated with the independent variable used in this model. In a full or very low unemployment, which is generally the case even as stated in the summary statistics part, for these states the empirical estimates have marginal significance. The more important question is the statistical significance of the estimate which can be easily estimated by the bivariate model used for this analysis.

The results in table 5 of the four specifications (listed below as models 1 through 4) are based on classification of Ai (A1 through A4).

Table 5. Results

	Model 1		Model 2		Model 3		Model 4	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Intercept	7.91***	0.28	9.66***	0.82	.80**	0.12	.52***	0.09
Ag as % of SGP	-0.20***	0.025	-.30***	0.05	-0.04	0.02	-0.2	0.01
# of Obsv.	105		42		105		77	
Multiple R- Square	0.61		0.69		0.21		0.18	

Note: *** statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%

The results from table 5 show that the coefficient estimates are statistically significant at one percent level for model 1 and model 2 (model one is for all top fifteen ag producing states and model is for states where agriculture contributed at least ten percent of more of SGP). The negative signs of the estimates support the hypothesis that unemployment rate is lower for the states with higher agriculture production in relative terms. The estimates were not statistically significant for model 3 and model 4 implying that agriculture production played little role in determining the unemployment rate. Since, the magnitude of agriculture's contribution to the SGP was very low the results are as expected. The negative sign does imply that if the contribution of agriculture was to be increased there would be a decrease in unemployment rate.

6. Conclusions and policy implications

There are two important conclusions from this study. The first one is that the absolute measure of agriculture production value, agricultural commodities receipts, in itself does not determine the ability of a state to absorb economic downturns. The second conclusion is that the relative measure, Ag commodities receipts as a percent of SGP, suggests that there is an inverse relationship between the relative measure and unemployment rate. The higher the percentage of Ag receipts the lower the unemployment rate in normal as well as economic decline years. Furthermore, this relationship is even stronger when the measure is above 11 %. This is primarily because there are different industries supported by agriculture production complex on both sides.

Finally, there is another way to analyze this question and that is to look at the overall Ag production complex value (including value added components). As stated previously, doing so would only change the results quantitatively but

not qualitatively. This is because there is a direct correlation between the value of Ag. receipts and Ag production complex. The reason Ag. production complex value was not used for this analysis is that those are estimates and the data on all states are hard to find especially from one source.

One of the policy implications of this finding is that agriculture helps absorb shock in the economic system. So, it is important to support agriculture sector. The payoffs of the investment in agriculture sector might be must crucial in the years when the majority of country and world is facing economic declines. The other important policy implication of this study is that states whose Ag receipts are slightly below 10 percent of SGP need to be supported, encouraged and provided incentives so as they surpass the 10 percent threshold as there is moderate evidence that once that threshold is passed they can absorb economic declines much better.

7. Further study

Recent 2012 drought was an example where many Ag states saw a significant decrease in production. While the farmers for the most part did not see a decline in their net farm income, due to high crop insurance payments as prices of corn and soybean rose significantly, other stakeholders directly and indirectly associated with agriculture saw a decline in economic activity. For instance, livestock producers incurred high input costs (mainly grain cost) which in many cases forced them to liquidate their stock and operate in loss. The grain elevators did not have enough grain to stock due to reduced production so saw a decline in their revenue sources. These all had significant multiplier effects.

Figure 3 shows the agricultural production complex relationships and the effect of a single year drought (which results in significant reduction in production of crops) on supply schedule and demand. An empirical estimate of the shifts in demand and supply would help policy makers be better prepared to support the sectors which experience the most significant economic declines.

References

Dietz, Robert D., and Donald R. Haurin. "The social and private micro-level consequences of homeownership." *Journal of Urban Economics* 54.3 (2003): 401-450.

Grusky, D. B., Western, B., & Wimer, C. C. (Eds.). (2011). *The great recession*. Russell Sage Foundation.

Verick, S., & Islam, I. (2010). The great recession of 2008-2009: causes, consequences and policy responses

Eggert, K. (2008-2009). Great Collapse: How Securitization Caused the Subprime Meltdown, The. *Connecticut Law Review* 41(4), 1257-1312.

Elhorst, J. Paul. "The mystery of regional unemployment differentials: theoretical and empirical explanations." *Journal of economic surveys* 17.5 (2003): 709-748.

Merkley, J., & Levin, C. (2011). Dodd-Frank Act Restrictions on Proprietary Trading and = Conflicts of Interest: New Tools to Address Evolving Threats, The. *Harv. J. on Legis.*, *48*, 515.

Partridge, Mark D., and Dan S. Rickman. "An SVAR model of fluctuations in US migration flows and state labor market dynamics." *Southern Economic Journal* (2006): 958-980.

ERS farm cash receipts by commodity and State are computed from USDA's National Agricultural Statistics Service (NASS) production data and unit prices of farm products in each State: http://www.ers.usda.gov/Data/FarmIncome/FinfidmuXls.htm.

U.S. agricultural export values by State are obtained from the USDA Foreign Agricultural Service's Global Agricultural Trade System (GATS): http://www.fas.usda.gov/gats/default.aspx

Farm production data by State are published by NASS, Quick Stats 2.0: http://www.nass.usda.gov/Quick_Stats/

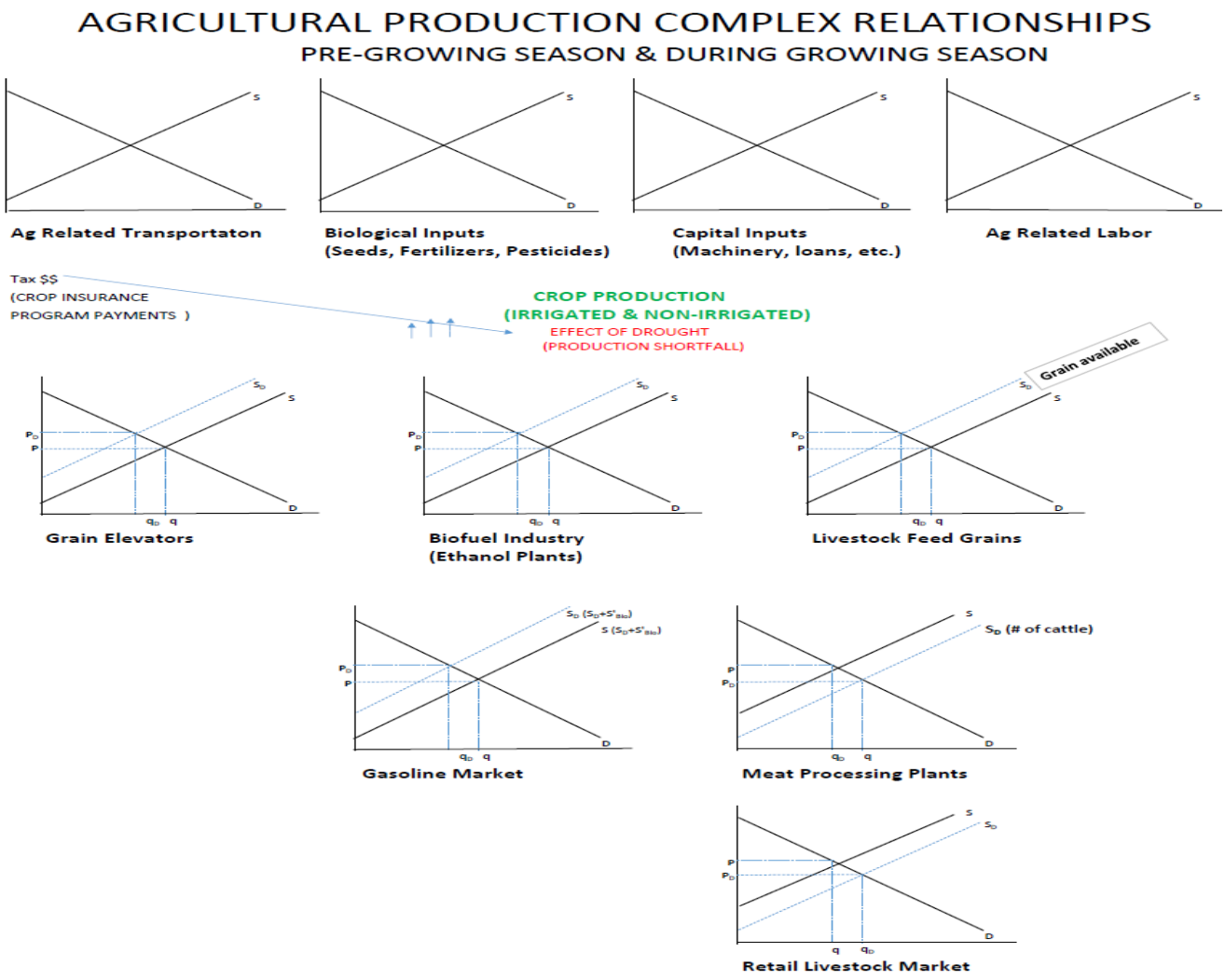


Figure 3. Agricultural production complex relationships and changes during a significant drought year.

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

Analysis of the Economic Impacts of Tennessee's Turfgrass Industry and Perceptions of Future Growth

Kimberly L. Jensen
Burton C. English
R. Jamey Menard
Christopher Boyer
Jim Brosnan
University of Tennessee - USA

Abstract: Turfgrasses form the foundations for many activities in everyday living, growing in residential lawns, golf courses, sports fields, and businesses' and organizations' facilities landscapes. This study examines the economic impacts from turfgrass related activities in selected industries (sod producers; landscape, lawn, and sports turf companies; and golf courses) as well as projections based upon growth perceptions by the industry participants. An online survey of industry participants was conducted in 2014/2015 to obtain expenditures, receipts, and anticipated growth in receipts. The economic activity from sod producers was $28 million, $590 million was from landscape, lawn, and sports turf companies, and $499 million was from golf courses. Most industry participants were optimistic about growth in receipts in the next five years, lawn service (9.4% annually), sports turf firms (5.2% annually), and landscapers (4.4%). Less optimistic were sod producers projecting 3.9% annually. Least optimistic were golf courses at 0.2%. Using these growth projections and deflating them with the IMPLAN deflator for 2018, the projected 2018 values in 2013$ increase to $33 million for sod production, $811.3 million for landscape, lawn maintenance, and sport turf, and $503 million for turf care at golf courses.

1. Study Background and Objectives

Turfgrasses are a vital component in residential and commercial landscaping as well as activities on sports fields and golf courses. As shown in Figure 1, the market channel for the turfgrass industry includes a wide range of producers or suppliers as well as end-users or consumers. Some examples of turfgrass suppliers include:

- sod and seed producers;
- sectors such as irrigation equipment and fertilizer and chemical manufacturers, plus nursery, garden center, farm supply stores; and
- landscape, lawn, and sports turf services. In our analysis, we consider these as the production group.

Turfgrass users or consumers can include:

- airports, apartments/ condominiums, residential builders/developers, cemeteries, churches, colleges/ universities, elementary/ secondary schools, parks, gardens, museums, state highway roadsides, hotels/motels, golf course, homeowners, and other non-profit/ profit entities.

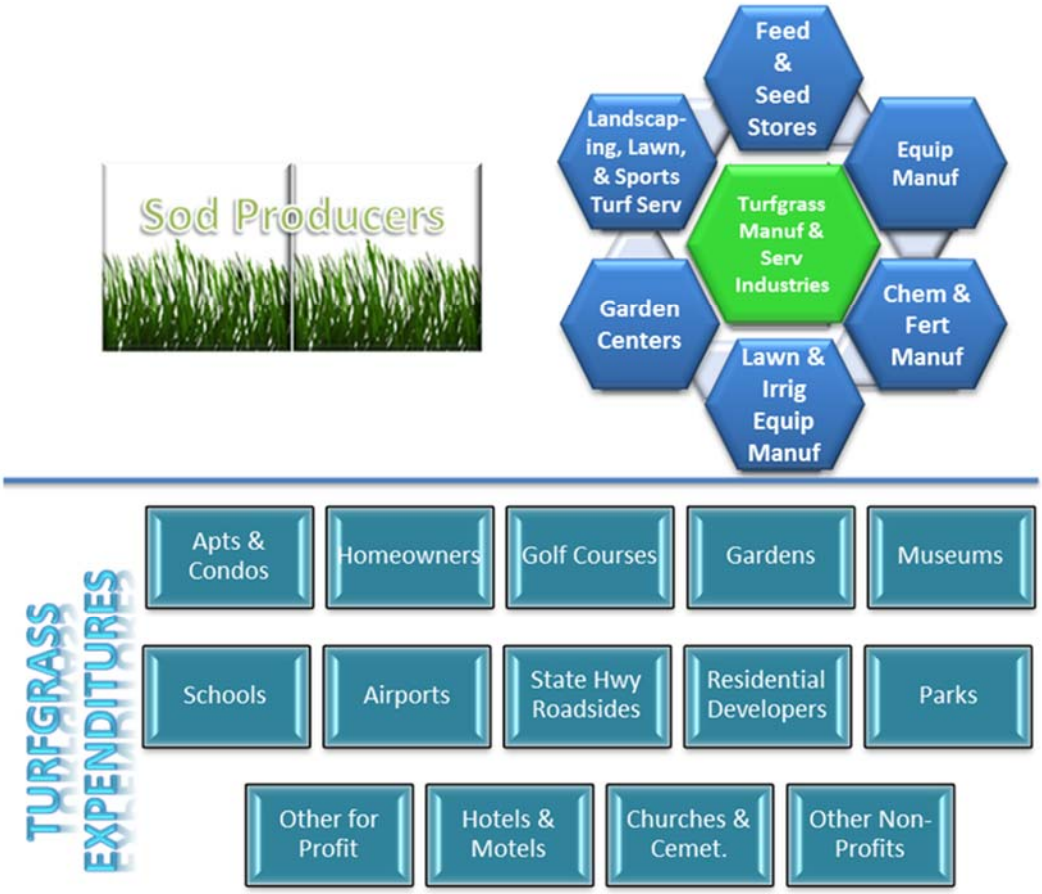


Figure 1. The Tennessee Turfgrass Industry

Turfgrass requires expenditures by turfgrass producers, manufacturer and service providers, and users for goods and services such as land, labor, capital equipment, and other materials that enhance the local economy and the local tax base. No recent studies of the economic contributions of Tennessee's turfgrass industry have been conducted. Hence, analysis was needed to provide estimates of the economic impacts from both turfgrass suppliers and turfgrass users. This study focuses on a set of industries most often closely associated with turfgrass: sod producers; landscapers, lawn care services, and sports turf companies; and golf courses. In addition to economic impacts current to the time of the survey, projections about growth in receipts among these industries are used to project economic impacts in five years. The purposes of this study are: a) to project economic contributions from turfgrass related activities in selected industries to the Tennessee economy; and b) to acquire information about turfgrass participants' future growth plans to project future industry impacts.

2. Prior Research

In a 2006 study of the U.S. turfgrass industry[1], Haydu *et al*. reported that the turfgrass industry generated close to $58.0 billion (2002$) annually in revenue, and accounted for close to 823,000 jobs across the United States. The Southeast region of the U.S. (Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee) was found to employ 24 percent of the 823,000 jobs, which was the largest contributing region to employment. The two main employment sectors in the southeast were golf courses and lawn services. The majority of the Tennessee jobs were concentrated in sod production and lawn equipment manufacturing. In fact, the state was fifth in total jobs for the sod production sector and second in total jobs for the lawn equipment manufacturing sector for the U.S. While this study is helpful in measuring the economic contribution of the turfgrass industry for Tennessee, the study used national census and survey data, which excludes some turfgrass businesses.

Numerous state level turfgrass studies have been conducted attempting to capture the importance and economic significance of the turfgrass industry to a state's economy. In a 1998 Virginia study, the turfgrass industry (i.e., establishment, management, and maintenance activities) was found to contribute over $2.1 billion in estimated economic contributions and over $1 billion in value added to the state's economy (Beddow *et al*., 2001). Golf, golf related activities, and turfgrass expenditures in a 2004-2005 study in New Mexico contributed $1.3 billion in estimated economic contributions to the state's economy (Diemer, 2004). A 1999 study in North Carolina found that the turfgrass industry contributed an estimated $4.7 billion in economic contributions and employed 96,000 people (NCDA, 1999). Georgia's turfgrass industry contributes an estimated $7.8 billion in economic output and accounts for nearly 87,000 full- and part-time jobs (Kane and Wolfe, 2012), and Florida's turfgrass industry, which was defined as retail lawn and garden stores, landscape vendors, golf courses, sod farms, homeowners, commercial property managers, apartments, airports, cemeteries, and public parks, contributed an estimated $7.8 billion in economic contributions with total employment contribution estimated at 173,166 jobs (Hodges and Stevens, 2010). For Tennessee, the most recent study on the estimated economic contributions of the turfgrass industry was published in 1993 (Brooker *et al*.), where the authors used a value-added approach (i.e., from producer to user) to determine the industry's total economic value. They found the direct economic contribution for Tennessee's turfgrass industry was estimated at $890.2 million (1991$). Of that value, approximately $360.4 million was for turfgrass maintenance, $271.4 million for turfgrass maintenance supplies, $169.6 for equipment purchases, and $88.1 million for labor to maintain turfgrass.

3. Input-Output Analysis: Data and Methods Used

3.1 Data

From September 15, 2014 to January 31, 2015 a set of surveys were conducted for Tennessee's turfgrass sector participants in the state. Turfgrass participants were contacted either by email or post card to direct potential survey respondents to a landing page advertising the URL to begin the survey. The format of the surveys varied depending on whether the turfgrass respondents were sod producers or other primary turfgrass industrial sectors suppliers and users (copies of the survey are available from the authors upon request). Both email and physical address contact information were obtained from turfgrass industry sources and also from the

[1] Defined in the Haydu *et al*. study as sod farms, lawn-care services, lawn and garden retail stores, lawn equipment manufacturing, and golf.

Tennessee Secretary of State's Business Entity Database (https://tnbear.tn.gov/ Ecommerce/ DBDownloadWizard.aspx) purchased for this project. Duplicate email and physical address mailings were eliminated resulting in 1,913 potential survey responders emailed and 11,025 received post cards (12,938 total). Qualtrics was the online survey tool used for this study. A total of 818 partially- or fully-completed surveys were received and of that value 19 were sod producers, 605 were turfgrass users, and 194 were neither. Fully completed surveys totaled 600 responses and of that value 10 were sod producers, 396 were turfgrass users, and 194 were neither.

The overall survey response rate was 6.3 percent (818 full/partial completed survey ÷ 12,938 mailed/emailed to respondents). However, for businesses commonly associated with the turfgrass industry the response rate was greater than ten percent as can be seen in Table 1.

Table 1. Turfgrass Responders, Numbers Mailed, Responses Received, Response Rate, and Grouping for Industries Commonly Associated with the Turfgrass Industry

Turfgrass Responder	Number Mailed	Responses Received	Response Rate	Grouping
Sod Producers	38	19	50.0%	Sod Producers
Golf	65	138	213.8%	Golf
Sports Turf/Athletic Field	--	37	--	Lawn Service/Sport Turf
Landscaping	415	32	7.7%	Landscaping
Lawn Service	345	68	19.7%	Lawn Service/Sport Turf

Surveys were designed to obtain expenditure, sales, and growth projection information from sod producers, turfgrass manufacturing and service sectors, and turfgrass users. To obtain expenditures and direct economic impacts, questions were included in the surveys for each industry regarding expenditures on inputs and services used in turfgrass production, installation, or maintenance. These values were then inputted into IMPLAN® (Version 3.0), to estimate the economic contributions of the turfgrass industry to Tennessee's economy. In addition to current receipts and expenses, the participants were asked to project the growth of their receipts over the coming 5-year period. These estimated were then used with IMPLAN to project economic impacts from these industries in 5 years.

3.2 Economic Impacts

This study uses 2013 IMPLAN data, the most recent data available at the time of the analysis. The IMPLAN model describes the transfer of money between industries and institutions and contains both market-based transactions and non-market financial flows, such as inter-institutional transfers. Output from the model provides descriptive measures of the economy including total industry output (a measure of economic activity), employment, labor income, value-added, and state/local taxes for 536 industries in

the Tennessee economy.[2] Not only can the model describe a regional economy, but the model also can be used for predictive purposes by providing estimates of multipliers. This analysis uses the local purchase percentages (LPP) option available in IMPLAN modeling. Consequently, this affects the impact value applied to the multipliers. Instead of a 100 percent expenditure value applied to the multiplier the model is set to the value which reflects Tennessee purchases. To account for double-counting for the economic contributions estimated, regional purchase coefficients[3] (RPC) are also set equal to zero for the backward linked supply and service industries outlined in Figure 1.

Multipliers measure the response of the economy to a change in demand or production. Multipliers analysis generally focuses on the impacts of exogenous changes on: a) output of the sectors in the economy, b) income earned by households because of new outputs, and c) employment (in physical terms) that is expected to be generated because of the new outputs. The notion of multiplier analysis rests on the difference between the initial impact of an exogenous change (final demand) and the total impacts of a change. This study uses Type 1 and Type SAM (Social Accounting Matrix) multipliers. Type 1 multipliers are calculated by dividing direct plus indirect impacts by the direct impacts, where the Type SAM multipliers = (direct + indirect + induced impacts)/direct impacts. The Type SAM multipliers take into account the expenditures resulting from increased incomes of households as well an inter-institutional transfers resulting from the economic activity. Therefore, Type SAM multipliers assume that as final demand changes, incomes also increase along with inter-institutional transfers. As consumers and institutions increase expenditures this leads to increased demands from local industries.

4. Results

The results are divided into two sections: 1) analysis of responses regarding expenditures, receipts, and associated economic impacts; and 2) analysis of responses regarding projected growth in receipts and projected economic impacts in five years.

4.1 Expenditures and Economic Impacts

The average non-payroll expenditures derived from the survey responses are shown in Table 2. As can be seen from Table 2, the categories included non-irrigation equipment, irrigation, utility and other overhead expenses, and establishment and maintenance expenses. As might be expected, golf courses incurred the largest overall expenses per firm, while landscape services incurred the smallest overall expenses per firm. The average payroll expenditures and number of employees for each industry are shown in Table 3. Figure 2 provides an overview of shares of total expenditures by type (including payroll and non-payroll expenditures). Notably, the landscape and lawn care services have the highest percentage of turfgrass related payroll expenditures. Golf courses have a higher share of the overhead expenditures. This is due to higher expenditures on mortgages, rents, leases, facilities maintenance and repair, and golf course remodeling, expansions, and construction.

---

[2] ***Total industry output*** is defined as the annual dollar value of goods and services that an industry produces. ***Employment*** represents total wage and salary employees, as well as self-employed jobs in a region, for both full- and part-time workers. ***Labor income*** consists of employee compensation and proprietor income. ***Total value added*** is defined as all income to workers paid by employers (employee compensation); self-employed income (proprietor income); interests, rents, royalties, dividends, and profit payments; and excise and sales taxes paid by individuals to businesses. ***State/local taxes*** are comprised of sales tax, property taxes, motor vehicle licenses taxes, severance taxes, and other taxes.

[3] IMPLAN's regional purchase coefficient (RPC) represents how much of each commodity purchasing industries and institutions buy from regional sources. For example, a RPC of .55 for a given commodity means that for each $1 of local need, 55 percent of the commodity will be purchased locally.

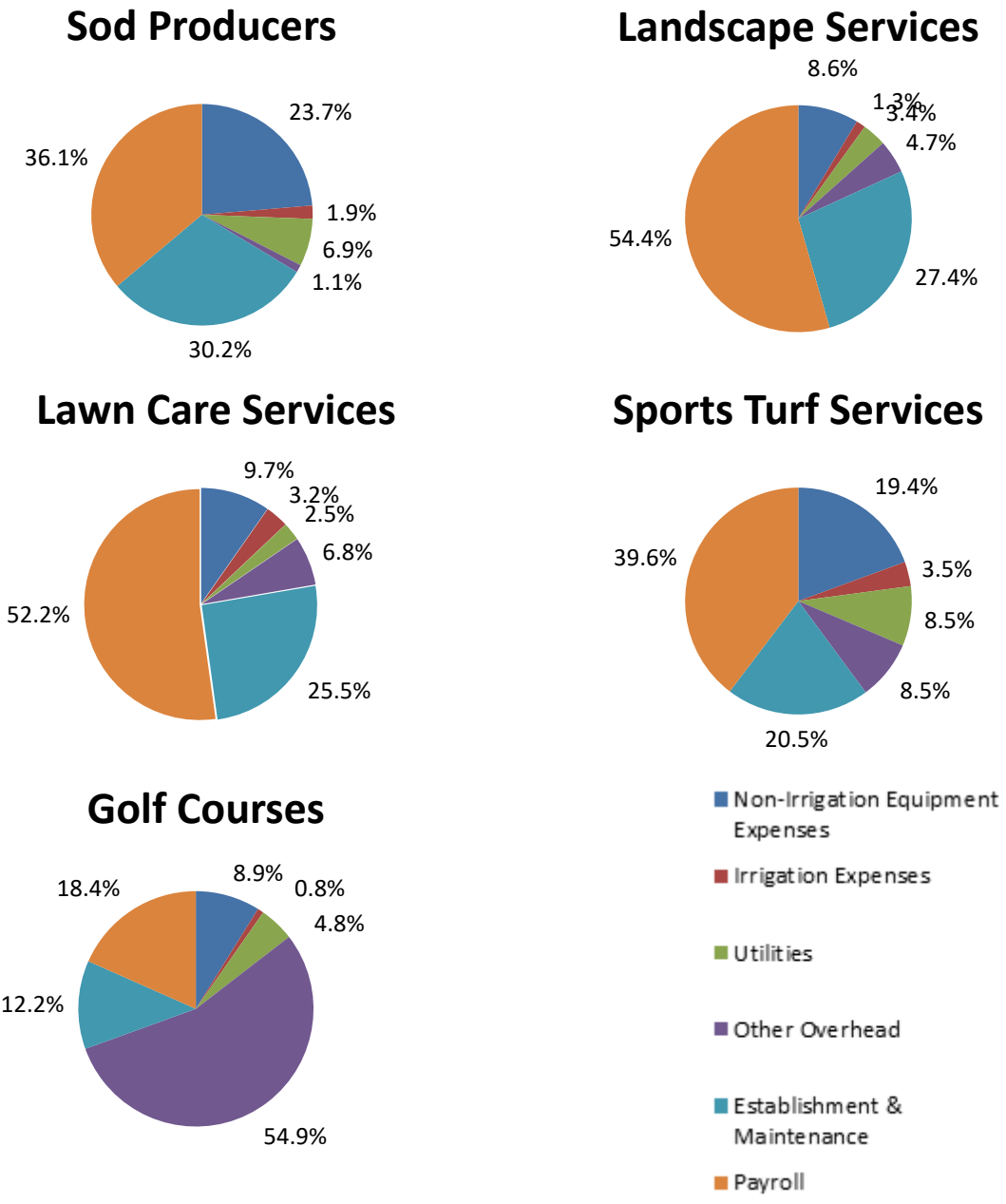


Figure 2. Expenditure Shares by Participants, by Type of Turfgrass

Table 2. Turfgrass Associated Expenditures by Sod Producers, Landscape Service, Lawn Care Service, and Sports Turf Firms, and Golf Courses

Expense Type	Sod Producers	Land-scape Services	Lawn Care Services	Sports Turf	Golf Courses
	Per Firm				
Non-Irrigation Equipment Expenses					
Maintenance/repair of structures housing turfgrass/sod equipment	$14,444	$3,469	$7,001	$5,358	$6,398
New/used turfgrass/sod equipment purchases	$23,968	$10,252	$21,480	$18,086	$34,416
Turfgrass/sod equipment leases/rentals	$1,875	$4,407	$1,365	$37,841	$57,993
Turfgrass/sod equipment maintenance/repair	$26,705	$3,206	$5,343	$6,498	$31,908
Turfgrass/sod equipment supplies (blades, trim lines, etc.)	$19,522	$2,691	$2,426	$3,634	$13,311
Fuel for turfgrass/sod machinery operations	$32,833	$11,929	$11,003	$5,342	$30,124
Sod hauling truck purchases (N=8)	$8,125				
Sod hauling truck maintenance (N=8)	$17,102				
Irrigation Expenses					
Irrigation water	$2,778	$569	$4,722	$10,253	$5,424
Irrigation repairs	$4,911	$2,144	$6,651	$1,668	$7,204
Irrigation maintenance	$4,113	$2,882	$4,825	$1,858	$3,912
Utility & Other Expenses					
Water/sewer (does not include irrigation)	$1,266	$354	$511	$4,930	$11,009
Electricity	$9,046	$1,409	$1,212	$12,073	$41,863
Natural gas	$475	$321	$595	$679	$5,540
Insurance	$31,478	$12,276	$10,224	$16,000	$30,419
Telephone					$6,347
Training	$813	$1,085	$1,933	$9,456	$7,058
All other overhead expenditures	$6,033	$18,686	$32,117	$24,143	$507,442

Ownership/leasing expenses (i.e., mortgages, rent) (golf facilities)					$180,738
Facility maintenance & repair (not wages & salaries) (golf facilities)					$195,656
Facility remodeling, additions, and/or construction (golf facilities)					$189,111
Establishment & Maintenance Expenses					
Plant materials purch. for sod, seed, sprigs, plugs, etc.	$19,556	$29,509	$14,277	$13,833	$12,796
Other plant materials purchased (i.e., ornamental/landscape plants)	$0	$52,760	$41,589	$1,835	$4,548
Chemicals (i.e., herbicide, fungicide, etc.)	$28,961	$5,236	$16,275	$7,555	$49,737
Fertilizers	$48,299	$7,323	$13,275	$17,279	$29,841
Soil, soil conditioners & mulch (i.e., lime, compost, etc.)	$8,250	$7,433	$12,640	$7,489	$5,602
All other sod/main non-wage expenses	$79,561	$1,577	$12,181	$13,536	$129,056
Installation/maint contracts		$10,500	$17,165	$19,462	$7,457
Total	$390,114	$190,018	$238,810	$238,808	$1,604,910
	Statewide*				
Number of Firms	41	1,403			207
Non-Payroll Expenditures	**$15,994,674**	**$317,875,288**			**$332,216,370**

*Information was not available about the specific types of firms for landscaping, lawn care, and sports turf services. However, share weighted averages of responses from landscape services, lawn care services, and sports turf firms for each type of expenditure were calculated based upon numbers of responses to each question about expenditures. To obtain the total projection across all firms, the share weighted average for each category was summed to a total and this total was then multiplied by the total number of firms (1,403).

Table 3. Turfgrass Associated Payroll Expenditures and Employees by Sod Producers, Landscape Service, Lawn Care Service, and Sports Turf Firms, and Golf Courses

	Sod Producers	Land-scape Services	Lawn Care Services	Sports Turf	Golf Courses
	Per Firm				
Payroll ($)	$220,654	$227,125	$260,807	$156,877	$360,950
Full-time Employees	7.1	7.0	7.5	4.5	9.2
Part-time Employees	2.8	3.6	4.4	4.3	6.8
	Statewide*				
Number of Firms	41	1,403			207
Wages & Salaries	$9,046,814	$301,583,736			$74,716,650
Employees	405.9	14,638			3,312

*Averages per firm across landscape services, lawn care services, and sports turf firms were multiplied by the total number of firms (1,403)

These average non-payroll and payroll expenditures were then expanded to state-wide estimates. According to the most recent USDA Census of Agriculture (2012), there were 41 sod producing farms in Tennessee. The non-payroll expenditure value was used to estimate the direct economic contribution of sod producers' expenditures to the state, which totaled close to $16.0 million (see Table 2) (2013$). Using the local purchase percentage (LPP) option in IMPLAN, $3.8 million was not purchased within the state. Therefore, the direct impact was estimated at $12.1 million.

According to the 2012 Census Bureau's Censtats County Business Patterns, there were 207 golf courses and country clubs in Tennessee. This value was used along with the non-payroll expenditures for golf from Table 2 to estimate the direct economic contribution of golf turfgrass expenditures to the state, which totaled $332,216,370 (2013$). Using the LPP option in IMPLAN, $64.3 million was not purchased within the state. Therefore, the direct impact was estimated at $267.8 million.

According to the 2012 Census Bureau's Censtats County Business Patterns, there were 1,403 landscape, lawn service, related firms in Tennessee. Using the expenditures by these firms and the number of firms, the direct economic contribution of landscaping, lawn, and sports turf turfgrass expenditures in the state was $317,875,288 (2013$). Using the LPP option in IMPLAN, $109 million was not purchased within the state. Therefore, the direct impact was estimated at $208,636,546 (2013$).

The economic impacts from the expenditures by each of the industries and wages and salaries for 2013 are shown in Table 4 along with the sum of these two. The direct and total (direct, indirect, and induced) impacts are presented for each industry. The direct total industry output from the sum of expenditures and wages and salaries was

$12.1 million directly and $28.2 million total for sod producers, $208.6 directly and $590.0 million total for landscape, lawn care, and turf, and $267.8 million directly and $498.5 million total for golf courses. The numbers of jobs resulting from these industries were 625.6 directly and 745.3 total for sod producers, 18,329.7 directly and 21,188.0 total for landscape, lawn care, and turf, and 7,621.5 directly and 9,321.1 total for golf courses.

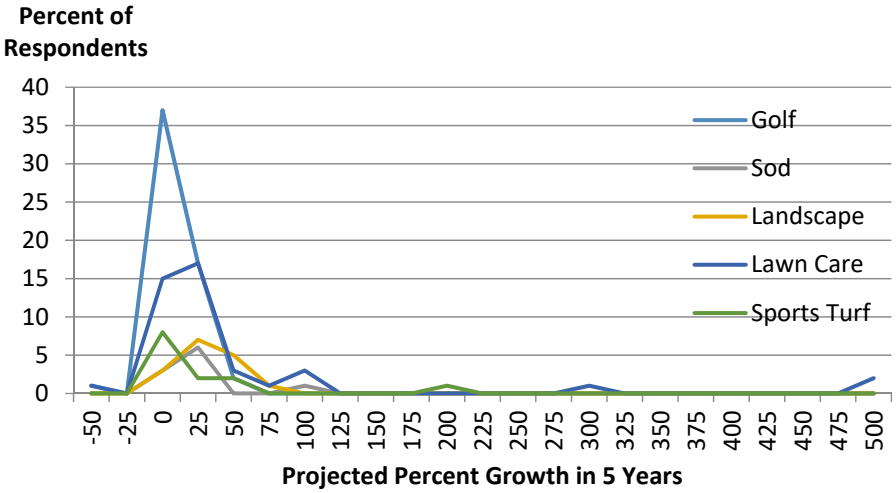
Table 4. Estimated Economic Contributions for Sod Production, Landscape, Lawn, and Sports Turf Services, and Golf Courses in Tennessee, 2013.

	Sod Producers		Landscape, Lawn Care, and Sports Turf		Golf Courses	
	Direct	*Total*	*Direct*	*Total*	*Direct*	*Total*
	Results from Non-Labor Expenditures					
Total Industrial Output[a]	$12,099,040	$20,995,621	$208,636,546	$350,969,963	$267,841,559	$439,159,239
Total Value Added[b]	$7,973,594	$13,163,986	$139,612,747	$222,513,583	$176,256,820	$275,804,306
Labor Income[c]	$6,180,461	$9,021,562	$97,010,574	$143,139,071	$113,418,300	$167,839,202
Employment[d]	219.7	284.5	3,691.7	4,734.3	4,309.5	5,558.0
State/Local Taxes[e]		$1,189,806		$48,295,579		$18,407,753
	Wages & Salaries					
Total Industrial Output[a]	$0	$7,219,260	$0	$239,049,399	$0	$59,362,805
Total Value Added[b]	$9,046,814	$13,438,170	$301,583,736	$447,045,448	$74,716,650	$110,835,998
Labor Income[c]	$9,046,814	$11,370,575	$301,583,736	$378,497,744	$74,716,650	$93,819,380
Employment[d]	405.9	460.8	14,638.0	16,453.7	3,312.0	3,763.1
State/Local Taxes[e]		$397,409		$13,144,909		$3,265,501
	Total					
Total Industrial Output[a]	$12,099,040	$28,214,881	$208,636,546	$590,019,362	$267,841,559	$498,522,044
Total Value Added[b]	$17,020,408	$26,602,695	$441,196,483	$669,559,031	$250,973,470	$386,640,304
Labor Income[c]	$15,227,275	$20,392,137	$398,594,310	$521,636,815	$188,134,950	$261,358,582
Employment[d]	625.6	745.3	18,329.7	21,188.0	7,621.5	9,321.1
State/Local Taxes[e]		$1,587,215		$61,440,488		$21,673,254

[a]Annual dollar value of goods and services that an industry produces; a measure of economic activity.
[b]Estimated employee compensation, proprietary income, other property type income (payments from interest, rents, royalties, dividends and profits), and tax on production/imports.
[c]Consists of employee compensation and proprietary income.
[d]Estimated number of total wage and salary employees (both full- and part-time), as well as self-employed.
[e]Consists of sales taxes, property taxes, motor vehicle licenses taxes, severance taxes, and other taxes

4.2 Industry Growth Projections and Economic Impacts

Among the industries commonly associated with turfgrass, most industry participants are optimistic about growth in receipts in the next five years. Lawn care service firms project 9.4% annually (47.1% over the next 5 years), followed by sports turf firms at 5.29% (25.9% over the next 5 years) and landscapers at 4.4% (21.9% over the next 5 years). Least optimistic are sod producers at 3.9% (19.5% over the next 5 years) and golf courses at 0.2% (0.9% over the next 5 years). Figure 3 displays the growth expectations across the industries and Figure 4 shows the 2013 and projected 2018 expenditures by industry and broken down into non-salary and salary and wage expenditures. The share weighted average growth used for landscape, lawn care, and sports turf is 37.5 percent growth by 2018.



Mean Estimate of Projected Growth in Receipts in 5 Years (2018), by Industry				
Golf	Sod	Landscape	Sports Turf	Lawn Care
0.9	19.5	21.9	25.9	47.1
Annual Average				
0.2	3.9	4.4	5.2	9.4

Figure 3. Projected Growth in Receipts by 2018, by Industry

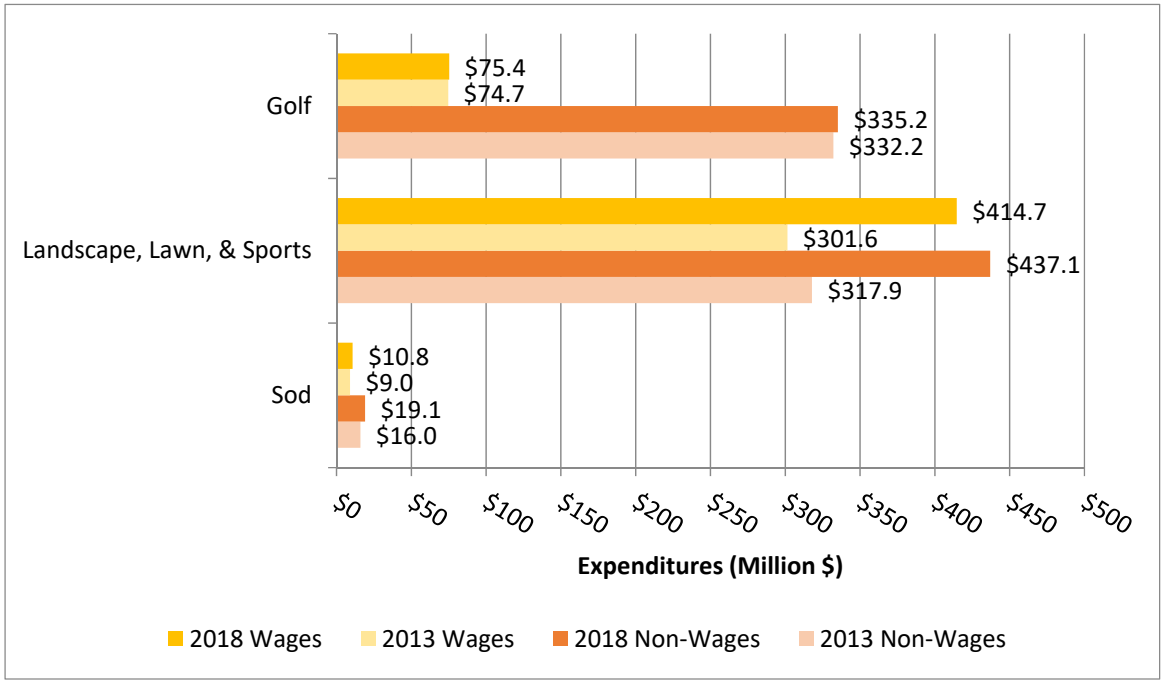


Figure 4. Projected Expenditure Values for 2013 and 2018, by Industry

The dollar value growth projections are adjusted with the IMPLAN deflator for 2018. As can be seen in Table 5, the projected total TIO values for 2018 (in 2013$) non-labor expenditures increase to $25 million for sod production, $482.6 million for landscape, lawn maintenance, and sport turf, and $443.1 million for golf courses. Values for total TIO from wages and salaries are $8.6 million for sod production, $328.7 million for landscape, lawn maintenance, and sport turf, and $60 million for golf courses. When considering both non-labor and wages and salaries effects, by 2018, the sod industry is projected to contribute $33.7 million, landscape, lawn maintenance, and sports turf $811.3 million, $503 million for golf courses. Overall jobs are projected to increase to 891 for sod production, 29,134 for landscape, lawn care, and sports turf, and 9,405 for golf.

Table 5. Estimated Economic Contributions for Sod Production, Landscape, Lawn, and Sports Turf Services, and Golf Courses in Tennessee, 2018.

	Sod Producers		Landscape, Lawn Care, and Sports Turf		Golf Courses	
Projected Growth by 2018	19.5		37.5		0.9	
	Direct	*Total*	*Direct*	*Total*	*Direct*	*Total*
Results from Non-Labor Expenditures						
Total Industrial Output[a]	$14,458,353	$25,089,767	$286,875,251	$482,583,699	$270,252,133	$443,111,672
Total Value Added[b]	$9,528,445	$15,730,963	$191,967,527	$305,956,177	$177,843,131	$278,286,545
Labor Income[c]	$7,385,651	$10,780,767	$133,389,539	$196,816,223	$114,439,065	$169,349,755
Employment[d]	262.5	340.0	5,076.1	6,509.7	4,348.3	5,608.0
State/Local Taxes[e]		$1,421,818		$66,406,421		$18,573,423
Wages & Salaries						
Total Industrial Output[a]	$0	$8,627,016	$0	$328,692,924	$0	$59,897,070
Total Value Added[b]	$10,810,943	$16,058,613	$414,677,637	$614,687,491	$75,389,100	$111,833,522
Labor Income[c]	$10,810,943	$13,587,837	$414,677,637	$520,434,398	$75,389,100	$94,663,754
Employment[d]	485.1	550.7	20,127.3	22,623.8	3,341.8	3,797.0
State/Local Taxes[e]		$474,904		$18,074,250		$3,294,891
Total						
Total Industrial Output[a]	$14,458,353	$33,716,783	$286,875,251	$811,276,623	$270,252,133	$503,008,742
Total Value Added[b]	$20,339,388	$31,790,221	$606,645,164	$920,643,668	$253,232,231	$390,120,067
Labor Income[c]	$18,196,594	$24,368,604	$548,067,176	$717,250,621	$189,828,165	$263,710,809
Employment[d]	747.6	890.6	25,203.3	29,133.5	7,690.1	9,405.0
State/Local Taxes[e]		$1,896,722		$84,480,671		$21,868,313

[a]Annual dollar value of goods and services that an industry produces; a measure of economic activity.
[b]Estimated employee compensation, proprietary income, other property type income (payments from interest, rents, royalties, dividends and profits), and tax on production/imports.
[c]Consists of employee compensation and proprietary income.
[d]Estimated number of total wage and salary employees (both full- and part-time), as well as self-employed.
[e]Consists of sales taxes, property taxes, motor vehicle licenses taxes, severance taxes, and other taxes.

5. Conclusions and Discussion

This study examined the economic impacts of the turfgrass industry in Tennessee, focusing on sod production, landscape, lawn, and sports turf companies, and golf courses. The largest TIO and employment estimates for 2013 are those for landscaping, lawn care, and sports turf, followed by turf associated activities at golf courses, then sod producers. While sod, and the landscaping, lawn care, and sport turf firms expect steady growth, the golf course industry anticipates nearly flat growth. Golf course expectations may reflect the decline in the number of golf courses in Tennessee since 2002 (from 223 in 2002) (Census Bureau 2015). In contrast the number of landscape and lawn care establishments increased during the 2000's (up from 1,169 in 2002), as did sod production acreage (USDA 2012). When asked what about problems, labor availability and quality appeared to be problematic for the firms. Over 60 percent of the sod producers indicated their business struggled to find ways to grow when the economy is negatively affected, while over 40 percent of lawn care did. About 50 percent of landscape companies suggested similar issues with growth during slow economic times. Interestingly, among golf courses only around 20 percent agreed that their business struggled during slower economic times.

Residential and commercial turfgrass growing associated purchases, such as purchasing seed, fertilizer, etc. are not represented in this part of the analysis. These expenditures for growing of turf are a major component of the overall market, while this analysis focused on more specialized industries focused on sod production and management of turf by landscapers, lawn care, and sports turf companies, as well as golf courses. Further research should expand the focus of this study. Furthermore, as more input conserving (example water and weed control) are developed, the expenditure patterns for turfgrass may change over time, necessitating follow-up analyses to capture these changes in expenditure patterns.

References

Beddow, J., E. Jones, D. Lamie, K. Mundy, and D. Chalmers. 2001. "The Economics of Turfgrass in the Commonwealth of Virginia." College of Agriculture and Life Sciences, Virginia Tech. Virginia Agricultural Experiment Station, Bulletin 01-2. Available at http://scholar.lib.vt.edu/ejournals/vaes/01-2.pdf.

Brooker, J., M. Gray, E. Carson, and T. Samples. 1993. "Tennessee's Turfgrass Industry: Structure and Econ. Value." Research Report 93-16, University of Tennessee Agricultural Experiment Station, Knoxville, TN.

Diemer, J. 2004. "Economic Impact: Golf and Turfgrass in New Mexico 2004-2005." Department of Agricultural Economics and Agricultural Business, New Mexico State University. Available at http://aces.nmsu.edu/programs/turf/documents/economic-impact.pdf.

Hodges, A, and T. Stevens. 2010. "Economic Contributions of the Turfgrass Industry in Florida." Final Project Report to the Florida Turfgrass Association. University of Florida, Food and Resource Economics Department. Available at http://www.fred.ifas.ufl.edu/economic-impact-analysis/pdf/Turfgrass%20Florida%202007.pdf.

IMPLAN Group, LLC. 2013. IMPLAN System (data and software). 16740 Birkdale Commons Parkway, Suite 206, Huntersville, NC 28078. Available at http://implan.com/.

Kane, S., and K. Wolfe. 2012. "Economic Contributions of Turfgrass Production, Ornamental Horticulture, and Landscape Services, and Related Industry in the Georgia Economy, 2010." The University of Georgia, Center for Agribusiness and Economic Development, Center Report: CR-12-05. Available at http://www.caes.uga.edu/center/caed/documents/CAEDTurfgrassandRelated2012_FINAL.pdf.

North Carolina Department of Agriculture (NCDA). 1999. Center for Turfgrass Environmental Research and Education: Economic Impacts. Available at http://harvest.cals.ncsu.edu/ncars/index.cfm?pageID=5247.

United States Census Bureau. 2012. "2012 American Community Survey 1-Year Estimates." American Fact Finder, Selected Housing Characteristics. Available at http://factfinder2.census.gov/faces/tableservices/ jsf/pages/productview.xhtml?src=bkmk.

United States Census Bureau. 2015. "2012 County Business Patterns (NAICS). Censtats Databases. Available at http://censtats.census.gov/.

United States Department of Agriculture, National Agricultural Statistical Service. 2012. "Tennessee State and County Data." 2012 Census of Agriculture Report. Volume 1, Geographic Area Series, Part 42. Available at http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Tennessee/tnv1.pdf

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

Do Contribution of Agriculture Procedures Differ Across States? A Survey of Methodological Approaches Used by Economists

Leah English
Jennie Popp
Wayne Miller
University of Arkansas

Abstract: Contribution analyses performed using IMPLAN data and software are an increasingly popular method for illustrating the importance of agriculture to state and local economies. Over the past decade, at least 24 states have used IMPLAN to conduct contribution of agriculture analyses at some level. In many cases, methods for conducting these analyses are described, however most descriptions aren't presented in sufficient detail to allow an effective comparison of procedures used between studies. To further analyze methodological variations between contribution of agriculture studies, an online survey was developed and distributed to agricultural economists across the country. Survey questions focused on respondents' choices related to trade flow models, multipliers, model customization procedures, and agricultural sector selection. Results of the survey show that, although there are general similarities in methodologies between researchers, no two agricultural economics researchers appear to perform contribution of agriculture analyses the same way. These results suggest a need for the development of standard procedures for use in conducting contribution of agriculture analyses, as this would function to increase transparency and comparability between studies.

1. Introduction

IMPLAN is a widely used tool for assessing the status of local, regional, or national economies. IMPLAN's datasets and software are primarily used by governments, universities and public/private sector organizations for conducting economic impact studies (IMPLAN, 2016a; USDA NRCS, 2016). Although IMPLAN is largely used for impact analysis, contribution analyses using the software are becoming increasingly popular, especially among agricultural economists across the United States. In fact, a recent online search for contribution of agriculture studies has revealed that, over the past decade, at least 24 states have used IMPLAN to conduct contribution of agriculture analyses at some level. Examination of these studies has revealed numerous variations in terms of: 1) terminology (contribution versus impact), 2) methodology, 3) defining agriculture through sector selection, and 3) reporting of results (output versus value added).

When comparing various contribution of agriculture reports, methods for conducting each analysis were described, however most descriptions weren't presented in sufficient detail to allow an effective comparison of procedures between studies. While IMPLAN provides an abundance of information concerning methods for using their software to conduct economic impact analyses, literature and reference materials for contribution analysis methodologies are sparse (Day, n.d.; Watson et al., 2007; IMPLAN, 2015). A paper by Watson et al. (2007) describes the differences between impact and contribution analysis, and discusses the appropriate use for each type of study. As the

studies being discussed in this paper aim to examine the economic activity associated with agriculture ex-post, contribution methodology would be an appropriate choice for these types of analyses.

Guidelines for conducting a single, or multi-industry contribution analysis using IMPLAN can be found within IMPLAN's online knowledge base (IMPLAN, 2016b). These guidelines suggest first modifying commodity production so that each industry produces only its primary commodity, then customizing trade flows by setting the Local Use Ratios (or Regional Purchasing Coefficients if using RPC method) to zero for the sector(s) being analyzed. Although this provides a basic guideline for conducting a contribution analysis using the IMPLAN software, there are several other areas where modifications to the model could drastically effect analysis outcome. Examples include: selection of trade flow method (e.g. IMPLAN National Trade Flows, Econometric RPC, or Supply/Demand Pooling); and selection of spending to include in the calculation of model multipliers (e.g. households, state/local government, federal government, enterprises, and inventory).

Sector selection can also have a drastic effect on the overall outcome of a contribution of agriculture study. When conducting a multi-industry analysis, it is generally left up to the researcher to define the aggregate industry being analyzed. When comparing contribution of agriculture studies, there does not appear to be a clear definition of agriculture in terms of sector inclusion for analysis. Although crop and livestock production are generally included within each contribution of agriculture analysis, there appears to be some contention regarding additional sectors falling under the umbrella of agriculture. Therefore, it is the task of each economist to determine which sectors may provide a full contribution to agriculture, which sectors contribute partially, and how to properly split any partially contributing sectors.

To further assess variation in methodologies among researchers performing contribution of agriculture analyses, an online survey was developed and distributed to agricultural economists across the country. Methods for conducting this survey are described in the following section.

2. Methodology

An online survey was developed using Qualtrics survey software. An anonymous link to the survey was distributed via email to agricultural economists across the country during December 2015 and again in January 2016.

Initial survey questions were aimed at collecting background information such as the frequency of contribution studies conducted, level of analysis (e.g. state, county, multi-county, multi-state, etc.), primary audience, and result distribution methods (e.g. hard copy report, electronic report, presentations, etc.). The bulk of the survey focused on methodologies used when developing individual contribution of agriculture models using IMPLAN. In particular, we wanted to know if researchers were following the guidelines provided by IMPLAN, as well as to determine what additional methods were followed in relation to choice of trade flow models, multipliers, model customization procedures, and agricultural sector selection.

The results of the survey were aggregated and used to identify varying practices used by researchers conducting contribution of agriculture studies across the country.

3. Results

Results consist of responses obtained from 18 completed surveys, coming from researchers in at least nine different states. Questions concerning background information show that 44% of respondents perform contribution of agriculture analyses on an annual basis with an additional 45% stating that they conduct contribution analyses at least every 5 years (Figure 1).

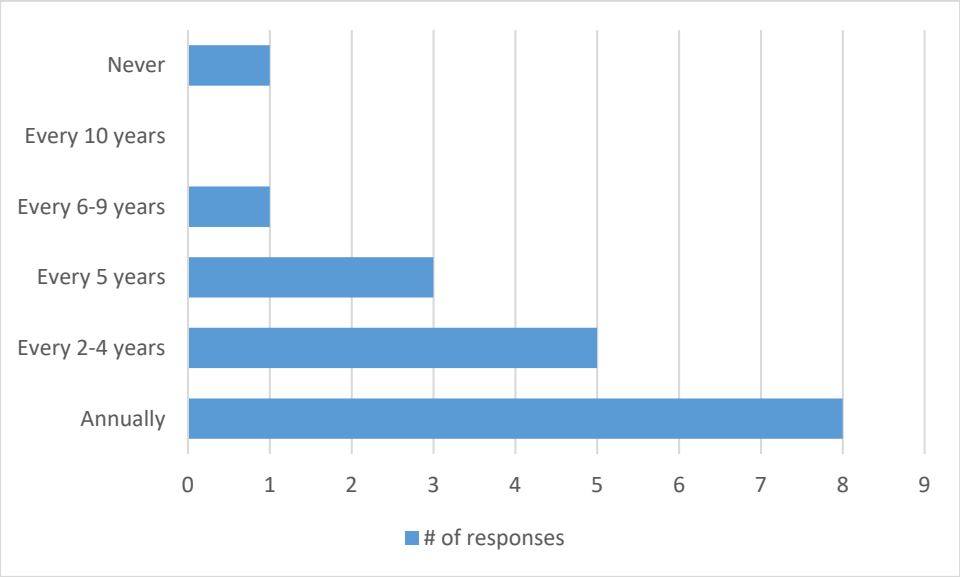


Figure 1. Contribution of agriculture analysis frequency

While the majority of respondents (94%) perform contribution of agriculture analyses at the state level, many researchers reported conducting additional analyses at the multi-state, multi-county, county, legislative district, or national level (Figure 2).

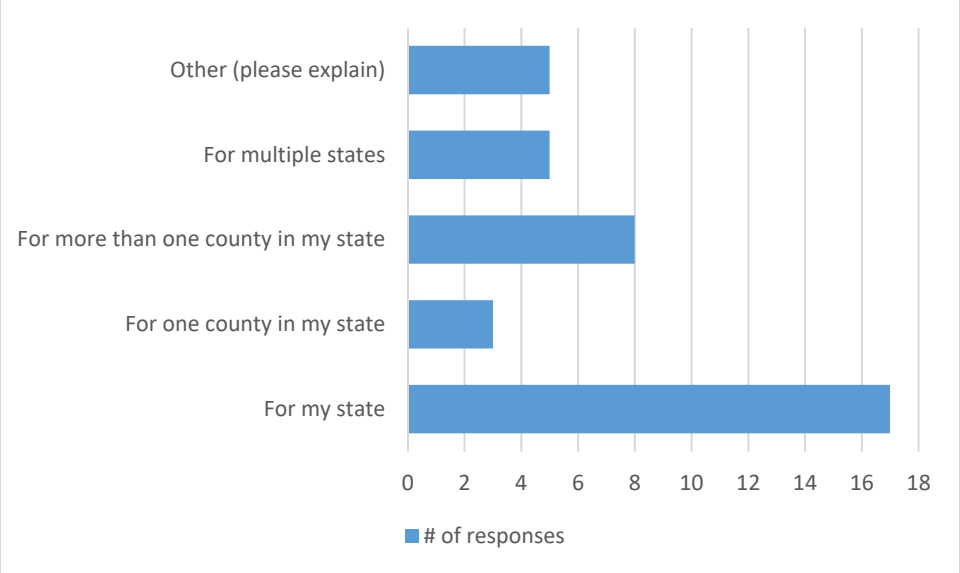


Figure 2. Contribution of agriculture level of analysis

The primary audiences identified for contribution of agriculture studies were state legislatures, state level agricultural commodity groups, and state departments of agriculture. Additional audiences include university administrators, congressional delegations, and the general public. The results were primarily distributed to the various audiences through electronic reports including detailed methods and results, electronic reports containing result highlights only and through presentations to government officials and industry leaders. Results are additionally distributed through hard copy reports, presentations at professional meetings, and in the form of a pocket guide.

As far as building the economic contribution model, there are some similarities between researcher approaches. However, it appears that many use methods outside of IMPLAN's suggested guidelines for conducting contribution analyses. For example, IMPLAN suggests adjusting the commodity coefficients to one for each sector being analyzed, but only 50% of respondents reported making this adjustment. To avoid double counting, IMPLAN also instructs users to zero out specific trade flow coefficients for the analyzed sectors. The survey revealed that only 67% of respondents make adjustments to trade flow coefficients when building their contribution models. Additionally, 44% of researchers reported making adjustments to industry production coefficients within IMPLAN.

Outside of following guidelines provided by IMPLAN, there are several other areas where users may make adjustments to their contribution model. These areas include selections for the model's trade flow method, multipliers, and agricultural sectors. Results of the survey show variation between researchers in each of these areas. For example, when selecting the trade flow method researchers reported using all three with most (72%) using the recommended IMPLAN National Trade Flows method, a smaller number (17%) using Econometric RPC, and two reported using the Supply/Demand Pooling option. For multipliers, all researchers reported using the nine default household categories in calculating multipliers with some (44%) including state and local government spending in the multiplier calculation. Thirty one percent also included corporations, and two researchers reported using multipliers that included all household and state, local and federal government spending (Figure 3).

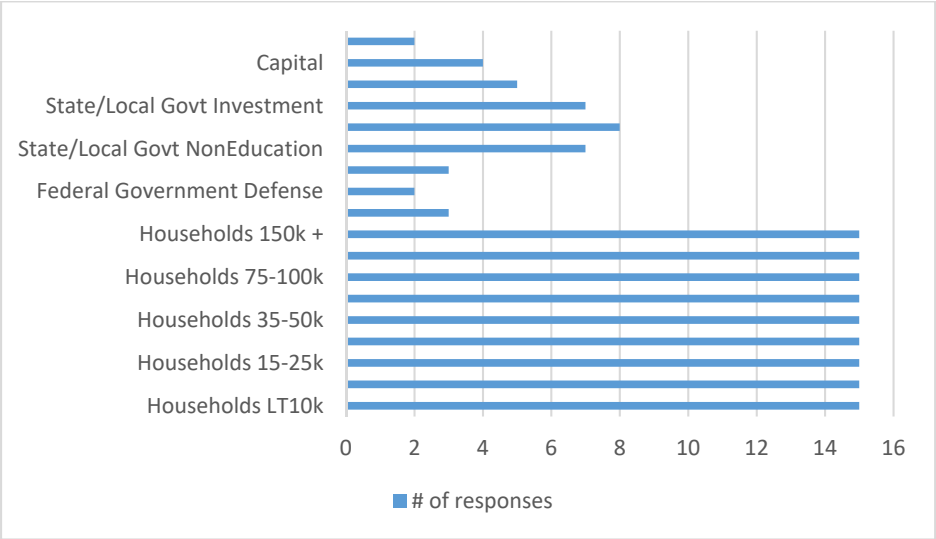


Figure 3. Selection of IMPLAN multiplier spending categories for contribution analysis.

In terms of selecting IMPLAN sectors to be included as part of agriculture, all agreed that crop and livestock production should be included within a state-level contribution of agriculture analysis. Almost all (89%) believe that crop and livestock processing should also be included with many (50% and 61%, respectively) adding forestry production and processing as well. Some researchers also include agriculture-related industries such as fishing, trapping, and hunting, as well as agriculture and forestry support and input sectors (Figure 4).

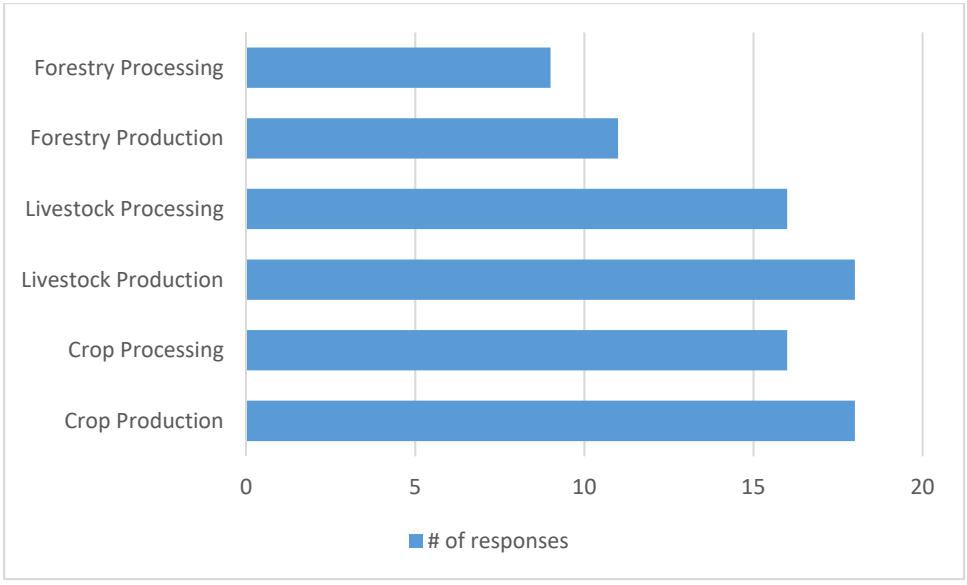


Figure 4. Aggregate sectors to be included in contribution of agriculture analysis.

Respondents were asked which of IMPLAN's 536 sectors should be included in a contribution of agriculture analysis (regardless of whether that activity took place in their state or not). When breaking down the aggregate agriculture sectors into the individual IMPLAN sectors, almost all (94%) agreed that IMPLAN sectors 1 thru 15 (crop and livestock production) and sector 19 (support activities for agriculture and forestry) should be fully included in a contribution of agriculture analysis. Although most researchers would include agricultural processing in their analyses, results show a wide variation regarding the selection of individual processing sectors for inclusion. For example, over 75% of respondents indicated that all industries classified under NAICS code 311 (Food Manufacturing) should be included in the contribution of agriculture analysis. A lower percentage felt that those falling under NAICS classification 312 (Beverage and Tobacco Product Manufacturing) should also be included. And less than 50% would include Textile Mills, Textile Product Mills, Apparel Manufacturing, Leather and Allied Product Manufacturing, Wood Product Manufacturing, and Paper Manufacturing. Forty one percent would include sector 262 (Farm Machinery and Equipment Manufacturing), with around a quarter adding sectors 263 (Lawn and Garden Equipment Manufacturing), 267 (Food Product Machinery Manufacturing), 269 (Sawmill, Woodworking, and Paper Machinery), 459 (Veterinary Services), 469 (Landscape and Horticulture Services), and 501-503 (Food and Drinking Places). There were several other sectors that a lesser percentage of respondents felt could contribute, either fully, or partially to agriculture. In total, 164 sectors were identified as being considerable for inclusion in a state-level contribution of agriculture analysis.

In addition to the previously discussed variations, several researchers described working outside of IMPLAN's software and datasets when conducting their analyses. For example, 67% reported customizing IMPLAN's study area data and 44% customized industry production coefficients using various sources and methods. When asked to explain any additional customization procedures being performed, some also reported building the social accounting matrix (SAM) within IMPLAN, then exporting those data into an Excel spreadsheet for their contribution analysis.

When asked about the importance of consistency in methodologies used by researchers to conduct contribution of agriculture analyses, most respondents felt that this was either extremely important (50%) or very important (44%).

4. Conclusion

Overall, results from the survey show that there is much variation in methodologies used to conduct contribution of agriculture studies across the United States. This may suggest a need for the development of standard procedures for use in conducting contribution analyses for agriculture. As these studies are distributed to a wide variety of audiences, such a protocol would function to increase reliability and transparency for stakeholders, while also increasing comparability and replicability for future research. Furthermore, recent literature has described methods for improving regional contribution studies (Watson et al., 2015). As several researchers were shown to conduct portions of their analyses outside of IMPLAN, it may be worthwhile to consider additional methods for enhancing the accuracy and reliability of results.

References

Day, F. n.d. Principles of impact analysis and IMPLAN applications: First Edition. Hudson, WI: MIG.

IMPLAN. 2015. IMPLAN V3 Software Manual. *IMPLAN Group LLC Website*. http://support.implan.com/index.php?view=document&alias=31-v3-reference-manual-2&category_slug=internal-docs&layout=default&option=com_docman&Itemid=1764. Accessed 10 August 2016:

IMPLAN. 2016a. Who we are. *IMPLAN Group LLC Website*. http://implan.com/company/. Accessed 10 August 2016.

IMPLAN. 2016b. Multi Industry Contribution Analysis. *IMPLAN Group LLC Website*. http://support.implan.com/index.php?option=com_content&view=article&id=366#7-setting-up-the-multi-industry-contribution-analysis. Accessed 10 August 2016.

USDA NRCS (U.S. Department of Agriculture National Resource Conservation Service). Introduction to NRCS Uses of the IMPLAN Model. *NRCS Website*. http://www.nrcs.usda.gov/wps/portal/nrcs/detail//?cid=nrcs143_009748. Accessed 10 August 2016.

Watson, P., J. Wilson, D. Thilmany, and S. Winter. 2007. Determining economic contributions and impacts: What is the difference and why do we care? *The Journal of Regional Analysis and Policy*, 37(2), 1-15.

Watson, P., S. Cooke, D. Kay, and G. Alward. 2015. A method for improving economic contribution studies for regional analysis. *The Journal of Regional Analysis and Policy*, 45(1): 1-15.

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

FOREIGN AID EFFECTIVENESS IN AFRICA: SISTER MORPHINE

M. Emre Görgülü
Afyon Kocatepe University - Turkey

Abstract: In today's world of post-colonialism era, foreign aids play an important role in the economic development agenda for many least developed and for some developing countries. As a significant fund for countries in need, foreign aids also bring along many controversies. These critiques are mainly concentrated on the purposive structures of foreign aid flows and on the country ownership issues. The question is; are foreign aids really able to turn the nightmares of host countries into dreams? Apart from the foreign aid flows in humanitarian crises, do foreign aids really promote economic growth in host countries, or do they just create countries addicted more and more to aid flows? Is that possible to claim that all foreign aids are made in good faith or can we find any ill-minded ones? In either case, the hard task is to sort out the sheep from the goats. To do this, we can measure the foreign aid effectiveness in host countries in order to have a better understanding.

Accordingly this study attempts to capture the aid effectiveness particularly in Africa through her effects on host country economic growth by means of a regression analysis. The results reveal that as long as the host countries claim increased ownership on aid projects, better results can be yielded. Otherwise, foreign aids would only be helpful for a limited time frame and therefore would serve to turn the host countries into aid junkies in long term as observed in most of the cases. This process follows from the principal-agent problem. Once a country in need receives foreign aid, her ability to internalize aid flows and to channel those funds into productive projects for individuals determines to what extent foreign aids can be effective in those countries. Even if the aid flows are bona fide practices in host countries, any stumble that could happen along the way of increasing country ownership to overcome the principal-agent problem may result in loss of efficiency. In short, there is a thin line between aid flows becoming effective and turning into sister morphine. This thin line is drawn by the level of host country ownership.

1. Introduction

In today's world of post-colonialism era, foreign aids play an important role in the economic development agenda for many least developed and for some developing countries. As a significant fund for countries in need, foreign aids also bring along many controversies. Some researchers (ex., Bauer, 1972; Mosley, 1980; Mosley, Hudson and Horrel, 1987; Singh, 1985) argue that foreign aids can bring along many inefficiency related problems such as increasing the financial power of the elite in poor countries or just been wasted, while others (ex., Sachs, McArthur, Schimdt-Traub, Kruk, Bahadur, Faye and McCord, 2004; Papanek, 1973; Levy, 1988) claim that foreign aids can play a part in reducing poverty or at least prevent worse performances (Radelet, 2006). Differences in structures of foreign aids and in structures of aid receiving countries enables these diversified conclusions.

On aid effectiveness the question is; are foreign aids really able to turn the nightmares of host countries into dreams as sister morphine[1] does? Apart from the foreign aid flows in humanitarian crises, do foreign aids really promote economic growth in host countries, or do they just create countries addicted more and more to aid flows? Is that possible to claim that all foreign aids are made in good faith or can we find any ill-minded ones? In either case, the hard task is to sort out the sheep from the goats.

[1] "Turning nightmares into dreams" is a fragment of the lyrics of famous song, "Sister Morphine", written by Mick Jagger, Keith Richards and Marianne Faithful in 1969 (Jagger, Richards and Faithful, 1969).

Measuring the foreign aid effectiveness in host countries can serve this aim. The effectiveness of foreign aids is really closely related with the principal-agent problem. Once a country in need receives foreign aid, her ability to internalize aid flows and to channel those funds into productive projects for individuals determines to what extent foreign aids can be effective in those countries. Even if the aid flows are bona fide practices in host countries, any stumble that could happen along the way of increasing country ownership to overcome the principal-agent problem may result in loss of efficiency. Therefore, the main purpose of this paper is to test the efficiency of foreign aids in Sub-Saharan Africa through the country ownership perspective and to draw a clear line between the success or failure of them.

The rest of the paper is structured as follows: The next section gives information about the conceptual framework of foreign aids. The third section summarizes the empirical findings in the literature about the efficiency of foreign aids, focuses the success and failure conditions of them and presents mainstream views on the matter. The analysis took place in the fourth section and the results of the analysis and the policy implications are covered in the final section.

2. Foreign Aids: The Conceptual Background

Development Assistance Committee (DA) of Organisation for Economic Co-operation and Development (OECD) defines foreign aids as financial flows in the form of grants and subsidized loans[2], technical support programs and transfer of resources such as specific goods from one country to another with the main goal of economic development and amass wealth in the host country. Among the types of foreign aid, Official Development Assistance (ODA) is the most common one. Others include Other Official Flows (OOF) and Private Flows (PF) (OECD, 2010: 271-276).

Foreign aids mostly appear in the form of improvement of social, financial, technical, logistical and administrative infrastructures along with debt relief programs and humanitarian aids in times of crises (OECD, 2014; OECD, 2015).

The single most important causative factor in foreign aid rationale is fighting with poverty. Thus, donors send their most distinctive aids to the poorest countries (OECD, 2015). However, international political expectations also play an important role in determining the direction of foreign aid flows. Many developed countries see foreign aids as a tool for gaining new allies while expanding their influential zone and moreover, in the hopes of keeping ex-colonial ties alive, foreign aids have been made in substantial amounts without even monitoring the developmental effects of them (Roodman, 2004; Alesina and Dollar, 2000). Plus, donors would like to influence many countries as possible. Therefore, instead of sending their aid funds to crowded large countries where aid per capita would be relatively low, they tend to direct their aid flows to smaller countries (Radelet, 2006). Additionally, some researchers (eg., Helble, Mann and Wilson, 2012) argue that foreign aid can be used to ease international trade and to overcome the foreign trade barriers, thus turning aid recipient host countries into global markets.

Among the types of foreign aids; it can be said that bilateral aid in the form of one country to another, is tailored in accordance with the economic interest of some fractions in the donor countries. Multilateral aid whereas, pools the funds together and deliver them through international organizations and in that way provides a relatively more efficient way of helping the poor countries (OECD, 2015).

Total foreign aid flows globally has reached to 613.1 billion USD in 2014. ODA flows has shown a steady increase since 1960s when they first recorded and reached important peaks in 1992 following the dissolution of USSR with 68 billion USD and in 2003 following the global affairs as a result of September 11, 2001 with 80.4 billion USD. Today, the figure has reached to the historic peak of 178.3 billion USD in 2014. Since 1960s till today, USA, Japan, United Kingdom, Germany and France are

[2] At least 25 percent of the loan must be granted to the host country (OECD, 2010: 273).

among the largest ODA donors in terms of total dollars (OECD, 2016).

Historically, Sub-Saharan Africa, South & Central Asia and Far East have been the most ODA receiving regions. On overall, since mid-1960s till today Sub-Saharan Africa has dominantly become the most ODA receiving region. After September 11, 2001, US and the Ally operations and following reconstruction processes has increased aid flows to Middle-East (mainly due to Iraq) and to South & Central Asia (mainly due to Afghanistan) in substantial amounts since 2003. In 2014, Sub-Saharan Africa received 25.7 billion USD worth ODA flows, whereas 12.6 billion USD worth ODA directed to South & Central Asia and 7.3 billion USD worth ODA to the Middle-East (OECD, 2016).

Donor countries in DAC have consistently shifted their ODA support from higher-income countries to lower-income ones (OECD, 2015: 318). As for 2014, foreign aids consist on average 3% of the national income of lower-income countries and 0.06% of the national income of high-middle income countries. This shows that as countries get richer the financial resource role that is played by foreign aids is replaced by private capital flows. In addition, it also reveals that as the level of income in host countries decrease, the relative size of foreign aids and the role they play in those economies increase (OECD, 2016).

In 2014, Afghanistan, Vietnam, Ethiopia, India, Pakistan, South Sudan, Kenya and Syria are among the most ODA receiving countries in terms of total dollars. However, once the percentage of ODAs to their national income is accounted for, then Liberia, Kiribati, Afghanistan, South Sudan and Solomon Islands would top the list in 2014. In terms of ODA per capita, this time many large countries are replaced by micro ones such as Tokelau, Saint Helena, Niue, Montserrat, Wallis and Futuna, Cook Islands, Tuvalu, Nauru, Micronesia, Palau and Marshall Islands (OECD, 2016). From such lists it is evident that as the measurement procedure for foreign aids change, the perspective of "the most" changes as well.

3. The Efficiency of Foreign Aids

The efficiency of foreign aids is most commonly measured through their effects on economic growth of the host countries as achieving that would be their top priority. However, the existence of an apparent relationship between the two is a matter of debate. In general growth numbers of aid recipient countries are not directly proportional to the amount of foreign aid they receive. While some countries can work miracles with only limited amounts of aid, the others exhibit slow or even negative economic growth despite being host for substantial amounts of aid (OECD, 2016; Radelet, 2006). For some researchers (ex., Bauer, 1972; Mosley, 1980; Mosley et al., 1987; Singh, 1985) this ambiguity shows that foreign aids are unsuccessful in reaching their primary goal.

International Monetary Fund (IMF) and the World Bank periodically monitor the effectiveness of aid projects that they provided to countries who adopt their stabilization and structural regulation measures. These processes reveal that in low-income countries aid projects could perform better than they do in other country groups. However, they also reveal that the projects lack self-sufficiency and sustainability (IMF, 2015; The World Bank, 2015).

Some researchers (ex., Bauer, 1972; Bauer, 1984; Easterly, 2001) argue that, geopolitical concerns, domestic interest groups, increasing corruption, the desire to control financial power, unethical practices and the inherent difficulties of externally inducing economic development are all contribute to weaken the efficiency of foreign aids. Even in some cases foreign aids have been wasted and adversely affected host country economic growth (Papanek, 1973).

Moreover, on one side, allocating more aids to countries with low growth rates and less to relatively faster growing ones can cause their potential development effects to be ignored (Clemens, Radelet and Bhavnani, 2004) and on the other side, having foreign aids following a time of crisis could be misleading as in most of these cases even if the most faulty designed aid programs can contribute to development and this would hinder their true nature (Burnside and Dollar, 2000).

Moreover, some donors may require some certain disciplines in their aid programs to ensure aid recipient countries to get in harmony with the them. This often involves the procurement of goods and services involved in the aid programs is being limited to donor countries and with investments, an obligation to spent the funds to donor country contractors (OECD, 2010: 275). Tying foreign aids in this manner is also another common malpractice that would diminish the efficiency of aid programs. In this way, as the most efficient suppliers would not be chosen, this would diminish the local competition. So this would reduce the real value of foreign aid programs as well as their efficiency (Radelet, 2006:7). However, foreign aids tied to necessitate increase in recipient country ownership or require compulsory improvements in infrastructure of the host country can have increased efficiency effects. Differences related with country characteristics come into play at this point, they contribute to determine imposing which conditions and when (UNCTAD, 2015).

Foreign aid flows also inherent the Samaritan's dilemma for both parties (Radelet, 2006). The dilemma suggest that sending aid to poor countries may act as an incentive for them to pursue the actions what would keep them in the state of being poor. Thus, aid receiving countries may tend to rely on this effortless award and become slothful. Plus, cutting down these aid flows after some point would make the people in host countries suffer as they would got used to live with the effortless aid flows (Buchanan, 1975; Svensson, 2003).

Foreign aid flows typically exhibit diminishing returns principle and therefore can be effective for a limited time frame. The length of this time frame mainly depends on the host country characteristics. Different country characteristics can help to explain various growth rates in aid receiving countries. Foreign aids can contribute to economic growth of the host countries following proper policies[3] and having institutional quality to some extent, given that donors would not exploit any interest out of these programs (Papanek, 1973; Levy, 1988; Hansen and Tarp, 2000; Clemens et al., 2004; Collier and Dollar, 2002; Burnside and Dollar, 2004; Dalgaard, Hansen and Tarp, 2004). Additionally, poor countries usually lack to amass necessary savings to induce growth conducive investments, and even some of them could be caught in poverty trap for a long time. In such cases, foreign aids could come to help and could increase savings, thus could finance the investments and could contribute to capital accumulation in the host countries (Sachs et al., 2004). However, excess cases of foreign aid programs can result in over-appreciation of local currency and therefore by increasing imports and decreasing exports could shrink the profitability of local producers, a phenomenon known as the Dutch disease (Bigsten, 1998; Adam and Bevan, 2004, Nkusu and Sayek, 2004; Radelet, 2006).

In cases where foreign aids support investments on health or educational infrastructures, they tend to increase the efficiency of social policies. Moreover, they can enable the spread of new knowledge through spillover effects inherent in aid programs accommodating high-tech capital goods (Sachs et al., 2004).

The types of foreign aids and the host country characteristics matter the most when it comes down to differences in foreign aid programs' developmental effects. Infrastructural aid programs would have different effects than debt relief programs and their developmental effects would differ from that of humanitarian aids (Clemens et al., 2004). Moreover, the efficiency of foreign aids in terms of economic development, would be highest in countries follow aforementioned proper policies, would be null in average environments and would be worse in inadequate political and institutional environments (Burnside and Dollar, 2000). Particularly, aid to countries lack institutional and political quality can create adverse effects (Bauer, 1972; Djankov, Montalvo and Reynal-Querol, 2006). In latter cases, elites in power could use foreign aids to accommodate their excessive luxury needs and corruption could be encouraged, thus foreign aids could be wasted. Additionally, aid

[3] Low inflation, increased openness to trade and small budget deficits (Burnside and Dollar, 2000).

flows can help incapable governments to remain in power, increase their desire to control, strengthen them against their local opposers, thus can contribute also to political instability and this way can lead poor economic policies to be pursued and can contribute to postpone improvements on institutional quality (Bauer, 1972). Many African economies would be a perfect example for this situation as politics have a very influential effect on economics in Africa. Many arbitrary interventions led to increased corruption and rent seeking in the continent. Also, in times of turmoil and conflict, foreign aids may unintentionally finance these conflicts and may cause them to endure longer, thus can contribute to instability in whole another level. For instance, one of the main reasons of the civil wars in Somalia is to control the substantial amounts of food aid (Maren, 1997). Plus, governments primarily concerned with preservation of their own existence would care less about ownership principles (Bigsten, 1998).

Many Sub-Saharan countries along the 1980s, despite the common irregularities in their economic performances, usually adopted foreign aids in the form of structural reform programs supported by IMF and the World Bank. The problems typically include increasing fiscal and current account deficits, deferred foreign liabilities and relative price discrepancies which are closely related with incapable management of the economy (IMF, 2015; The World Bank, 2015). One example of such a case is properly called the Zairean disease. Following substantial foreign aids for decades, Zaire has shown no signs of development, and foreign aids caused inability, corruption and mislead policies (Knack, 2000:2).

Another point is, in cases where foreign aids do not have full grant, host countries would have to take the burden of additional debt. Eventually, for the poor countries debts can pose an important obstacle on the road of economic development (Presbitero, 2005).

One of the main obstacles on the foreign aid efficiency is the principal-agent problem. There is an indirect and distant relationship between the taxpayers in donor countries who finance the foreign aid flows and the ultimate beneficiaries in poor countries who were intended to receive such flows. Their purposes, motives and knowledge may differ in many occasions. In domestic programs, or policy practices, taxpayers and the ultimate beneficiaries are the same people, thus enable them to judge the success or failure of the projects and can accordingly punish or reward their politicians. However, in foreign aids this process is not plausible. Taxpayers often do not have fully transparent information about whether their funds have been spent on right purposes or not, and beneficiaries may even have no knowledge about the funds. Therefore their punishing and rewarding mechanisms become functionless (Radelet, 2006). In addition to that, the countries receive substantial amounts of foreign aids may become responsible against donors instead of their own taxpayers. Aid provider countries or institutions may reach the position where they would be the ultimate authority on the economic decisions of the host countries (Brautigam, 1992). In this way, principal-agent problem inherent in foreign aid flows can diminish the efficiency of them.

Increasing aid flows regardless of the efficiency of reform programs would contribute more to the principal-agent problem and would cause unbalances in the economy to endure rather than wipe them out (Rattso, 1992). Also, high level of external control of reform programs (Carlsson, Somolekae and van de Walle, 1997), limited local responsibilities, host country participation and ownership rights would also undermine the efficiency of foreign aids (Bonnick, 1997; Bigsten, 1998).

Moreover, in cases it is not clear whether the responsibility is on donors or on host countries, the projects tended to be unsuccessful. Therefore, for donors the only option left is to claim full responsibility (OECD, 2007). This would increase the success chance of the projects for the project time frame, but left it ambiguous in terms of sustainability. In increasing the sustainability aspect of aid projects, while one alternative is to share the responsibility equally among the donor and the host country, increasing host country participation is the other, given that the aid projects would be enforcing reforms in nature. Host country ownership assumes host country leadership on the projects, whereas host country

participation entails host country government participation in a large scale. In both cases, it would be more possible to overcome principal-agent problem as both cases would enable increased integration between the principals and agents (Radelet, 2006). Both IMF and the World Bank also aimed at increasing local participation in projects they finance and conduct (IMF, 2015; The World Bank, 2015). One another alternative on improving host country participation and ownership is pushing some portion of the project cost off on the host countries in the initial stage as a token of cogency. By this way, either host countries would dedicate themselves into the projects or the projects shall never start at all (Bigsten, 1998).

Increasing foreign aid addiction contradicts with and would harm the long-term development objectives of the donor countries. The main goal of the donors should be to achieve self-sufficient sustainable development by increasing self confidence in the aid recipient countries in the long-run, and not creating aid-junkies which would cry out for sister morphine.

Consequently, many researchers have searched for a link between foreign aids and economic growth, but most of them failed to find a significant correlation among the two and most of them reached a consensus that foreign aids lack systematic positive effects on institutions and policies (ex., Durlauf, Kourtellos and Tan, 2008; Mosley et al., 1987; Collier and Gunning, 1997). However, project based evaluations reveal the success of projects (IMF, 2015).

4. The Analysis

The efficiency of foreign aids is tested through their effects on economic growth in the Sub-Saharan host countries. However, some Sub-Saharan countries were omitted[4] from the analysis as they lack the necessary data for this research. The analysis covers 45 Sub-Saharan countries over the 2004-2014 period.

In this paper the Data Envelopment Analysis (DEA) is used. DEA is a relative measure of efficiency and this method is best known for its ability to measure efficiency with multiple input models (Charnes, Cooper and Rhodes, 1978). DEA measures the relative and normalized effectiveness of each and every decision making unit (DMU)s -i.e. each country in the analysis- through either effectiveness of the inputs on the output or vice versa. Thus, the efficiency of a country is measured relative to the efficiency of all others (Veiderpass and Andersson, 2007). The method assigns weights for each input and output on the output/input ratio in order to measure the efficiency. Assigning weights provides a normalized measure -i.e. 0 < Efficiency of a DMU < 1. So, efficiency score equal to 1 means efficient, whereas as the score moves away from 1 to 0, the efficiency decreases and becomes relatively inefficient, depending on how far the efficiency score from 1. In short, the analysis exposes the normalized efficiency of each DMU relative to the other DMUs.

The logic of DEA programming used in the analysis is based on the simple efficiency ratio of output over input, and through the introduction of weight assignments for multiple inputs and outputs the procedure becomes as follows (Charnes, Cooper and Rhodes, 1978):

$$DMUEfficiency = \sum_{r=1}^{s} u_r y_{rj} / \sum_{i=1}^{m} v_i x_{ij} \quad (1)$$

where y_{rj} are the outputs and x_{ij} are the inputs and u_r , $v_i \geq 0$ are the assigned weights. So, our dynamical programming problem becomes:

$$Max \sum_{r=1}^{s} u_r y_{rj} / \sum_{i=1}^{m} v_i x_{ij} \quad (2)$$

subject to u_r , $v_i \geq 0$.

And it becomes:

$$Max \sum_{r=1}^{s} u_r y_{rj} \quad (3)$$

[4] Equatorial Guinea, Mayotte, Saint Helena, Sao Tome and Principe, Somalia and South Sudan.

$$\text{subject to } \sum_{i=1}^{m} v_i x_{ij} = 1 \quad ,$$
$$-vX + uY \geq 0,\ u_r, v_i \geq 0.$$

Therefore, below (4) solves the dynamical programming problem:

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \qquad (4)$$

In the DEA analysis the Y_{it} - Y_{it-1} variable is the output and it represents the annual difference in gross domestic product (GDP) per capita (The World Bank, 2016b). However according to the DEA software limitations of non-negativity, as the largest negative difference, 2461.70 USD were added to each data point. Y_{it-1} is the first input of the model and is for the previous year's GDP per capita (The World Bank, 2016b). The second input of the model is the FA_{it} variable and it stands for the annual ODA per capita flows (OECD, 2016). The rationale behind using per capita terms in aid flows and GDP instead of total dollars is that, per capita terms are more likely to reflect changes in personal wealth and under normal conditions the ultimate goal of any aid project would be to increase the standard of living in a country. The final input of the model is the absorptive capacity variable; AC_{it}. According to the World Bank, in order to ensure country ownership, institutional capacity is required in the host countries (The World Bank, 2016a). Thus, as institutional capacity is a measure of absorptive capacity, then the absorptive capacities can be used as proxies for country ownership. At least it could explain country ownership to some extent. Accordingly, in the analysis absorptive capacity of the host countries is used as an indicator of country ownership. The absorptive capacities of the host countries are attempted to be captured by applying another version -due to data limitations- of a new method that is introduced by Gorgulu (2015). According to the method, the weighted average of gross capital formation relative to GDP (the World Bank, 2016b) and domestic credit to private sector relative to GDP (the World Bank, 2016b) are used to capture the financial development aspect of absorptive capacities. Then, the technology gap measure (the World Bank, 2016b) is obtained as a ratio of difference of GDP per capita between US and the host countries, relative to host country GDP per capita (Li and Lui, 2005) and negatively multiplied with one minus the weighted average. Ultimately, these negative values were subtracted from 1000 due to the non-negativity constraint and to normalize the values. By this way, the method aims to nullify the negative effects of technology gap through absorptive capacities and as the value gets higher absorptive capacity level of the host countries gets better.

The results with relative efficiency levels of each country are presented in below Table-1. According to the applied DEA method, it is revealed that in many countries the efficiency of foreign aids were diminishing. In fact, mean values lower than 0.936 benchmark -the overall average- mean that the foreign aids in those countries were ineffective for the 2004-2014 period. As values depart from 1 the efficiency of foreign aids in host countries decreases. One interesting finding is that, Burundi, with very limited annual aid flows[5] managed to use it most efficiently. Along with Burundi, the foreign aids in Gabon and South Africa seemed to be more efficient than the others. However, worst foreign aid efficiency performances was recorded in Benin, Burkina Faso, Djibouti, Gambia, Mozambique, Sierra Leone, Sudan and Tanzania.

Table 1. Results of the DEA

	Years											Mean
Countries	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**(Country)**
Angola	0.444	1.000	1.000	1.000	1.000	0.98	0.906	1.000	1.000	1.000	1.000	**0.939**
Benin	0.621	0.875	0.935	0.878	0.883	0.929	0.981	0.921	0.937	0.916	0.897	**0.888**

[5] 54.41 USD per capita per annum (OECD, 2016).

Botswana	0.879	0.994	0.995	0.958	0.99	0.89	1.000	0.999	0.998	1.000	0.963	**0.970**
Burkina Faso	0.492	0.859	0.933	0.868	0.882	0.948	0.959	0.923	0.936	0.921	0.89	**0.874**
Burundi	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	**1.000**
Cabo Verde	0.967	0.952	0.989	0.96	0.977	0.891	0.997	0.997	0.956	0.918	0.905	**0.955**
Cameroon	0.476	0.946	0.944	0.868	0.971	0.942	0.981	0.96	0.963	0.95	0.93	**0.903**
C. African Rep.	0.729	0.946	0.933	0.93	0.913	0.983	0.97	0.946	0.97	0.933	0.954	**0.928**
Chad	0.975	0.855	0.907	0.915	0.952	0.965	0.98	0.957	0.955	0.95	0.946	**0.942**
Comoros	0.962	0.886	0.939	0.866	0.891	0.933	0.982	0.923	0.938	0.913	0.888	**0.920**
Congo, D., Rep.	0.806	0.935	0.945	0.988	0.939	0.978	0.983	0.971	1.000	0.99	1.000	**0.958**
Congo, Rep.	1.000	1.000	0.974	1.000	0.995	0.9	1.000	0.993	0.957	0.965	0.933	**0.974**
Cote d'Ivoire	0.626	0.916	0.943	0.947	0.968	0.943	0.984	0.937	0.943	0.947	0.939	**0.918**
Djibouti	0.681	0.892	0.941	0.872	0.893	0.907	0.994	0.933	0.922	0.9	0.88	**0.892**
Eritrea	0.691	0.88	0.932	0.957	1.000	1.000	0.985	0.989	0.991	1.000	1.000	**0.948**
Ethiopia	1.000	1.000	1.000	1.000	1.000	0.994	0.981	0.984	0.988	0.956	0.948	**0.986**
Gabon	1.000	1.000	0.993	1.000	1.000	1.000	0.998	1.000	0.997	0.998	0.995	**0.998**
Gambia, The	0.516	0.867	0.938	0.869	0.897	0.948	0.964	0.934	0.955	0.942	0.945	**0.889**
Ghana	0.923	0.85	0.922	0.873	0.905	0.928	0.988	0.938	0.929	0.938	0.926	**0.920**
Guinea	0.909	0.959	1.000	1.000	0.985	1.000	1.000	1.000	0.994	0.969	0.947	**0.978**
Guinea-Bissau	0.919	0.881	0.948	0.883	0.895	0.954	0.972	0.926	0.97	0.947	0.918	**0.928**
Kenya	0.922	0.919	0.891	0.898	0.953	0.953	0.995	0.933	0.924	0.906	0.887	**0.926**
Lesotho	0.87	0.882	0.923	0.86	0.891	0.945	0.981	0.926	0.928	0.906	0.909	**0.911**
Liberia	0.852	0.97	0.988	0.95	0.966	0.953	0.968	0.951	0.964	0.935	0.921	**0.947**
Madagascar	1.000	0.884	0.939	0.911	0.946	0.986	1.000	1.000	1.000	1.000	0.996	**0.969**
Malawi	0.943	0.921	0.936	0.924	0.924	0.988	0.959	0.972	0.998	1.000	1.000	**0.960**
Mali	1.000	0.858	0.933	0.864	0.883	0.951	0.965	0.919	0.944	0.921	0.893	**0.921**
Mauritania	0.926	0.849	0.93	0.866	0.89	0.915	0.997	0.926	0.922	0.906	0.88	**0.910**
Mauritius	0.862	0.993	0.992	0.96	0.99	0.888	0.999	0.998	0.997	0.998	1.000	**0.971**
Mozambique	0.445	0.866	0.932	0.881	0.89	0.953	0.963	0.917	0.931	0.907	0.888	**0.870**
Namibia	0.996	0.968	0.992	0.933	0.985	0.891	0.998	0.998	0.992	0.98	0.933	**0.970**
Niger	0.602	0.903	0.953	0.956	0.972	0.998	0.979	0.98	0.969	0.963	0.943	**0.929**
Nigeria	1.000	0.873	0.937	1.000	1.000	1.000	1.000	0.946	1.000	0.993	1.000	**0.977**
Rwanda	0.828	0.879	0.917	0.88	0.888	0.95	0.962	0.926	0.941	0.921	0.898	**0.908**
Senegal	0.993	0.875	0.937	0.853	0.888	0.917	0.992	0.922	0.927	0.91	0.881	**0.918**
Seychelles	0.852	0.997	1.000	0.998	0.999	0.888	0.999	0.999	1.000	1.000	0.994	**0.975**
Sierra Leone	0.417	0.883	0.932	0.89	0.906	0.959	0.958	0.933	0.944	0.92	0.896	**0.876**
South Africa	1.000	0.986	0.988	0.993	0.995	0.957	1.000	0.997	0.995	0.996	0.991	**0.991**
Sudan	0.56	0.856	0.931	0.857	0.899	0.927	0.989	0.949	0.947	0.952	0.964	**0.894**
Swaziland	0.843	0.966	0.998	0.907	0.976	0.936	1.000	1.000	0.975	0.959	0.91	**0.952**
Tanzania	0.509	0.86	0.934	0.862	0.906	0.95	0.968	0.937	0.932	0.914	0.908	**0.880**
Togo	1.000	1.000	1.000	0.997	0.914	0.951	0.962	0.921	0.973	0.955	0.954	**0.966**
Uganda	0.949	0.878	0.927	0.89	0.926	0.978	0.959	0.953	0.955	0.943	0.932	**0.935**
Zambia	0.987	0.852	0.929	0.86	0.897	0.915	0.99	0.945	0.931	0.917	0.887	**0.919**
Zimbabwe	0.869	0.892	0.953	0.943	0.988	0.981	0.959	0.938	0.935	0.931	0.914	**0.937**

Resources: OECD, 2016; The World Bank, 2016b.

5. Conclusion

The results of the analysis reveals that we have "sister morphine effect" in many Sub-Saharan African countries. It is found that the absorptive capacities thus the country ownership in most of the host countries are inadequate, hence the inefficiency. This implies that, only countries with absorptive capacities above a certain threshold can extract benefits from foreign aids, whereas countries lack such capacities, foreign aids become ineffective. However, the concept of absorptive capacities to explain efficiency are necessary but not sufficient. With very little aid and lowest absorptive capacity Burundi case suggests that limiting aid flows that host countries receive can be another alternative to increase their efficiency. Therefore, host countries should either follow policies that limit the foreign aid flows they receive or should promptly adopt absorptive capacity increasing policies such as investment in human capital or improving institutional quality in host countries in case they decide to participate more in aid projects. In either case, whether because of coping with limited aid flows would be easier or increased absorptive capacities enable augmented efficiency, as a natural result, increased host country ownership would follow.

The structure of the foreign aids and donor implementations matter as well on the efficiency of foreign aids. Donors should be more selective on aid recipients and they should direct their funds to countries with high institutional quality and who follow proper policies (Dollar and Levine; 2004; Dollar and Pritchett, 1998). Also, they should purify their country selectivity decisions out of political interests (Bauer, 1984). Moreover, if donors would tie their aid flows, this obligation should include absorptive capacity improving structural reforms or investments on health, education and environment. Additionally, they should include improving education levels and salaries of public servants. By this way, more talented bureaucrats would be hired by governments and this would reduce corruption in turn (Van Rijkeghem and Weder, 1997).

In evaluating the efficiency of foreign aids improved monitoring is also needed. The foreign aid programs should aim to reach pre-specified targets on a pre-specified time frame and the decision to renew aid programs should depend on these monitoring results. By this way, taxpayers would have more transparent information on to what extent the ultimate beneficiaries would benefit from the aid programs and this would be another step taken to overcome the principle-agent problem (OECD, 2010). Additionally, increased host country ownership and participation is needed. In this direction, as donors increase their coordination and coherence with the host countries, this would increase the efficiency of aid programs (Kanbur and Sandler, 1999).

High debt burden is another macroeconomic constraint on many low-income countries. So donors should avoid projects that would increase the debt burden of host countries and instead they should employ fully or partially debt relief programs. As debt relief would accelerate the development in many aspects, and diminish the uncertainties on aid receiving countries, this would be a new fresh start for the host economy (Presbitero, 2005).

Lastly, another alternative in increasing the efficiency of foreign aids would be promoting co-operation among countries with similar development levels, instead of the partnership between countries that have huge development gaps among them (OECD, 2014).

On overall, the results reveal that as long as the host countries claim increased ownership on aid projects, better results can be yielded. Otherwise, foreign aids would only be helpful for a limited time frame and therefore would serve to turn the host countries into aid junkies in long term as observed in most of the cases. In short, there is a thin line between aid flows becoming effective and turning into sister morphine. This thin line is drawn by the level of host country ownership.

This paper, on one side, challenges the efficiency of foreign aids, proposes ways to improve them on the other. To summarize, using tied aids in the manner that serving the donor interests, the inherent principal-agent problem on foreign aids, increased corruption particularly in environments lack sufficient institutional quality, their resource unbalancing slothfulness effects and lack of host country ownership, all diminishes the efficiency of

foreign aids. However, either limiting aid flows or following policies that would increase the institutional quality and the absorptive capacity of the host countries, would include political interest-free country selectivity on aid flow recipients, would allow increased host country ownership and participation, and would employ aid programs that relieve or at least do not accumulate host country debt burden would increase the efficiency of foreign aids

Bibliography

Adam, C.S., and D.L. Bevan. (2004). Aid and the Supply Side: Public Investment, Export Performance and Dutch Disease in Low Income Countries. *University of Oxford, Department of Economics, Economics Series Working Papers, No: 201*.

Alesina, A., and D. Dollar. (2000). Who Gives Foreign Aid to Whom and Why? *Journal of Economic Growth, 5(1)*, 33-63.

Bauer, P.T. (1972). *Dissent on Development*. Cambridge: Harvard University Press.

Bauer, P.T. (1984). *Reality and Rhetoric: Studies in the Economics of Development*. Cambridge: Harvard University Press.

Bigsten, A. (1998). Can Aid Generate Growth in Africa. *Department of Economics, Goteborg University, Working Papers in Economics, No: 1998:3*.

Bonnick, G.G. (1997). *Zambia Country Assistance Review: Turning an Economy Around*. Washington DC: The World Bank.

Brautigam, D. (1992). Governance, Economy, and Foreign Aid. *Studies in Comparative International Development, 27(3)*, 3-25.

Burnside, C., and D. Dollar. (2000). Aid, Policies and Growth. *The American Economic Review, 90(4)*, 847-868.

Burnside, C., and D. Dollar. (2004). Aid, Policies, and Growth: Revisiting the Evidence. *The World Bank Policy Research Working Paper Series, No: 2834*.

Buchanan, J. M. (1975). The Samaritan's Dilemma. E.S. Phelps (Ed.), *Altruism, Morality and Economic Theory* (ss. 71-86). New York: Russel Sage Foundation.

Carlsson, J., G. Somolekae, and N. van de Walle. (1997). *Foreign Aid in Africa, Learning from Country Experiences*. Uppsala: Nordiska Afrikainstitutet.

Charnes, A., W. Cooper and E. Rhodes. (1978). Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research*, Vol. 2.

Clemens, M.A., S. Radelet, and R. Bhavnani. (2004). Counting Chickens When They Hatch: The Short-Term Effect of Aid on Growth. *Centre for Global Development Working Paper, No. 44*.

Collier, P., and D. Dollar. (2002). Aid Allocation and Poverty Reduction. *European Economic Review, 46(8)*, 1475-1500.

Collier, P., and J.W. Gunning. (1997). Explaining African Economic Performance. *Oxford University, Centre for The Study of African Economies Working Paper, No: 97-2*.

Dalgaard, C., H. Hansen, and F. Tarp. (2004). On the Empirics of Foreign Aid and Growth. *The Economic Journal, 114(496)*, F191-F216.

Djankov, S., J.G. Montalvo, and M. Reynal-Querol. (2006). Does Foreign Aid Help. *Cato Journal, 26(1)*, 1-28.

Dollar, D., and L. Pritchett. (1998). *Assessing Aid: What Works, What Doesn't, and Why*. World Bank Resarch Report: Oxford University Press.

Dollar, D., and V. Levine. (2004). The Increasing Selectivity of Foreign Aid, 1984-2002. *The World Bank Policy Research Working Paper Series, No: 3299*.

Durlauf, S., A. Kourtellos, and C. Tan. (2008). Are any Growth Theories Robust? *Economic Journal, Royal Economic Society, 118(527)*, 329-346.

Easterly, W. (2001). *The Elusive Quest for Growth: Economists Adventures and Misadventures in the Tropics*. Cambridge: Massachusetts Institute of Technology Press.

Görgülü, M.E. (2015). The Effects of Foreign Direct Investments on Transition Economies: The Balkans Case. *Journal of Economic and Social Studies, 5(2)*, 23-39.

Hansen, H., and F. Tarp. (2000). Aid Effectiveness Disputed. *Journal of International Development, 12(3)*, 375-398.

Helble, M., C. Mann and J.S. Wilson. (2012). Aid for Trade Facilitation. *Review of World Economics, 148(2)*, 357-376.

IMF. (2015). *World Economic Outlook, Uneven Growth: Short- and Long-Term Factors, April 2015*. Washington, DC: IMF.

Jagger, M., K. Richards and M. Faithfull. (1969). Sister Morphine. On *Sister Morphine*. United Kingdom: London Records 1022.

Kanbur, R., and T. Sandler. (1999). The Future of Development Assistance: Common Pools and International Public Goods. *Overseas Development Council Policy, Essay No: 5*.

Knack, S. (2000). Aid Dependence and the Quality of Governance: a Cross-Country Empirical Analysis. *The World Bank Policy Research Working Paper Series, No: 2396*.

Levy, V. (1988). Aid and Growth in Sub-Saharan Africa: The Recent Experience. *European Economic Review, 32(9)*, 1777-1795.

Li, X., and Liu, X. (2005). Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship. *World Development, 33 (3)*, 393-407.

Maren, M. (1997). *The Road to Hell: The Ravaging Effects of Foreign Aid and International Charity*. New York: The Free Press.

Mosley, P. (1980). Aid, Savings, and Growth Revisited. *Oxford Bulletin of Economics and Statistics, 42 (2)*, 79-95.

Mosley, P., J. Hudson, and S. Horrel. (1987). Aid, the Public Sector and the market in Less Developed Countries. *Economic Journal, 97(387)*, 616-641.

Nkusu, M. and S. Sayek. (2004). Local Financial Development and the Aid-Growth Relationship. *IMF Working Paper, No: WP/04/238*.

OECD. (2007). *OECD Journal of Development, Development Co-operation Report 2007*. Paris: OECD Publishing.

OECD. (2010). *Development Co-operation Report 2010*. Paris: OECD Publishing.

OECD. (2014). *Development Co-operation Report 2014, Mobilising Resources For Sustainable Development*. Paris: OECD Publishing.

OECD. (2015). *Development Co-operation Report 2015, Making Partnerships Effective Coalitions for Action*. Paris: OECD Publishing.

OECD. (2016). *OECDstat*. Access Date: 11.04.2016, http://stats.oecd.org/

Papanek, G. (1973). Aid, Foreign Private Investment, Savings, and Growth in Less Developed Countries. *Journal of Political Economy, 81(1)*, 120-130.

Presbitero, A.F. (2005). The Debt-Growth Nexus: an Empirical Analysis. *Universita Politecnica delle Marche, Dipartimento di Economia, Quderno Di Ricerca, No: 243*.

Radelet, S. (2006). A Primer on Foreign Aid. *Center for Global Development Working Paper, No:92*.

Rattso, J. (1992). *Structural Adjustment in Tanzania, Study Prepared for the Ministry of Foreign Affairs*. Oslo: Government of Norway.

Roodman, D. (2004). The Anarchy of Numbers: Aid, Development, and Cross-Country Empirics. *Center for Global Development Working Paper, No. 32*.

Sachs, J.D., J.W. McArthur, G. Schimdt-Traub, M. Kruk, C. Bahadur, M. Faye, and Gordon McCord. (2004). Ending Africa's Poverty Trap. *Brookings Papers on Economic Activity, 35(1)*, 117-240.

Singh, R.D. (1985). *"State Intervention, Foreign Economic Aid, Savings and Growth in LDCs: Some Recent Evidence"*, Kyklos, 38 (2).

Svensson, J. (2003). Why Conditional Aid Does Not Work and What Can Be Done About It. *Journal of Development Economics, 70(2)*, 381-402.

The World Bank. (2015). *World Development Indicators 2015*. Washington, DC: The World Bank.

The World Bank. (2016a). *Comprehensive Development Framework: Country Ownership*. Access Date: 14.04.2016, http://web.worldbank.org/archive/website01013/WEB/0__CON-5.HTM

The World Bank. (2016b). *World Development Indicators*. Access Date: 12.04.2016, http://data.worldbank.org/data-catalog/world-development-indicators

UNCTAD. (2015). *World Investment Report 2015, Reforming International Investment Governance*. New York: United Nations Publications, United Nations.

Van Rijekeghem, C., and B. Weder. (1997). Corruption and the Rate of Temptation: Do Low Wages in the Civil Service Cause Corruption. *IMF Working Paper, 97: 73*.

Veiderpass, A., and P-A. Andersson. (2007). *SADEV REPORT 2007:1 Foreign Aid, Economic Growth and Efficiency Development A Data Envelopment Analysis Approach.* Karlstad: Swedish Agency for Development Evaluation.

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

Multi-Year Capital Development Projects: Recent Insights from Oil Pipeline Impact Evaluations

Dave Swenson
Iowa State University[*]*- USA*

1. Introduction

Owing to the Great Recession and subsequent private and public capital development initiatives, great emphasis has been placed in recent years on the sum and timing of job creation. And this was especially true between 2010 and 2014 as states one-by-one righted themselves from their respective contractions. Quite prominently and earlier on, projects associated with the American Recovery and Reinvestment Act (ARRA), for example, included a wide array of capital and safety net spending over several years. Measuring and reporting those impacts at the state and regional levels often involved analytic deftness in order to properly inform the public and lawmakers about the timing and value of economic change at the state or the sub-state levels. In Iowa, for example, we carefully modeled state ARRA receipts by category (capital spending, extended unemployment assistance, direct aid to state and local government, and expanded medical care for low income children) to demonstrate to policy makers and citizens the value of the "stimulus" to the state's economy and the duration of those impacts.

Done and presented properly, these job-creation estimates received wide media coverage. They offered an opportunity for the state's regional economists to highlight the tangible consequences of decline, as was occurring during the economic downturn, and publicly-funded countercyclical projects designed to put some people back to work and keep others working.

During the worst of the economic downturn there was also a domestic energy boom in the U.S. Rapid expansion in the nation's corn ethanol sector continued through 2010. There were large investments in wind energy in several states. And owing to the U.S. shale oil and natural gas booms in the Mountain West, Texas, and North Dakota, as well as in the Marcellus Shale areas of Pennsylvania and Ohio, coupled with rapidly developing oil field growth in Canada, several intrastate and interstate natural gas and crude oil pipeline projects were deployed that affected Midwestern and Plains state economies.

This short impact modeling review looks at recent pipeline deployments. The construction effects of these large, but of typically short duration, projects created bursts of economic activity along the proposed routes. They also have had some political salience because of their short-term, but nonetheless important job creating consequences, which is a preoccupation for government officials. They have salience, too, because of environmental concerns and land-owner resistance to the use of eminent domain to secure pipeline right-of-way access. This paper, though, looks at the economic impact evaluations.

Many of the pipeline projects were not of an interstate nature and involved linking either natural gas or shale oil wells to central collection points. These were the kinds of projects found in Texas, North Dakota, Ohio and Pennsylvania during their boom periods, and those pipeline construction activities blended seamlessly with

[*] Associate scientist in the Department of Economics, Iowa State University and lecturer in the School of Urban and Regional Planning, The University of Iowa. This paper presented at the 47th Annual Conference of the Mid-Continent Regional Science, June 2016, Charlotte, North Carolina.

the deployment of other well-drilling and well services infrastructure in the regions. Others, however, were hundreds of miles long, and crossed many political boundaries. The massive Alberta tar sands development in Canada led to the first set of Keystone pipelines to bring that crude oil to refineries in Illinois, Oklahoma, and ultimately to the Gulf of Mexico. Three of the four planned pipeline phases were completed between 2010 and 2014, and those first three lines were comparatively uncontroversial.

More politically contentious, however, was the Keystone XL pipeline project (Phase 4), which would have traversed Montana, South Dakota, and Nebraska. Little attention was paid to the overall economic worth of the earlier Keystone projects. The first economic impact study of the Keystone XL phase received much attention as it promised, according to the Perryman Group who did the analysis, U.S. impacts totaling "$9.605 billion in output and 118,935 person-years of employment."[1] Approval of the pipeline was immediately linked on its job creation potential, especially during the fledgling recovery, and the robust job creation estimates became part of presidential campaign rhetoric in the 2011-2012 election cycle.

The Perryman economic impact findings were quickly assailed by analysts as much too high.[2] Such robust outcomes, albeit temporary, would have been noticed, for example, during Keystone Phase 1, the first major pipeline from Canada down to a terminus in Nebraska that had just been completed. Eventually, upon review and having conducted its own estimation, the U.S. State Department concluded that the Keystone XL pipeline[3] The job estimates by the State Department were nearly two-thirds lower than the first Keystone XL study. And as we now know, President Obama and the U.S. State Department did not approve that project, its short-term job creation gains notwithstanding. The difference between the State Department's estimates and the Perryman Group's were very large, and it underscored the magnitude of impact variability that is often demonstrated in these kinds of undertakings when publicly-conducted analysis is compared to privately prepared studies. [4]

In 2014, a different private consultancy working for an oil industry services firm reported that a new proposed pipeline designed to bring North Dakota crude from the booming Bakken region to a refinery in Illinois would generate "33,000 job-years of work," and it would boost labor income by $1.9 billion and total output by $5 billion in the four affected states of North Dakota, South Dakota, Iowa, and Illinois. [5]

---

[1] These figures come from the web page of the Perryman Group who did the original impact study for Keystone XL, however links to the original study no longer work. https://www.perrymangroup.com/special-reports/classics-from-the-archives/keystone-xl-impact-study/

[2] See, for example, Wald, Ellen R. Pipe Dreams: How Many Jobs Will Be Created By Keystone XL? Forbes, May 10, 2013. http://www.forbes.com/sites/energysource/2013/05/10/pipe-dreams-how-many-jobs-will-be-created-by-keystone-xl/#191d930d660c See, too, Levi, Michael. Would the Keystone XL Oil Pipeline Create 250,000 Jobs? Council on Foreign Relations, October 27, 2011. http://blogs.cfr.org/levi/2011/10/27/keystone-oil-jobs/

[3] United States Department of State Bureau of Oceans and International Environmental and Scientific Affairs, Final Supplemental Environmental Impact Statement for the Keystone XL Project, Executive Summary, January 2014. https://keystonepipeline-xl.state.gov/documents/organization/221135.pdf

[4] Readers are also directed to a harsh and point by point critique of the Perryman study by the Global Labor Institute at Cornell University. Their analysis, Pipe Dreams? Jobs Gained, Jobs Lost by the Construction of Keystone XL, 2011, ILR School, Cornell University, found that the likely short term construction jobs created by Keystone XL would range from 50 percent to 80 percent fewer than those estimated by the Perryman study. http://www.ilr.cornell.edu/sites/ilr.cornell.edu/files/GLI_keystoneXL_Reportpdf.pdf

[5] Siegelman, Harvey, Mike Lippsman, and Dan Otto. An Assessment of the Economic and Fiscal Impacts of the Dakota Access Pipeline in North Dakota, South Dakota, Iowa and Illinois. Strategic Economics Group.

These numbers were based on summing the effects of the individual states through which the project traversed as opposed to using a national model to gauge impacts. However, much like the case with the State Department review and summary, closer inspection revealed significant flaws in both analytic methods and the manner by which the results were presented to the public. This paper discusses those flaws in light of the project's presentation of the economic impacts to the state of Iowa in seeking and ultimately receiving regulatory approval for the pipeline.

2. Background

To move oil from the booming Bakken play in western North Dakota, a company called Energy Transfer Partners proposed and is ultimately now building a 1,681 mile 30 inch diameter pipeline diagonally across North Dakota, South Dakota, Iowa, and Illinois (see Figure 1). It is called the Dakota Access Pipeline. The company applied for regulatory approval in 2014 in all states affected, and as part of that regulatory approval, the company submitted the project's purported economic impact as part of the supporting material for that approval.

Constructing 343 Iowa pipeline miles of that the project would, the study reported,

- boost Iowa employment by nearly 7,263 job-years,
- generate a $390 million increase in labor income, and
- add nearly $1.04 billion in total, multiplied-through industrial output

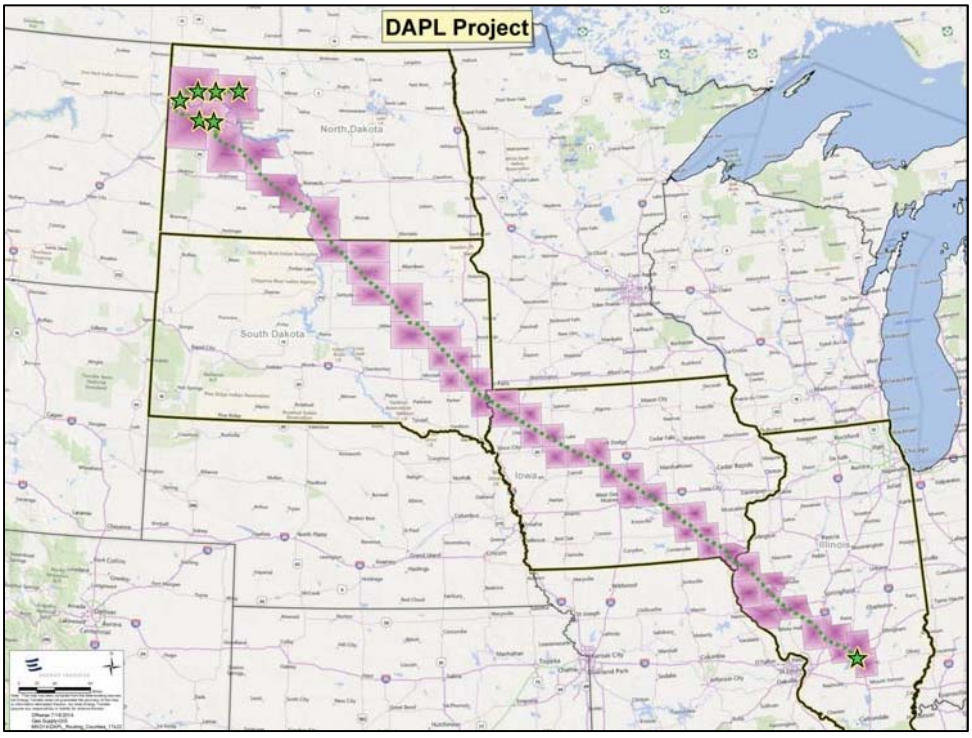


Figure 1.

Close reading of the document, however, revealed serious methodological and assumption errors in the impact analysis of the several states and, for this review, Iowa. Those errors in both

November, 2014. http://www.economicsgroup.com/reports/DAPL%20Report.pdf. Note, the posted study has been heavily edited from its original posting to remove a multitude of typographical and layout errors.

analysis and in presentation led to inflated claims of in-state job growth and labor incomes. Those errors also over-linked the project to the Iowa economy.

The consulting firm used IMPLAN for its analysis. The estimation errors, however, had little to do with the modeling system they utilized. What follows are three critiques of the study approach to presenting or estimating the impacts.

3. Estimating Impacts

3.1 Issue 1: Reporting impacts in "job-years"

The use of "job-years" has become rampant in recent years among private economic impact consultants and among advocacy groups. And as has already been demonstrated, the State Department also reported their revised Keystone XL estimates that way.

The need for reporting economic impact information in a job-years format originally arose in instances where, for a comparatively short period of time, there are many, many jobs involved in an activity. Major sporting events, music festivals, seasonal occurrences like a state fair all can generate a high demand for labor for a temporary period. To properly describe that labor demand, input-output accounting takes all of that labor and labor income and translates it into full-year job equivalences appropriate to the industries being evaluated. For example, 500 vendor jobs working during two weeks of the Iowa State Fair might be reduced to the equivalent of 20 persons were those jobs counted on an annualized basis. This kind of translation standardizes many jobs over a short duration to the annual input output accounting framework.

Disturbingly, however, practitioners measuring multi-year projects, like construction projects, have taken to entering the total construction for all years of a project and then producing job-year estimates "as if" the project were only occurring during one year. This practice is distorting and disregards the annualized foundation to economic impact reporting. I contend that it is used primarily to boost the appearance of job impacts to naïve reviewers.

There is no acceptable justification for compressing multi-year values into a single job-years summary.

If, as in the case of the Bakken Pipeline, the project in Iowa was to take more than one year, then a prudent and non-distorting presentation would report those job (and labor income) impacts in the years in which they occurred – year 1, year 2, etc. In the Iowa study, the authors could have simply divided the totals by two and therefore declared the project would support 7,623 / 2 = 3,811 jobs annually rather than publishing the larger number.[6] As construction projects like these always contain highly detailed descriptions of the kind and sequence of activity involved, the analysts could have made their results sensitive to the actual activity taking place during specific months or quarters and then, from project start to finish, summarized those values on an annualized basis.

For example, in a recent study of a new hydroelectric facility in Iowa, we clearly summarized the total economic impacts for the region during the actual years of activity.[7] This is to be preferred for planning purposes rather than the more distorting summing of all values into a job-years total because it helps communities and planners understand the nature (direct, indirect, and induced), magnitude, and duration of the job impacts.

[6] The study authors also claimed their results represented full-time equivalencies, however, they reported their findings as they would come out of IMPLAN, and IMPLAN does not report FTE values, they produce full-year values. From IMPLAN supporting documents we are told that "… one cannot tell from the data the number of hours worked to the proportion that is full or part-time." This is more of a minor issue, but it is also a common error among users of IMPLAN to assert the output represents FTE job values.

[7] See Swenson, David. The Regional Economic Impact of the Red Rock Hydroelectric Project, Department of Economics, Iowa State University, August 2011.

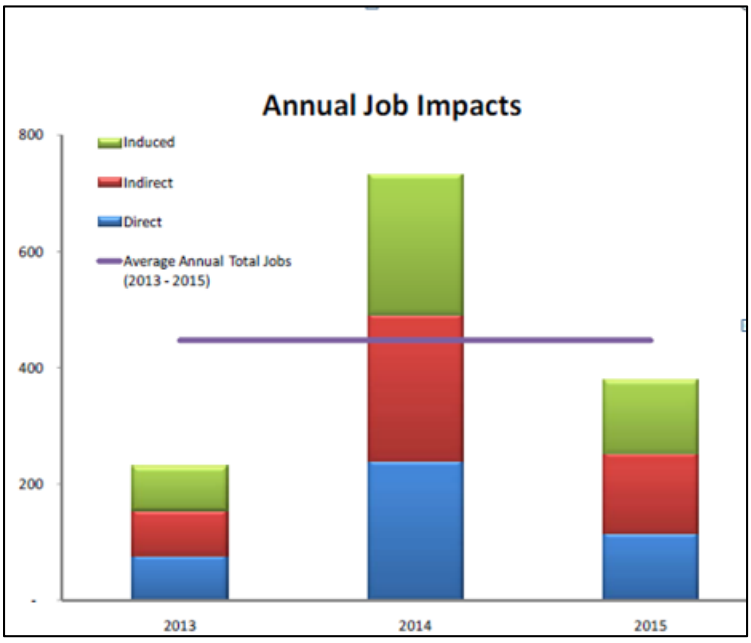


Figure 2: Hydroelectric Dam Job Impacts by Year and Type

3.2 Issue 2: Assuming the project would link to durable goods manufacturers in the affected states

Because pipelines are quite atypical of conventional construction projects, separate inputs into the construction project were run individually through the IMPLAN model. Doing this allows the modeler to quickly over-ride IMPLAN's default assumptions and tailor input demands to the region's supply capacity. This is called a "bill of goods" or an "analysis by parts" approach. For this review, only two specifications are critiqued: the regional supply of durable manufactured inputs (pipe, valves, etc.) and the regional demand for construction inputs, which is summarized in the next section.

This pipeline requires 30 inch diameter pipe, pumps, valves, joints, and a range of other high-quality manufactured inputs. The modelers in this study, however, assumed without justification that these steel products, machines, valves, and other fittings would be purchased from suppliers within the states. Using default values from their IMPLAN model, Figure 3 shows that for Iowa, the project would buy 9.4 percent of steel products and 9.6 percent of valves and fittings from state suppliers.

Sector	Industry Sales	Employment	Local Purchase Percentage
29 Support activities for oil and gas operations	$32,390,000.00	218	22.27 %
36 Construction of other new nonresidential stru...	$533,870,000.00	3,528	99.91 %
171 Steel product manufacturing from purchase...	$219,870,000.00	286	9.38 %
198 Valve and fittings other than plumbing manu...	$59,980,000.00	111	9.60 %

Figure 3

This significantly inflated the economic impacts even though the local purchase percentages appear quite low. The inputs into pipeline manufacturing are highly specialized and certified by the American Petroleum Institute (API). The IMPLAN sector shocked by the analysts includes water pipes, drain pipes, sewer pipes, exhaust pipes, electrical conduit, and even steel fence posts. The API maintains a directory of all of its certified manufacturers, and the only certified pipeline manufacturer in Iowa produces 4.5 to 8.625 inch pipe, not the 30 inch pipe required for the pipeline. As the project would not be buying those goods from Iowa firms, those values should have been assumed to be zero. Linking to those sectors in the modeling process boosted the total job estimates by 16 percent owing to their robust jobs multipliers.[8]

[Note: as the economic impact consulting firm was defending its methods and results before the Iowa Utilities Board, the pipeline company was busy stockpiling long-ago manufactured pipe in a rural Iowa county. None of the pipe was manufactured in any of the states to be traversed by the pipeline.]

Figure 4

3.3 Issue 3: Assumed that nearly all of the construction would be purchased from the state economy

The greatest amount of impact distortion in the research involved its assumptions about the construction industry. As Figure 5 demonstrates, the analysts allowed for a nearly 100 percent local purchase percentage of construction firm activity, yet the authors offered no justification for assuming Iowa's construction sectors could, in fact, assume a project of this size. A quick scan of Bureau of Labor Statistics data for Iowa revealed it had 34 oil and pipeline construction firms with a combined payroll employment of 245 persons – 7.2 workers per firm. Those firms typically lay new gas lines for residential or commercial developments, not large diameter interstate lines. The study, however, assumed roughly 1,764 annual jobs (or 3,528 on a job-years basis) in pipeline-related construction would be needed annually. And that demand was run through the IMPLAN model assuming nearly all of the jobs would come from Iowa firms.

[8] The jobs multiplier for steel pipe (steel products manufactured from purchased steel) was 3.25 and the valve and fittings sector multiplier was 2.66.

Events | New Event | Copy Event | Paste Event | Delete Event | Event Options

Sector	Industry Sales	Employment	Local Purchase Percentage
29 Support activities for oil and gas operations	$32,390,000.00	218	22.27 %
36 Construction of other new nonresidential stru...	$533,870,000.00	3,528	99.91 %
171 Steel product manufacturing from purchase...	$219,870,000.00	286	9.38 %
198 Valve and fittings other than plumbing manu...	$59,980,000.00	111	9.60 %

Figure 5

A cursory evaluation of the Iowa economy or of credible studies done on previous pipeline projects should have raised a red flag. The consultants failed to understand that there is no civil engineering prominence in this category in Iowa. One would assume that firms that had handled major pipeline projects in the recent past would be the likely major contractors, not Iowa firms that were small or otherwise not specialized in this manner. Had the analysts taken note of the U.S. State Department's economic impact study of the Keystone XL pipeline they would discovered disappointingly low projections for state level impacts. The State Department's questioning of TransCanada yielded this admission as to within state labor demand from the first Keystone project:

> Because of the specialized nature of the work, Keystone estimates that only approximately 10 percent of the construction workforce would be hired from the four proposed Project area states.[9]

Even more guidance might have been gleaned from the Keystone XL review process in South Dakota where its Public Utilities Commission asked TransCanada (the Keystone XL construction company) the number of jobs that had been supported in that state during the construction of Keystone Phase 1. For the South Dakota portion of that project, TransCanada revealed that

> … it employed a total of 2,580 workers in South Dakota, but only 282 workers (11%) of the workers were residents of the state. This included 20 workers in supervision, 3 welders, 32 truck drivers, 27 equipment operators, 110 laborers, and 90 construction managers, surveyors or inspectors.[10]

Within weeks of issuing the Iowa report, however, Energy Transport Partners began to back-peddle on the construction impacts reported in the study. Principles in the firm were quoted in the Des Moines Register as assuring Iowa unions that "at least half of the workers for the Iowa section of the pipeline" would come from Iowa construction unions. And early in 2016, "two union contractors [had] been hired ... to build the pipeline in Iowa,"[11] both of which were from Wisconsin, a state the pipeline does not run through. Those major contractors would need a range of operating engineers for heavy machinery and skilled welders, pipefitters, and a fraction of those jobs would go to in-state labor, but a substantial fraction would not. The analysts made no attempt to address this important point.

[9] United States Department of State Bureau of Oceans and International Environmental and Scientific Affairs, Final Supplemental Environmental Impact Statement for the Keystone XL Project, January 2014. p. 4-10-2

[10] Cornell Global Relations Institute, p. 9

[11] Petroski, William. Greenlight Likely for Dakota Access Pipeline, Des Moines Register, 1 June 2016.

4. Conclusion

Large capital project economic impact studies are often problematical, as has been shown with the Bakken pipeline study for Iowa and with the previous and controversial Keystone XL project. The analysts did not attempt to properly annualize the impacts, they over-attributed critical component supply linkages to the state economies, and they assumed state construction industries would handle nearly all of the pipeline activity. To their credit, they did attribute the impacts, however mis-specified, to the individual affected states using state models instead of assuming national economic impacts.

Construction of the pipeline, considering all concerns listed will yield Iowa annualized economic impacts that will likely be half if not less than those reported by the consulting firm.

What are the lessons to be learned?

First, this reviewer has conducted construction-related economic impacts associated with wind energy, hydroelectric power, solar energy, as well as a range of civil and other large private and public construction projects. Done properly, these analyses require extra scrutiny when the project clearly does not reflect the normal values that are in an IMPLAN model. One must use a "bill of goods" or what is also known as an "analysis by parts" approach, which means separating out the impacts of the actual construction activity from the supplies needed to construct the project and then summing the individual components. Or, one must specify a construction sector within IMPLAN that in fact reflects the production functions for the enterprise that needs to be measured. The point is that large, atypical capital projects require analytic care and extraordinary model specificity. Because of the large dollar value of the projects, over-attributing labor or some other critical input, as was demonstrated in this review, can have profound multiplied-through effects.

Second, there is no justification for reporting multi-year projects "as if" they occurred in one year. All impacts should be reported for the years in which they occur, and multiyear values, especially job values, should not be added to some grand total. How hard this practice is to quell can be demonstrated from the following example: I conducted a comprehensive assessment of different deployment strategies for Iowa's wind energy industry recently, and in so doing being very careful to report the construction job impacts plus accumulating operational job impacts for the actual years in which they would occur under each separate scenario. Many months later, an umbrella wind energy advocacy group took the 15 years of separate numbers that I carefully segregated and reported, summed them, and reported that total in job-years, notwithstanding my strident admonishment to not do so. It is a problem rampant among consultants, industry groups, and advocacy groups. It needs to be confronted at every instance.

Third, IMPLAN is stupid. It doesn't know, for example, whether the pipe manufacturing sector in your economy does or does not make petroleum pipe versus exhaust pipes for automobiles. Analysts have an obligation to smarten up their modeling efforts with good investigation of the likelihood of state-supplied inputs. In this case that involved both the durable manufactured goods and the construction linkages, which amounted to huge errors in the estimates.

Fourth, analysts, in my opinion, have both an opportunity and an obligation to use economic impact models to teach clients and citizens about their regional economies. Replicating closely other flawed studies is not an effort in public education. But by properly specifying a modeling effort and reporting the findings, analysts provide a public service and help local and state policy makers and industry properly plan for and adapt to change. They also help citizens and policy makers temper their expectations regarding capital development and the worth of increasingly large, but ultimately often labor-stingy projects.

Finally, there will be continued opportunities to evaluate pipelines, wind energy, solar projects, and transmission line undertakings in the near future. These projects usually do not align well with the default sectors in the modern IMPLAN

structure, notwithstanding the addition of several more construction sectors in the latest version. If one has the opportunity or obligation to do these kinds of studies, carefully scrutinize other studies and reviews of those studies try very hard to not make the same kinds of indefensible economic impact declarations as the analysts did in the Iowa pipeline project.

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

The Impact of Small Business Administration Lending Activity on Micropolitan Statistical Areas: The Plains Region

Bienvenido S. Cortes
Pittsburg State University - USA

Abstract
This study examines the economic impact of Small Business Administration (SBA) guaranteed loans on the states comprising the Plains region (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) for the period 1990-2015. Past studies (mainly by Craig and colleagues) find that the effect of SBA loans on regional economic performance, particularly in low-income areas, is positive, albeit small. The present study adds to the literature by focusing on another government-defined geographic unit called the micropolitan statistical area (which consists of at least one county with an urban core population of 10,000-50,000). Thus, the main purpose of this study is to analyze and measure the impact of SBA loans on various indicators of micropolitan area economic activity such as employment and output growth, while also controlling for other determinants of local economic growth (ex., industrial composition, relative wealth, local fiscal policy, education and other demographics). The main finding is that credit access (as measured by SBA loans and bank deposits), industrial composition, market size, and local fiscal policy are significant determinants of the economic growth and development of micropolitan areas in the Plains region.

1. Introduction

The relationship between the financial health (of an individual, household, or community) and economic growth has been the subject of much research recently. In particular, a collection of research papers entitled "What It's Worth: Strengthening the Financial Future of Families, Communities and the Nation," edited by Choi, *et al* (2015) identifies and analyzes the concept of "financial health or well-being" and provides behavioral and policy implications from a variety of perspectives. The financial health or well-being of an individual economic agent or a community not only refers to the understanding of financial issues and obligations, and access and means to meet these obligations, but more importantly, the willingness and ability to make wise financial choices so as to be more financially secure and sustainable. The topic of financial health and the economy is a more disaggregated and micro-level analysis similar to the financial development-economic growth nexus that has been studied extensively at the national and regional levels.

Although the significance of financial health is well-accepted, there is no consensus on the appropriate measures for financial health. For example, based on their survey results, Newberger and colleagues (2015) classify the "metrics for small business financial health" into three types: (1) information and working knowledge of available financial products and services; (2) experience in terms of access and receipt of funding; and (3) good management and business practices. In this current study, U.S. Small Business Administration (SBA) guaranteed loans to small business firms will represent the knowledge and access components of the "financial health" concept. Given the SBA's mission of fostering entrepreneurship, the objective of the study is to examine the impact of such government-supported lending on the

economic health and prosperity of small communities called "micropolitan statistical areas."

The Small Business Administration (SBA) is an independent federal government agency established in 1953; its charge is to "help Americans start, build and grow businesses" (see https://www.sba.gov/about-sba/what-we-do/mission) by providing small firms with access to financing, entrepreneurial development, government contract opportunities, and advocacy. The SBA's largest loan program is the 7(a) General Business Loan program which accounted for nearly $17 billion and approximately 63,500 loans in 2015. The 7(a) program is designed to assist in the financial needs of new businesses and to help in the expansion of existing firms by guaranteeing loans approved by private lenders. Based on the Small Business Job Act of 2010, the guaranteed SBA amount is 90 percent of the approved loan amount. In her May 2016 U.S. Senate testimony, SBA Administrator Contreras-Sweet stated: "… we reached historic levels for small business lending. I'm particularly proud to report significant increases in 7(a) lending to Americans who typically struggle most to access capital. During my tenure, 7(a) loans are up 47 percent to women, 32 percent to veterans, 75 percent to African-Americans, 50 percent to Hispanics, 30 percent to Asian Americans and Pacific Islanders, 18 percent to Native Americans and 41 percent to rural entrepreneurs.

These gains are more important than ever. As our national economy continues to rebuild from the Great Recession, SBA backed loans are creating jobs and rebuilding communities. Currently, conventional small business lending is only at 84 percent of pre-recessionary levels, which creates a $58 billion shortfall as compared to 2008. At the SBA, we are working hard to fill that gap by supplementing – not supplanting – the private capital markets."

(Source: https://www.sba.gov/content/testimony-us-senate-small-business-committee-hearing)

Table 1 shows that, compared to the nation, the seven Plains states (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota) accounted for less than $1 billion and only generated 4,367 loans (or 7 percent) of total SBA 7(a) loans in the country in 2015.

Table 1. SBA 7(a) Loans for Nation and Plains Region in 2015

	USA	Plains States
Number of SBA 7(a) Loans	63,461	4,367
Total $ Amount	$17.4 billion	$970 million
Average $ Amount	$274,311	$222,156

Source: SBA and author's calculations.

In 2003, the U.S. Office of Management and Budget defined the "micropolitan statistical area" as a geographic entity consisting of one or more counties with an urban core population of 10,000-50,000. Focusing on the micropolitan statistical areas in the Plains region, Table 2 shows that the Minnesota micropolitan areas accounted for the largest dollar amount of $14 million in 2015 while those in North Dakota received less than $700,000 in SBA guaranteed loans.

Table 2. SBA7(a) Loans for Micropolitan Statistical Areas in the Plains States in 2015

Plains State	Number of Micropolitan Areas	Number of SBA 7(a) loans	$ Total	$ Average
Iowa	14	28	7,395,850	264,138
Kansas	16	39	13,424,400	344,215
Minnesota	16	104	14,254,513	137,063
Missouri	19	60	10,356,000	172,600
Nebraska	9	42	7,822,800	186,257
North Dakota	4	10	674,150	67,415
South Dakota	9	20	5,810,330	290,517

Source: SBA and author's calculation

The objective of this paper is to examine the financial health-economic growth linkage from the perspective of micropolitan statistical areas located in the seven Plains states for the 1990-2015 period. The present study derives much from earlier research by, among others, Armstrong *et al.* (2010), Shaffer and Collender (2009), and Kobeissi (2009). It also extends earlier studies on micropolitan statistical areas by Cortes, Davidsson, and McKinnis (2015 and 2013) and Davidsson and Rickman (2011). In particular, it analyzes the impact of SBA lending activity, other financial health variables, and locational characteristics on various measures of micropolitan economic growth (such as Gross Regional Product, employment, and household income) using pooled cross-sectional and time-series data.

2. Review of the Literature

An early study by Hancock and Wilcox (1998) analyzed the impact of a credit crunch on small firms using SBA data. A major objective of the authors was to determine whether the 7(a) loan guarantee program of the SBA "accentuate or attenuate the capital crunch." Examining U.S. state data for the period 1989-92, Hancock and Wilcox find that declines in the capital of large banks lead to very small declines in SBA loans, while declines in small bank capital indicated that SBA loans would increase; thus, they conclude that "SBA lending programs might be regarded as a credit market stabilizer in that

SBA lending slowed far less than total lending and may have even risen in response to adverse bank capital shocks." (1998: 1010).

A 2003 study by PM KeyPoint conducted for the SBA Office of Advocacy applied a similar model as Hancock and Wilcox (1998) on a panel data set of 46 states for the period 1990-2000. The study looked at the effect of SBA lending, bank capital, real estate and commercial delinquency rates, and interest rates on small business activity (measured by the number of small firms, employment, and payroll). The study found that SBA guaranteed loans were positively related to small firm employment and payroll especially during periods of tight money and slow economic growth, confirming Hancock and Wilcox's (1998) contention that SBA loans act as a stabilizer.

In a series of working papers beginning in 2004, Craig and colleagues from the Federal Reserve Bank of Cleveland analyzed the role of SBA guaranteed lending in local/county banking markets. In their 2004 study, Craig, Jackson, and Thomson used per capita income as the measure of local economic performance and SBA loans scaled by total deposits as the primary explanatory variable of interest. Control variables included market structure variables (Herfindahl index and rural-urban dummy), local (employment rate) and national economic conditions (a dummy variable for national economy in recession), and types of SBA lending (share of 7(a) loans, share of loans going to manufacturing firms). The model was tested for levels and rates of change. In the levels regression, the SBA loan to deposit variable is positive but insignificant. However, using growth rates, CJT found that SBA lending significantly and positively affect income growth but only after two lags.

Craig *et al.* (2006) analyzed data for all SBA 7(a) and 504 loans from 1991-2002 for MSA and non-MSA counties in the U.S. In their basic OLS fixed effects model, the employment rate was regressed on per capita income, Herfindahl index (to measure banking market concentration), a dummy variable for MSA county, total bank deposits per capita (a measure of financial development), total SBA loans per capita, and an interaction term equal to the product of bank deposits and SBA loans. This interaction term was the main focus in that a negative estimated slope parameter for this variable would mean that the impact of SBA lending is less at higher levels of bank deposits, or alternatively, SBA credit has more impact in low income counties. The authors found a negative and statistically significant coefficient for the interaction term thus indicating that "…at higher levels of financial market development, per capita SBA lending has a lower impact on employment than it does at lower levels of financial market development." (Craig *et al.*, 2006: 23) Craig *et al.* (2006) concluded that SBA lending serves a "social welfare function" by providing needed small business credit and reducing shortcomings in the credit market especially in low income areas. In 2007 and 2009, Craig and others surveyed the few studies (mostly theirs) which empirically test the impact of SBA guaranteed lending on economic performance; they generally find a positive, albeit small, impact of SBA financing and that the SBA lending-growth relationship is more significant in low-income markets. In another article, Armstrong teamed up with Craig and colleagues (Armstrong *et al.*, 2010) to analyze the impact of SBA lending and found that SBA lending has a greater positive effect on employment in local markets which are relatively less financially developed.

In a comparative study, Shaffer and Collender (2009) analyzed the effects of various U.S. federal government lending (including SBA loans) on economic performance (using six measures: mean and standard deviation of real per capita income level, mean and standard deviation of income growth rate, and the mean and standard deviation of employment growth rate). The authors used a panel data of county MSAs for the period 1990-2000. The economic performance variables were estimated as averages for 1996-2000 and were regressed on federal funding variables, measured as averages for the period 1990-95. Market control variables included county population, population density,

number of banks with offices in county, Herfindahl index of bank deposits (as a proxy for market concentration), real per capita bank deposits, educational attainment (%of high school graduates 1990), and average real per capita income for 1990-95. Shaffer and Collender (2009) found that, as compared with other federal credit programs, SBA lending is positively associated with more stable per capita income growth and with average employment growth.

Cortes (2010) reexamined Craig *et al.*'s findings by applying their general model to state-level data and using income growth, small firm growth, and employment as dependent variables. The estimated coefficients for SBA lending were found to be small, insignificant, and having the unexpected negative signs with respect to its relationship with income. This confirms earlier studies and may be a statistical consequence of the fact that SBA lending accounts for a very small part (less than 10%) of total lending in the economy. On the other hand, SBA loans had a positive and significant impact on the growth of small businesses and by consequence, the number of workers employed in small firms. More important, the coefficient for the interaction term between SBA and bank deposits (Craig *et al.*'s primary variable of interest) was statistically insignificant and very small in absolute value in all regressions, although it had the expected negative sign. This insignificant result is contrary to Craig's findings. Thus, Cortes (2010) concluded that SBA guaranteed loans were not biased in favor of lower income areas, thereby questioning the effectiveness of the SBA in providing credit lines to firms in most need.

Finally, Davidsson and Rickman (2011) and Cortes, Davidsson, and McKinnis (2015, 2013) applied economic growth models to micropolitan statistical areas. These recently defined local geographic areas have come into more prominence as a result of the combined urban-rural amenities (actual or perceived) which these areas offer. The authors find that the main determinants of micropolitan area growth are industrial diversity, market size or scale, distance to metropolitan areas, and government policy.

This paper extends the above previous studies with some differences. First, it uses more recent data and specifically focuses on the role and significance of SBA 7(a) lending activity during the 1990-2015 period. Second, it applies a fixed effects panel regression model with micropolitan area economic growth (i.e., as measured by gross regional product, employment rate, and mean household income) as dependent variable. Third, the analysis only covers the micropolitan areas of the Plains region.

3. Method

The model estimated here follows from the earlier studies by Armstrong *et al.* (2010), Kobeissi (2009), Hancock and Wilcox (1998), and Schaffer and Collender (2009). It differs primarily in the following ways: (1) the model is applied to Plains states micropolitan areas; (2) it tests the economic growth effects of financial health and well-being of an area as indicated by asset-building (as proxied by a wealth index) and by access to financial products and services (as proxied by SBA loans and bank deposits); (3) it uses as separate dependent variables three growth rate measures: gross regional product, employment rate, and mean household income for three time periods, 1990-1999, 2000-2009, and 2010-2015 .

Following past studies, the general model specification takes the following form:

$$GR = b_1 + b_2SBA + b_3DEP + b_4WEALTH + b_5MSHARE + b_6PCPI + b_7GREV + b_8GEXP + b_9EDUC + b_{10}BLACK + b_{11}HISP + e$$

where GR is the micropolitan area economic growth (as measured by real gross regional product, employment rate, or mean household income), SBA is real per capita SBA 7(a) loans, DEP is real bank deposits per capita, WEALTH is the Woods & Poole wealth index, MSHARE is the share of the manufacturing sector in total micropolitan area employment, PCPI is

micropolitan real per capita personal income, GREV is local government revenue, GEXP is local government expenditure, EDUC is the percent of area population with a college degree, BLACK is the percent of population that is African-American, HISP is the percent of population that is Hispanic, and *e* is the error term.

The model is applied to pooled data consisting of 87 micropolitan areas for three time periods: 1990-1999, 2000-2009, and 2010-2015. The dependent variable is defined as the average annual percentage rate (of real gross regional product, employment rate, or mean household income) over the ten-year period, except for 2010-15. To avoid the issue of endogeneity, all explanatory variables are initial values (in logs) for each of the three time periods. Gross regional product and household income are taken from Woods & Poole Economics 2016 CD-ROM; the employment rate is defined as one minus the unemployment rate; unemployment statistics are from the Bureau of Labor Statistics. The key variable of interest, SBA-approved loan data, is provided by the Small Business Administration. Data on local government revenues and expenditures are gathered from CenStats while bank deposit data are from the FDIC. All other variables are taken from the Woods & Poole database. Descriptive statistics of the variables of the model are provided in Appendix 1.

There are no agreed-upon metrics for "financial health or well-being" of a local area. This study takes the components of asset-building and access to financial products to define financial health. For this purpose, the flow of SBA 7(a) guaranteed loans and bank deposits in the micropolitan area serve as proxy variables for access as well as for financial market competition; similarly, the asset-building component of financial health is represented by the wealth index. These explanatory variables are expected to have a positive and significant impact on micropolitan area growth.

The last seven variables are control variables representing local economic conditions. MSHARE is the share of employment in manufacturing (versus farm or retail) and indicates the effect of industrial composition of the area; the a priori expectation is ambiguous. Per capita income (PCPI) indicates market size or demand conditions. Local government activity (as measured by government revenues (GREV) and expenditures (GEXP)) represents another form of government leverage similar to SBA activity; GREV and GEXP represent the role of the public sector (versus the private sector) in economic development. These variables are hypothesized to have a positive influence on micropolitan economic health and performance. Finally, EDUC, BLACK, and HISP variables represent demographic characteristics.

4. Analysis and Results

Pooled ordinary least squares regression with fixed effects is applied to a combined data set of 87 Plains micropolitan areas and three time periods. The fixed effects variable is the micropolitan statistical area. The EViews statistical package was used in the study. The results of estimating the model using three different dependent variables are shown in Table 3 below.

Table 3. Pooled Regression of the Model with Fixed Effects

Variable	Gross Regional Product is dependent	Employment rate is dependent	Mean household income is dependent
Constant	-57.50 (-8.11)***	100.31 (56.23)***	-10.62 (-1.54)
SBA per capita	0.20 (2.24)**	0.01 (0.30)	-0.003 (-0.06)
Deposits per capita	3.41 (7.46)***	-0.63 (-4.83)***	0.98 (2.25)**
Wealth index	1.69 (1.38)	-0.01 (-0.04)	-1.35 (-1.03)
Manufacturing share	-0.02 (-0.06)	0.37 (3.61)***	0.43 (1.92)*
Real per capita income	5.45 (4.27)***	1.51 (3.94)***	2.73 (2.66)***
Government expenditures	0.11 (0.16)	-0.15 (-0.81)	-0.99 (-1.70)*
Government revenues	-3.87 (-4.17)***	-2.02 (-7.54)***	-1.42 (-1.89)*
Education	-3.69 (-5.55)***	0.17 (0.52)	-0.73 (-1.09)
Black population	0.06 (0.59)	0.03 (0.80)	0.24 (2.43)**
Hispanic population	-0.60 (-4.13)***	-0.24 (-4.18)***	-0.44 (-3.56)***
Adjusted R-squared	0.72	0.96	0.42
F-statistic	7.99 (Prob<0.00)	67.93 (Prob<0.00)	2.98 (Prob<0.00)

Note: T-statistics are in parenthesis. ***indicates significance at 1% level; **significant at 5%; *10%.

The results in Table 2 indicate that the key variable of interest, SBA-guaranteed lending, has a positive and significant impact on output or Gross Regional Product growth in the micropolitan areas of the Plains states, but no differential effect on employment and household income. This contrasts with the bank deposits variable, which has a positive and statistically significant influence on both output and income growth. This finding may reflect the complementary nature of SBA loans and bank deposits as sources of credit for businesses. However, as Craig *et al.* (2008) caution: "…we do not know whether SBA loan guarantees are contributing to economic performance by helping to complete the market or are simply proxying for small business lending in the market." (p. 357) Aside from the two variables representing access to credit, the wealth index indicates the asset-building component of financial health or well-being. This measure is found to be insignificant in explaining economic performance in the micropolitan areas, thus indicating that wealth accumulation does not necessarily translate to economic prosperity.

Regarding the micropolitan-specific or control variables, the estimated coefficients for per capita income, a proxy for market size and demand conditions, are consistently positive and significant. Similarly, industry composition as

reflected by the manufacturing share variable directly correlates with employment rate and household income, consistent with earlier studies of micropolitan areas by Cortes *et al.* (2013, 2015) and Davidsson and Rickman (2011). The role of local government in promoting economic growth and development of micropolitan areas is further highlighted by the negative and statistically significant coefficients of the government revenues variable, indicating the need for judicious tax policy and strategy. Finally, certain demographic characteristics particularly the Hispanic share of the local population tend to have a negative influence on micropolitan growth.

5. Conclusions

Earlier studies by Armstrong *et al.* (2010) and Craig *et al.* (2008) examined the impact of SBA-guaranteed lending on the economic growth of U.S. counties. They found a positive but small effect of SBA lending on county employment rates and most important, discovered that the influence of SBA lending is larger in low-income counties or areas which are less financially developed. This paper extended this line of research by focusing on another geographical market entity called the micropolitan statistical area and in particular, tested the SBA lending-financial development relation on the Plains regional economy during the 1990-2015 period. Estimating a pooled least squares regression with fixed effects on 87 micropolitan areas for three time periods (1990-1999, 2000-2009, and 2010-2015), the main findings are: (1) SBA lending has a positive and significant effect on output or GRP growth; (2) per capita bank deposits, an indicator of an area's financial development, are directly correlated with micropolitan economic performance; (3) another metric of financial health of a geographic area, the wealth index, is not significant; (4) the most important local conditions are industrial composition (manufacturing employment share), market size (per capita personal income), local fiscal policy (particularly, government revenues), and demographics (especially the Hispanic population share). Further extensions of this study will examine the impact of SBA loans on all 536 micropolitan statistical areas in the country and a comparative study of other federal-mandated programs such as the Community Reinvestment Act.

References

Armstrong, Craig E., Ben R. Craig, William E. Jackson III, and James B. Thomson, "The Importance of Financial Market Development on the Relationship Between Loan Guarantees for SMEs and Local Market Employment Rates," FRB of Cleveland Working Paper 10-20, November 2010.

Choi, Laura, David Erickson, Kate Griffin, Andrea Levere, and Ellen Seidman, eds., *What It's Worth: Strengthening the Financial Future of Families, Communities and the Nation*. Federal Reserve Bank of San Francisco and Corporation for Enterprise Development, 2015. Also see: http://www.strongfinancialfuture.org/wp-content/uploads/2015/12/What-its-Worth_Full.pdf .

Cortes, Bienvenido S., "Impact of Small Business Administration Lending on State-level Economic Performance: A Panel Data Analysis," *International Journal of Business and Finance Research*, 4(3), pp. 55-66, 2010.

_____, Michael Davidsson, and Michael McKinnis, "Growth and Volatility of Micropolitan Statistical Areas in the U.S." *International Journal of Business and Finance Research*, vol. 9, no. 4, pp. 89-102, 2015.

_____, Michael McKinnis, and Michael Davidsson, "Industrial Composition, Local Fiscal Policy and Micropolitan Area Economic Growth," Mid-Continent Regional Science Association Conference Proceedings, pp. 30-40, 2013.

Craig, Ben R., William Jackson, and James Thomson, James (2009) "The Economic

Impact of the Small Business Administration's Intervention in the Small Firm Credit Market: A Review of the Recent Literature," *Journal of Small Business Management*, vol. 47(2), pp. 221-231.

_____, "Credit Market Failure Intervention: Do Government Sponsored Small Business Credit Programs Enrich Poorer Areas?" *Small Business Economics*, vol. 30, pp. 345-360, 2008.

_____, "Does Government Intervention in the Small-Firm Credit Market Help Economic Performance?" Federal Reserve Bank of Cleveland Policy Discussion Paper No. 22, 2007.

_____, "Small-Firm Credit Markets, SBA-Guaranteed Lending, and Economic Performance in Low-Income Areas," Federal Reserve Bank of Cleveland Working Paper 06-01, 2006.

_____, "On SBA-Guaranteed Lending and Economic Growth," Federal Reserve Bank of Cleveland Working Paper 04-03, 2004.

Hancock, Diana and James A. Wilcox, "The 'Credit Crunch' and the Availability of Credit to Small Business," *Journal of Banking and Finance*, 22, 1998, pp. 983-1014.

Kobeissi, Nada, "Impact of the Community Reinvestment Act on New Business Start-ups and Economic Growth in Local Markets," *Journal of Small Business Management*, 47(4), pp. 489-513, 2009.

Newberger, Robin, Susan Longworth, Craig Everett, and Chinwe Onyeagoro, "Measuring Small Business Financial Health," *ProfitWise News and Views*, Issue 2, pp. 1-12, 2015.

PM KeyPoint LLC, "Impact of Tight Money and/or Recessions on Small Business," study conducted for the SBA Office of Advocacy, June 2003.

Shaffer, Sherrill and Robert N. Collender, "Federal Credit Programs and Local Economic Performance," *Economic Development Quarterly*, 23(1), February 2009, 28-43.

Woods & Poole Economics, Inc., 2016 Complete Economic and Demographic Data Source (CEDDS) on CD-ROM, Washington, D.C. (www.woodsandpoole.com)

Appendix 1. Descriptive Statistics (N=261)

Variable	**Mean**	**Minimum**	**Maximum**	**Standard deviation**
Gross Regional Product growth	2.65	-2.07	31.17	2.62
Employment rate	95.2	88.9	98.45	1.66
Mean household income growth	1.68	-1.42	20.89	1.71
SBA loans per capita	5553	0.00	35793	4450
Deposits per capita	15371	1575	46964	5565
Wealth index	86.25	63.7	139.9	10.68
Manufacturing share	13.68	0.27	33.28	7.06
Income per capita	29314	17779	58515	5927
Local government expenditure	2422	835	5144	848
Local government revenue	2436	843	4924	843
Education	17.9	7.97	42.7	5.55
Black population	0.83	0.01	7.02	1.17
Hispanic population	1.64	0.03	18.84	2.69

MID-CONTINENT REGIONAL SCIENCE ASSOCIATION

MIG creators of IMPLAN

2016 MCRSA/IMPLAN Conference Proceedings

ANALYSIS OF ECONOMIC IMPACTS FROM SUNGRANT INITIATIVE PROGRAM FUNDED PROJECTS

Burton C. English
Kim Jensen
Jamey Menard
Jessica McCord
Tim Rials
University of Tennessee – USA

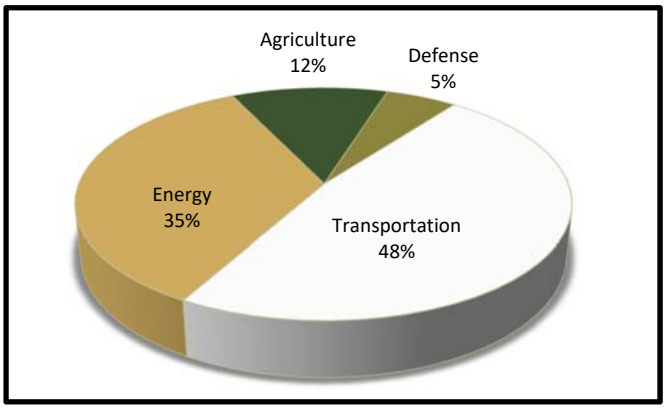
1. Introduction

In 2004, a consortium of the nation's land-grant universities addressing national bioenergy and bio-product challenges at the local level and on a regional scale was initiated. Congress authorized the Sun Grant Initiative (SGI) in the 2002, 2008 and 2014 Farm Bills. Sun Grant efforts are supported with funds from the U.S. Departments of Energy; Agriculture; and Transportation. Funding for the SGI was initiated in 2007. The consortium consisted of five universities, Oklahoma State University, Oregon State University, Penn State University, South Dakota State University, and The University of Tennessee. As is stated on the SunGrant Initiative web page, these institutes, at the forefront of research and innovation involving bioenergy and biofuels production, have the history, technology and resources available to lead the nation towards a renewable, sustainable, domestic energy industry. Their mission is to:

- Enhance national energy security,
- Provide opportunities for rural economic development,
- Promote environmentally sustainable and diversified energy crop production, and
- Foster collaboration between government agencies and academic institutions.

This SGI mission provides the federal agencies with access to regional and local expertise of land-grant university research and outreach networks. National priorities for bioenergy research and development were

addressed at the regional and site-specific levels, and established regional and national linkages between the researchers and federal agencies throughout the United States.



During the 2007-2015 time period, the nearly $90 million federal and $8 million match were provided to conduct and lead bioenergy research. Over $73 million have been awarded to more than 300 research projects since the Sun Grant Program's inception. In addition, almost $8 million in cost-share have been contributed by partner institutions. Just over $43 million was awarded to competitive projects. While the full impact of this program on creating a bio-economy will take years to determine, measurement of the economic impacts of these funds upon the regions where the funds were allocated is of interest. This paper provides these

measures of the regional economic impacts from the SunGrant Initiative.

2. Methods

To estimate the regional impact of the expenditures, an input-output (IO) model, IMPLAN, (2013 National Model) is used. The IO framework analyzes the interdependence of industries in an economy through market-based transactions. An analysis of expenditures by project was conducted for four of the five regions (Figure 2) and aggregated to the national level. Only aggregate data was supplied by Penn State and these data were assumed to be spent in similar categories to the other regions.

Impact indicators reported include total industry output (TIO), employment (EMP) and value-added, or Regional Domestic Product (RDP). The Local Purchase Percentage (LPP) or the amount of a transaction that stayed within the United States was used as estimated by IMPLAN. For a given year, the Sun Grant budgets were used to provide information on direct expenditures and their allocation across expenditure types. They were then assigned to an IMPLAN industry group. The analysis by parts method was employed to obtain these estimates (IMPLAN, 2016). Table 1 transforms the SGI expenditure categories into IMPLAN sectors. For instance, permanent equipment expenditures were assigned to analytical laboratory instruments (Sector 320). Indirect expenditures were assigned to sector 473.

In addition, the impacts of wages and salaries expenditures were treated through a labor income analysis through employee compensation. Actual expenditures are reported in Table 2. The Salaries and Wages and Fringe Benefits were used in the labor income analysis.

Table 1. Example of SunGrant Initiative Expenditure and Assigned IMPLAN Sector

Sun Grant Expenditure Category	IMPLAN Sector	IMPLAN Sector Description
Permanent Equipment	320	Analytical laboratory instruments
Expendable Supplies & Equipment	164/165	Organic or inorganic chemical manufacturing;
Travel	408/499/501/502	Hotels; limited- & full-service restaurants; air transportation
Publication & Documentation	155	Printing support services
Other	473	Junior colleges, colleges, universities, & professional schools

Table 2. SunGrant Initiative and the match as indicated by Leading Universities, (nominal 2007-2015 $)

Category	Total Sun Grant	Match	Total
Salaries & Wages	$40,534,747	$3,166,237	$43,700,984
Fringe Benefits	$2,065,727	$776,367	$2,842,094
Permanent Equipment	$1,687,332	$129,250	$1,816,582
Expendable Supplies & Equipment	$6,304,668	$147,649	$6,452,317
Travel	$3,578,008	$27,100	$3,605,108
Publication & Documentation	$120,395	$8,250	$128,645
Other	$15,210,797	$2,611,140	$17,821,937
Total Direct Costs	$69,501,674	$6,865,993	**$76,367,667**
Indirect Costs	$20,454,857	$1,041,599	$21,496,456
Total Costs	$89,956,530	$7,907,592	***$97,864,122***

Source: McCord, 2016

3.1 Results

Attracting $90 million in Federal funds to the regions resulted in a non-labor income impacts to the economy of nearly $149 million and added nearly 1,000 jobs (Table 4). Much of the impact is in value added or increasing RDP. In addition to the $149 million impact, an impact of $127 million occurs through payment of wages and salaries and their benefits (Table 5). The total impact of the funding from the SGI is estimated at $276.3 million over the 2007-08 to 2014-2015 time periods. This economic activity added an estimated 173.9 million in RDP to the nation.

Table 3. Economic Impacts from Non-Labor Expenditures and Wages, Salaries, and Benefits (2016 $)

Impact Type	Employment	Labor Income	Value Added	Output
Economic Impacts from Non-Labor Expenditures				
Direct Effect	501	$25,391,524	$31,936,738	$56,972,483
Indirect Effect	181	$9,806,765	$20,342,917	$40,905,980
Induced Effect	310	$15,952,226	$28,109,320	$51,025,947
Total Effect	992	$51,150,515	$80,388,975	$148,904,410
Economic Impacts -- Wages, Salaries, and Benefits				
Direct Effect	NA	$51,950,863	$51,950,863	$51,950,863
Indirect Effect	0	$0	$0	$0
Induced Effect	459	$23,588,778	$41,575,792	$75,470,659
Total Effect	459	$75,539,641	$93,526,655	$127,421,522
Total Economic Impacts				
Direct Effect	501	$77,342,387	$83,887,601	$108,923,346
Indirect Effect	181	$9,806,765	$20,342,917	$40,905,980
Induced Effect	769	$39,541,004	$69,685,112	$126,496,606
Total Effect	1,450	$126,690,156	$173,915,630	$276,325,932

NA indicates Not Applicable.

4. Conclusions

During its first ten years, the economic impacts of the Sun Grant program to the US was considerable. To date, more than $73 million has been awarded to carry out in excess of 300 research projects. Of the $73 million, over $43 million was allocated from federal sources to external/competitive projects. There were $108.9 million (2016$) in direct transactions generating $276 million in economic impacts. These expenditures created an average of 105 jobs/year.

5. Limitations

These impacts do not include the investments from states that developed the infrastructure and scientific personnel that allowed the research to occur. A portion of this was included in the charged F&A. Finally, these impacts are only the result of expenditures and there is no knowledge of where these funds might otherwise have been invested.

In addition, the longer term impacts of the research are largely unknown at this time and could not be estimated. Future research should examine the influence of the program on technology development and commercialization outcomes influencing development of the biofuels industry. Environmental and economic impacts from these new technologies and associated changes to the biofuels industry should also be measured.

References

IMPLAN Group LLC., 2016. How to Perform An Analysis-By-Parts, You Tube., accessed at https://www.youtube.com/watch?v=ClqdO9-wqgU

McCord, Jessica, 2016. Various emails providing information on center expenditures.