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Mid-Continent Regional Science Association

Componential Changes in the Food and Kindred Products Group Industry: A Class 1 Rail Carrier Origination Market Analysis

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Introduction

The Food and Kindred Products industry in the United States plays a vital role in freight originated by Class I railroads in the US economy and foreign trade due to its large size, stability, growth, diverse products, and competitive nature. Therefore, it is important to measure componential changes that have occurred in this industry over time because the Food and Kindred Products group must compete, in general, with other commodity groups for the services furnished by Class I railroads and this, in turn, impacts the amount of freight originated by hauling them from origins to destination markets on the carriers' rail lines.

This study evaluated the componential changes of the Food and Kindred Products relative to other commodity groups' freight originated by Class 1 railroads in the United States from 1990 through 2007. The authors accomplished the primary objective of this study by using the dynamic shift-share model. The dynamic shift-share model disaggregates a change into the national growth, industry mix, competitive effect, and the allocation effect components over time.

Figure 1 shows a schematic diagram of the dynamic shift-share model and its components (Allen, Myles, et al, 2010). Specific discussions of these components are contained in the following sections of the poster presentation.

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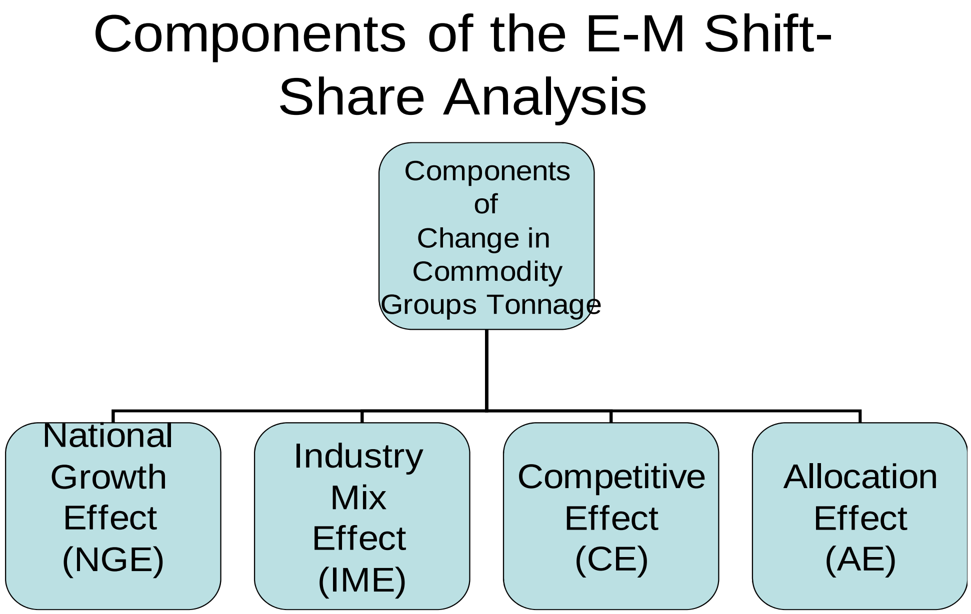
Figure 1. Schematic of Dynamic Shift Share Model



Objective

The general objective of this study is to examine the componential changes of the Food and Kindred Products freight originated by Class I railroads in the United States by using secondary data from 1990 through 2007.

Data and Methods

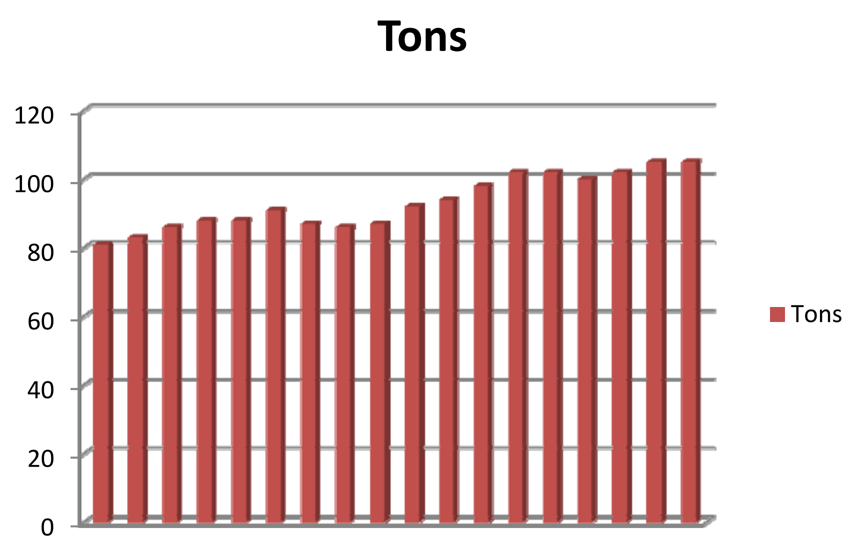
Data to accomplish the objective of this study came from secondary sources including the Statistical Abstract of the United States, published by the U.S. Department of Commerce and Association of American Railroads, Policy and Economics Department (1990 2007), Figure 2 and Table 1.

A dynamic shift-share analysis of the Esteban-Marquillas (EM) model was used to accomplish the study objective (Marquillas, 1972). This model separates economic changes into four components: national growth, industry mix, competitive, and allocation effects. The dynamic shift share analysis separated changes in Food and Kindred Products originated by Class I railroads into the aforementioned effects during the 1990-2007 periods.

Results obtained from the comparative static approach can be problematic if there are significant changes in the industrial structure over time. The potential for this problem is greatly diminished by using the dynamic shift-share model of EM.

Figure 2, Table 1. Tons of Food and Kindred Products Shipped by Class 1 Rail Carriers in the U.S.

Years	Tons
1990	81
1991	83
1992	86
1993	88
1994	88
1995	91
1996	87
1997	86
1998	87
1999	92
2000	94
2001	98
2002	102
2003	102
2004	100
2005	102
2006	105
2007	105



Model

The general form of the dynamic shift-share model and its components are shown in the following equation:

Equation 1: $CT_t = NGE_t + IME_t + CE_t + AE_t$

Where: CT_t = Change in tonnage originated of Food and Kindred Products in year t
NGEt = National Growth Effect of Food and Kindred Products in year t
IMEt = Industry Mix Effect of Food and Kindred Products in year *t*
CEt = Competitive Effect of Food and Kindred Products in year t
AEt = Allocation Effect of Food and Kindred Products in year t
t = years 1990 to 2007

To run the EM model, the year 2007 served as the base period for the analysis. The dynamic shift-share analyses were derived using Micro Soft Excel.

Interpreting the Shift Share Components

The national growth effect (**NGE**) is the amount that a Food and Kindred Products would have increased (or decreased) had it grown at the same rate as the nation's volume did.

The industry mix effect (**IME**) is the change attributable to differences in the initial industry makeup of the Food and Kindred Products relative to the nation (Coughlin and Pollard, 2001).

The competitive effect (**CE**) reflects whether Food and Kindred Products had a competitive advantage or disadvantage in comparison to the nation between 1990 and 2007 (Coughlin and Pollard, 2001).

The allocation effect (**AE**) is a measure of the railroad industry's degree of specialization in Food and Kindred Products in which they enjoy a competitive advantage. A positive value means the industry has the correct specialization (Ray, 1995). While the sign of the allocation component can be either positive or negative, other interpretations can be made (Table 2).

Table 2. Interpretations of Dynamic Shift Share Components

		Interpretation	
Effect	**Sign**	**+**	**-**
National Growth Effect (**NGE**)	**+ -**	Amount of potential growth in Food and Kindred Products had it grown at similar rate in nation	Amount of potential decline in Food and Kindred Products had it grown at similar rate in nation
Industrial Mix Effect (**IME)**	**+ -**	Potential change (increase) in Food and Kindred Products because of national makeup of Food and Kindred Products industry	Potential change (decline) in Food and Kindred Products because of national makeup of Food and Kindred Products industry
Competitive Effect (**CE**)	**+ -**	Competitive advantage	Competitive disadvantage
Allocation Effect (**AE**)	**+ -**	Correct specialization (advantage) in Food and Kindred Products	Incorrect specialization (disadvantage) in Food and Kindred Products

Results

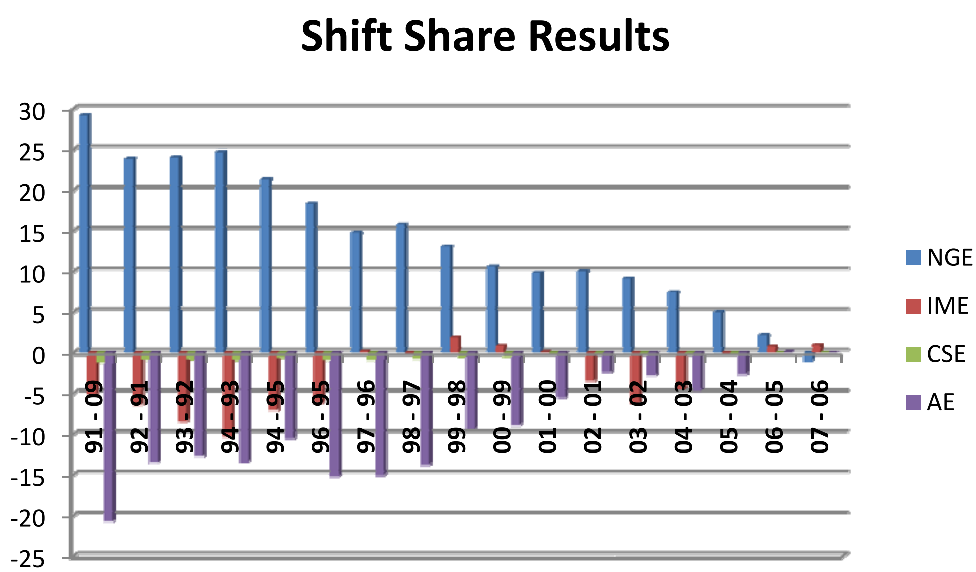
Results from the dynamic shift share analysis provided only a description of changes in Food and Kindred Products since 1990 (Figure 3, Table 3). The table clearly shows that NGE was a major determinant of Food and Kindred Products shipments and CE was not a significant factor among these firms between 1990 and 2007. During the period 1990 and 2007, CE's share of the total effect was less than one percent annually.

However, the results from this method do not provide an economic explanation about why shipments in Food and Kindred Products originated by Class I railroads were competitive or not competitive during the study period.

Table 3. Esteban-Marqullias Dynamic Shift Share Results for U.S. Shipments of Food and Kindred Products by Class 1 Railroad, 1990 – 2007

YEAR	NGE	IME	CSE	AE	Total Change
91 - 90	29	-5	-1	-21	2
92 - 91	24	-6	-1	-14	3
93 - 92	24	-8	-1	-13	2
94 - 93	25	-10	-1	-13	0
94 - 95	21	-7	-1	-11	3
96 - 95	18	-6	-1	-15	-4
97 - 96	15	0	-1	-15	-1
98 - 97	16	0	-1	-14	1
99 - 98	13	2	-1	-9	5
00 - 99	11	1	-1	-9	2
01 - 00	10	0	0	-6	4
02 - 01	10	-3	0	-2	4
03 - 02	9	-6	0	-3	0
04 - 03	7	-4	0	-5	-2
05 - 04	5	0	0	-3	2
06 - 05	2	1	0	0	3
07 - 06	-1	1	0	0	0

Figure 3. Dynamic Shift Share Components of Food and Kindred Products



The analysis reveals that the annual growth in tons of Food and Kindred Products originated by Class I railroads were positive for each year, except for 2007-2006 during the study. In absolute terms, NGE accounted for 51.78 percent of the total change in Food and Kindred Products tonnage between 2006 -2007 (Table 4). Similarly, AE and IME accounted for 32.7 and 13.56 percent, respectively, of the declines in tons shipped during this period. CSE accounted for the remaining 2 percent of changes in tons of Food and Kindred Products shipped during this period.

The results revealed that the competitive and allocation effects had no affect on the tons of Food and Kindred Products shipped via Class I railroads between 2006 and 2007. This suggested that the Food and Kindred Products group did not provide a competitive advantage nor specialized advantage for Class I railroads during this period.

In fact, CE accounted for less than one percent of the absolute changes in tons of Food and Kindred Products shipped by Class 1 Railroads between 1990 and 2007. This confirms earlier observations that Food and Kindred Products did not provide these firms with a competitive advantage in tonnage shipped during this period.

Table 4. Absolute Value of Share of Shift Share Components in Food and Kindred Products Shipped by Class 1 Railroad in 2007

YEAR	NGE	IME	CSE	AE	Total Change
91 - 90	29	5	1	21	2
92 - 91	24	6	1	14	3
93 - 92	24	8	1	13	2
94 - 93	25	10	1	13	0
94 - 95	21	7	1	11	3
96 - 95	18	6	1	15	4
97 - 96	15	0	1	15	1
98 - 97	16	0	1	14	1
99 - 98	13	2	1	9	5
00 - 99	11	1	1	9	2
01 - 00	10	0	0	6	4
02 - 01	10	3	0	2	4
03 - 02	9	6	0	3	0
04 - 03	7	4	0	5	2
05 - 04	5	0	0	3	2
06 - 05	2	1	0	0	3
07 - 06	1	1	0	0	0

The dynamic shift-share analyses of Food and Kindred Products revealed that almost all of the changes in tonnage originated by Class I railroads were due to expansion in the national growth between 1990 and 2007. NGE produced about 51.78 percent of the absolute changes in Food and Kindred Products shipped during the study. AE accounted for 35.3 percent of the declines in these products, which were because of a lack of specialization during this period. The remainder of the declines in Food and Kindred Product Shipments were because of a lack of growth (-13.56%) in the national industry (2.4%) and competitively disadvantaged (-1.99%) products when compared to other products shipped by Class 1 firms between 1990 and 2007 (see Table 4).

Table 4 also shows that the absolute value of the NGE effect steadily increased between 1990 and 2007, while IME, CSE, and AE declined during this period. The lack of specialization (i.e., AE) was highest between 1990 and 1991, even though it declined throughout the study period.

These results imply, in general, that Class I railroads might want to look closely at the opportunities or challenges to reevaluate the structure of commodity mix they currently originate to improve their efficiency.

Conclusion

The results of this study provided some insight into the competitive positions of commodity originations hauled by Class 1 railroads between 1990 and 2007. Specifically, the results revealed that declines in tons of Food and Kindred Products originated by Class I railroads were mainly because of the lack of growth in this industry (IME); and a lack of competitiveness (CSE) and specialization (AE) among firms in between 1990 and 2007.

During this period, NGE accounted for 51.78 percent of the growth in Food and Kindred Products. IME accounted for about 13.56 percent of the declines in tons shipped of these products, while CE accounted for almost 2 percent of the declines in tons of Food and Kindred Products shipped via Class 1 Railroads between 1990 and 2007.

AE, the allocation effect, accounted for almost 32. 7 percent of the declines in Food and Kindred Products shipped during this period. The large negative value for AE suggested that K&KP were not the best products to specialize in for Class 1 rail carriers between 1990 and 2007.

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Mid-Continent Regional Science Association

Estimating the Impact on Employment of USDA's Programs in the American Recovery and Reinvestment Act (ARRA)

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Whether an economic multiplier is derived from comparative static models, dynamic econometric models, or large macroeconomic simulations, it is an elegant conceptual device that quantifies the "ripple" effects that an initial increase or decrease in spending creates throughout the economy – that is, how much an initial change in spending generates secondary and tertiary spending rounds resulting in a total economic impact for a defined region.

By moving from a single measure for the multiplier to an input-output multiplier framework, we are able to assess the effects of an exogenous shock on the different sectors of production. The input-output framework is based on the fixed inter-industry relationships embedded in the national input-output accounts published by the Bureau of Economic Analysis. These accounts record flows of goods and services used in the production processes of industries in the U.S. economy. As part of this family of input-output multiplier models, the social accounting matrix multiplier model (SAM) extends the framework by mapping the entire circular flow of firm production, as well as household consumption and their incomes earned from producing these goods and services. While cognizant of their limitations, these multiplier models present a very good framework for quantifying in detail the short-run economy-wide impacts of a sudden change in spending by a particular firm, households, the government, or through trade.

Six agencies in USDA—ARS, FS, FSA, FNS, NRCS, and RD—are all using this general framework for estimating the potential effects on employment of the ARRA. We are generally using concepts and techniques embodied in a model called IMPLAN, originally developed by USDA's Forest Service, now maintained by a private company that took over in 1993. This model allows the analyst to construct a multiplier framework for a variety of regions—counties, metropolitan areas, groups of counties, states, or the Nation. It also allows the analyst to aggregate 509 industrial sectors tailored to their application. IMPLAN reports all multiplier effects on output, employment, income, earnings, and all components of value-added. It is one of only three surviving credible regional impact models that are still (widely) used for regional economic impact analysis. The others are REMI—Regional Economic Models Inc., also privately owned—and RIMS—Regional Input-Output Modeling System, maintained by the Bureau of Economic Analysis in the Department of Commerce.

On April 1, OMB published guidelines for job estimation in FR Doc. E9-7317, Section 2, Item ARRA-2-04 in the Federal Register, Vol. 74, No. 61, Wednesday, April 1, 2009, P. 14836, and for press release purposes. The only adjustment needed to this USDA approach was conversion from the Jobs definition used in BEA, Census, and IMPLAN to Full Time Equivalents (FTEs). IMPLAN has a standard conversion table for each industrial section on their website that was used for all conversions. The average conversion from IMPLAN Jobs to FTEs was an average nine percent reduction. The reduction factor varied significantly by industry (based on average wages, seasonality of work, and percent of part-time employment).

In order to provide consistency across the Agency, and conform to USDA standards, attached is a job creation calculator to be used by NRCS employees to estimate the creation of jobs for the Watershed Rehabilitation, PL-566, and Emergency Watershed Protection Flood Plain Easement Programs. This calculator is to be used to estimate the creation of federal and non-federal jobs at the National, State, and individual project levels. This will ensure consistency across the Agency and with OMB FR Doc. E9-7317, Section 2, Item ARRA-2-04 in the Federal Register, Vol. 74, No. 61, Wednesday, April 1, 2009, P. 14836, and for press release purposes.

Multiplier effects on employment are based on the ratio of jobs per $1 million of sales of goods produced. These structural relationships are embedded in national input-output tables and applied regional models. In the table below, the fourth column shows the employment multipliers for a few agricultural industries. So for example, for every additional $1 million spent in grain farming, about 13 jobs are either created or preserved economy-wide. This is a measure of the number of jobs that will be needed to produce this increase in spending. Whether these 13 jobs are created or preserved depend on the degree of unemployment in this regional labor market.

This framework quantifies the number of jobs demanded in producing $1 million in output. These are full-time and part-time jobs counted with equal weight.

Understanding this distinction between the jobs demanded versus jobs that may actually be created, highlights the strengths and the weakness in using this multiplier framework. Its strength lies in the flexible use in the regional and industrial levels of detail in quantifying the economy-wide increases in the demand for all goods and services and labor induced by a spending increase by a particular sector or household. Its weaknesses lie in the rigid assumptions underlying these models. For example, in a regional economy, an industry has limited access to inputs it needs, but these models assume that an industry has unlimited access to raw materials and its output is limited only by demand for its products. In the regional economy, producers and consumers respond to changes in prices, but in these models, prices do not vary. These assumptions force the analyst to use information from other sources to assess the likelihood that these economy-wide effects will occur. Consequently, these models may not be appropriate for assessing the impact of large changes in spending that do not allow supply to adjust. The hard work in using these models lies in carefully quantifying all significant effects of a spending increase, including potential offsetting effects. The analyst must accomplish this task by using other economic models or sources of expertise not accessible by this framework.

This family of input-output models has been widely used by the federal, state, and local governments, universities, and private-sector consultants to analyze the total regional economic impacts of, for example, constructing a new sports stadium, stimulating local tourism, closing of military bases, hurricanes and other natural disasters. At ERS, these models have been used with other economic models in addressing the regional economic impacts of declaring the salmon an endangered species in the Pacific Northwest, national and regional impacts of proposed increases in bioenergy production, changes in food stamp expenditures, and economic impacts of the Conservation Reserve Program on rural communities.

FSA, NRCS, and RD have used consistent assumptions within the same National IMPLAN model run by an experienced IMPLAN user. Assumptions used are:

- When actual projected project information is available, that information is directly used in the model.
- Where we have direct ARRA program information, those IMPLAN sectors are used.
- Where we do not have direct ARRA program information, historic program information was used to determine the IMPLAN sectors mix.
- Where the income was not directly tied to output sectors, 70% of the funds were used with the $50,000 to $75,000 household expenditure vector, and 30% of the funds were assumed to go through the household expenditures directly into savings and taxes. These were used for NRCS easement payments, delayed FSA SURE payments, and the portion of RD housing loans going to the seller of existing homes.

There were ten Rural Development items in ARRA. This analysis is based on data and assumptions from the National Program Managers. The Rural Development NRCS IMPLAN analysis was started in February, and the last adjustment made in mid-March. On April 1, OMB issued their job reporting guidelines, and the Rural Development (also with the NRCS and RD estimates) job estimates were revised to FTEs.

If you have further technical questions on this work, please contact:

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NOTE: This version is provided as documentation to the ARRA USDA Jobs Estimation Presentation at the National IMPLAN Conference, St. Louis, June, 2010. There are similar write-ups for the Natural Resources Conservation Service, and Farm Services Agency items in the analysis. The original usage of this document was as a review to agency leadership of the work; and the later use was as a presentation to the USDA Office of Inspector General (OIG) during their audit of the ARRA.

Total FTE jobs created per $1,000,000 in Economic Activities.

Initial Impacts:	IMPLAN Sector	Job Multiplier per $1Million Direct Impact	FTE Job Multiplier per $1Million Direct Impact
Community Facilities, Direct Loans	Historic Mixture of 23 IMPLAN Sectors	25.8	23.7
Community Facilities, Grants	Historic Mixture of 26 IMPLAN Sectors	21.9	20.2
Water and Waste Direct Loans	33 Water- sewage and other treatment facilities	16.7	15.3
Water and Waste Direct Grants	33 Water- sewage and other treatment facilities	16.7	15.3
Rural Business & Industry Guaranteed Loans Program	Historic mixture of 121 IMPLAN sectors	22.1	20.3
Rural Business Enterprise Grants	Historic mixture of 80 IMPLAN sectors	22.1	20.3
Single Family Housing Direct Loans	Loan to purchase existing or new homes.	15.4	14.1
Single Family Housing Guaranteed	Guaranteed for other loans to purchase existing or new homes.	13.5	12.4
Broadband	See RD Broadband sheet.	14.2	13.1
RD Salaries and Expenses	439 Federal Non-Military Employment	19.9	18.3
Totals		16.1	14.8

Total FTE jobs created per Rural Development programs.

Initial Impacts:	Federal Cost	Direct Impacts	Total Output	FTE Direct Jobs	FTE Total Jobs	FTE Jobs per $1 Million of Economic Activity
Rural Development ARRA Items						
Community Facilities, Direct Loans	$ 67,000,000	$ 1,171,000,000	$ 3,544,474,415	12,833	27,732.3	23.7
Community Facilities, Grants	$ 63,000,000	$ 63,000,000	$ 195,937,204	482	1,270.1	20.2
Water and Waste Direct Loans	$ 412,000,000	$ 2,820,000,000	$ 7,312,379,490	12,491	43,284.9	15.3
Water and Waste Direct Grants	$ 968,000,000	$ 968,000,000	$ 2,510,064,905	4,288	14,858.4	15.3
Rural Business & Industry Guaranteed Loans Program	$ 130,000,000	$ 2,990,000,000	$ 8,652,942,467	25,598	60,596.7	20.3
Rural Business Enterprise Grants	$ 20,000,000	$ 20,000,000	$ 57,879,215	171	405.4	20.3
Single Family Housing Direct Loans	$ 67,000,000	$ 1,000,000,000	$ 2,336,706,127	4,686	14,149.0	14.1
Single Family Housing Guaranteed	$ 133,000,000	$ 10,472,000,000	$ 20,735,932,353	48,689	129,808.6	12.4
Broadband	$ 2,500,000,000	$ 2,500,000,000	$ 6,806,104,568	6,262	32,729.8	13.1
RD Salaries and Expenses	$ 131,000,000	$ 131,000,000	$ 332,514,383	1,022	2,394.9	18.3
Rural Development Totals	**$ 4,491,000,000**	**$ 22,135,000,000**	**$ 52,484,935,127**	**116,522**	**327,230**	**14.8**

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Economic Contribution of a Rural Texas Community College

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Abstract. The current economic downturn and changing political views regarding education have resulted in an increased interest in community colleges. Community colleges play a unique role in communities, particularly in rural communities. They constitute a cultural and economic benefit to their host community and their service area. This paper reports the economic contribution of Western Texas College, a community college in rural Texas. The study considers the annual economic contribution from college operations, student/visitor spending, and the cumulative contribution of earnings power among local residents. Spending and earnings expectations are based on a February 2010 survey of current students. A sector-level operating budget, event data, and an account of resources provided to the community were calculated by the college's business office. Rural colleges report smaller local economic contributions than do similarly-sized urban schools because rural regions experience many economic leakages. Here, IMPLAN Version 3 is used to estimate the contribution of the college on surrounding metro areas that capture much of the leakage from the rural service area.

Key words: College economic contribution, College economic impact, Rural college spending

Introduction

Community colleges have recently made headlines as the current recession and increasing college costs have caused students to look for less expensive education alternatives. Jill Biden, wife of US Vice-President Joe Biden, was appointed by President Barrack Obama to lead a community college summit to showcase and strengthen the national community college system (Biden 2010). Biden noted that the Health Care and Education Reconciliation Act of 2010 had set aside money to strengthen the community college system and improve the educational outcomes to match the needs of regional economies. The current emphasis on fitting educational programs to the needs of regional economies has a counterpart in identifying the role that community colleges play in their regional economies. This study aims to identify the economic role of one rural community college in its home county, its service area, and nearby metropolitan areas.

Western Texas College (WTC) is a community college in Snyder, Texas. The college has 2,534 students across on-campus, online, and in the prison and secondary education systems. In addition, WTC hosts "College on the Square" in retail space in Snyder's town square. The venue provides classes in subject ranging from guitar to CPR and calligraphy to customer service. Community members can submit ideas for courses targeting youth, workforce, or senior audiences. The college is also home to the Scurry County Museum. The school hosts theatrical and sporting events, as well as other college and community events, such as conferences, celebrations, exhibitions.

The college's enrollment has grown for at least 17 consecutive semesters, and school officials were interested in identifying the economic role of the college in its host community and its service area. College officials had seen economic contribution studies from other schools and wished to combine elements of several of those studies. They were also interested in identifying their ties to nearby metropolitan areas, which is facilitated by the multi-regional analysis feature of IMPLAN Version 3.0 (MIG 2009). A questionnaire-based data collection method was devised to obtain the college and student expenditure data needed for such a study. This method should be applicable to other colleges as well.

The economic contribution study had five parts: college expenditures, student expenditures, visitor expenditures, metropolitan expenditures, and metropolitan trade flows. Earnings premiums of graduates and expenditures by locals at college events (import substitution) were also identified, although neither measure was included in the calculation of indirect and induced economic contributions. The following provides a brief discussion of methods used in previous college contribution studies. Section 3 describes the data needs and sources for each aspect of the study. Section 4 describes the study methods. Section 5 presents the results, and Section 6 concludes.

Previous Studies

Many colleges conduct or commission studies on the economic contribution of their presence and activities on their communities. Jafri, Dudley, and Buland (c2000) noted that colleges use economic contribution studies to justify the use of taxpayer funding, enhance bargaining positions, and improve communication between colleges and host communities.[1] They admit that the contributions of colleges are difficult to measure because short-term and long-term effects may differ and many benefits are intangible (e.g., appreciation for the arts, cultural tolerance, reduced crime). Their study of Tarleton State University in Texas (6,333 students) included college operations, construction remodeling expenditures, and capital outlay. Student, visitor, and retiree spending were also included in the survey-based study. Using IMPLAN, the authors found that Tarleton State supported $157.1 million in local sales and 2,648 jobs in addition to the 784 full-time equivalents employed by the college.

Eilrich, Doeksen, and St. Clair (2007) also included operations, construction, student, and visitor spending in their study of Lincoln Memorial College in Tennessee. They found that the total contribution of the 2,700+ student college was $68.2 million in income and $1,772 jobs across the state. They also found a $21.2 million contribution to retail sales in the state and a resultant $1.5 million contribution of sales tax dollars. A comparison of the Tarleton State and Lincoln Memorial studies shows that even studies with very similar methodologies can provide different outcome measures, for example county-level total sales or output (Tarleton State) versus state-wide income (Lincoln Memorial).

Lewis and Clark Community College (2006) in Illinois included college operations (including staff wages) spending and the effects of past students still in the local workforce in its study. Lewis and Clark uses indirect multipliers on both components to estimate an $11.0 million total effect from operations and a $25.1 million effect from past student productivity. The study also includes an investment analysis that includes social benefits such as medical, crime, welfare, and unemployment savings resulting from the college education of Lewis and Clark students. Benefit/cost ratios are constructed both for students and for taxpayers. The ratio is 7 for students and ranges from 2 to 15 for taxpayers depending on whether only increases in tax and social security contributions are considered or whether the broader range of social benefits is used.

Most studies look only at a defined region containing the college that is the subject of the study. Johnson (1994) studied the effect of South Plains Community College in Texas on both the local Hockley county economy and Lubbock County, the

[1] Jafri, Dudley, and Buland (c2000), along with most of the other studies described in the section use the term "impact" rather than "contribution". There is some debate about terminology among economists, but many prefer to reserve the term "economic impact" for new activity; existing and ongoing activity are discussed in terms of the more generic "contribution".

metropolitan county nearest the college. The study included institutional, faculty/staff, student, and visitor expenditures. Lubbock County residents actually could have decreased Lubbock spending while attending college part-time in Hockley County. Therefore, the expenditures of part-time students on the nonlocal economy were excluded. The college resulted in $20.9 million in total sales volume (output) in the local Hockley County economy and $21.0 million in sales volume in the nonlocal Lubbock County economy. Johnson noted that expenditures in the nearby metro area may actually result in higher quality of life for Hockley County residents as Lubbock is able to provided expanded services and activities.

Data

College and Service Area

Western Texas College is a community college in Snyder, Texas. During the 2009-2010 school year, enrollment was 2,534 students (Canada 2010). As is typical (Thevenot 2010), the majority of WTC students were classified as freshman. The school had 1,836 freshmen, 403 sophomores, and 295 students with more than 72 credit hours completed. Most students (1,852) are part-time while 682 were full-time with 270 to 300 in on-campus housing at any given time. Most of WTC's 657 concurrent high school students and 310 prison inmates were part-time. Because students were allowed to enroll in both campus and online courses, it was difficult to distinguish between campus and online students.

Snyder, Texas, a micropolitan area in West Texas, has a population of 16,222 (Census Bureau 2010). Snyder is the seat of Scurry County, which is the only county in the Snyder micropolitan area (US OMB 2008). The county population declined slightly from 16,361 in the 2000 Census. The decline mirrors the fortunes of most other rural counties in the region. However, employment increased between 2001 and 2008. The county's leading industries are mining/oil fields and agriculture (US BEA 2010).

The college's service area includes Borden, Dickens, Fisher, Jones, Kent, Mitchell, Nolan, Runnels, Scurry, and Stonewall counties (Figure 1).[2] Jones County is part of the Abilene, Texas, metropolitan statistical area (MSA) while other counties are rural (US OMB 2008; USDA 2003). The region's economy is similar to that of Scurry County, although agriculture is relatively more important in the larger area.

College Expenditures Questionnaire

The WTC business office was sent an Excel-based questionnaire regarding operational expenditures. The form contained itemized expenditure categories as detailed in Table 1. Each item was matched to an IMPLAN (MIG 2009) sector. The WTC business office provided expenditures for 2009. In some instances, the business office was unable to separate expense categories and provided a sum for a category or a group of items within a category. Based on their explanatory notes, those values were assigned to appropriate IMPLAN sectors. Expenditures for the museum, college on the square, farm and community service responsibilities (e.g., accounting for the local senior citizens group) were included in the college expenditures. The college denoted when expenditures were made within Scurry County or the service area. The payroll for student employees was excluded to avoid double counting when student expenditures were modeled.

Student Survey

A student expenditure survey was provided to WTC (Appendix). Students were asked to identify their year, gender, and residency as well as their post-college residency plans. The bulk of the survey asked students to provide information about their expenditures in Scurry County, in the remainder of the WTC service area, and in nearby cities. Only students living off campus were asked to provide information about housing and utilities because on-campus housing expenses were included in the

[2] Service areas are defined by the Texas Higher Education Coordinating Board (2006).

expenditures reported by the college business office. Finally, students were asked how many people visited them in Snyder each month. Expenses in the survey were matched to IMPLAN sectors.

The college administered the survey to a sample population of classroom students and returned 235 completed surveys. Six surveys were deemed unusable due to unreasonable values, leaving 229 surveys in the sample. Three of the discarded surveys had unreasonably high expenditures in one category relative to others (leading to concerns about earnestness, the legibility of the value, or possible inconsistency in reporting monthly versus semester expenditures). The remaining discarded surveys were clearly not honest results.[3]

Blanks in the completed surveys were coded as zero expenditures, leading to possible underreporting of student spending. However, this method was consistent with students reporting values in some blanks (e.g., gasoline and restaurants/bars) but not others (e.g., clothing and medical). When expenditure ranges were reported (a relatively rare occurrence), the simple average was recorded. In 10 cases, students appeared to provide semester or annual totals despite emphasis on monthly expenditures on the survey instrument; in such cases, the responses were converted to a monthly basis. In two cases it was unclear whether answers were for the county or the larger region so values were assigned to the region.

Because WTC is relatively close to four metropolitan areas, students often travel to these cities on pleasure trips. Students were asked to indicate the frequency of their trips to Abilene, Lubbock, Midland, and San Angelo. They were told only to count trips for pleasure and not to visit family. Students also reported their expenditures on these trips.

Students were asked how many visitors they had per month. They were asked to distinguish between one-day visitors, two-day visitors, and longer term visitors. Most students reported no visitors. Several respondents placed a checkmark or X rather than a number; those responses were recorded as one visitor. Visitor expenditures were then combined with Texas travel expenditure data from D.K. Shifflett and Associates (2005) to estimate college-related visitor spending in Scurry County and the WTC service area.[4]

<u>College Event Expenditures</u>

The college provided data on the special events held at WTC in 2009. The event name, purpose (business or leisure), total attendance, and percent of attendees from outside a 100-mile radius were recorded. A 100-mile radius was used as a proxy for the service area and to separate true visitors from individuals who might consider Snyder to be their regional community (within an hour and a half drive). The event visitor data was combined with the D.K. Shifflett and Associates (2005) travel expenditure data to estimate expenditures attributable to college-related events. The cost of hosting the event was included in the college expenditures.

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[3] Two students reported travelling to San Angelo every weekend and spending $1 million per month or "a lot" on those trips. Interestingly, these surveys were side by side in the stack. Another student also reported spending "a lot" on just about everything.

[4] DK Shifflett and Associates (2005) provides expenditures per visitor-day for in-state and out-of-state travelers on business and leisure trips. This study uses in-state expenditures. Shifflett data were adjusted to reflect 2009 prices (US Dept of Labor 2009). The CPI adjusted leisure expenses were transportation, $21.34; shopping, $23.37; food & beverage, $26.42; lodging, $9.14; and other, $6.10. The adjusted businesses expenses were transportation, $32.31; shopping, $22.74; food & beverage, $25.13; lodging, $25.13; and other, $4.79. No entertainment expenses were included because student and university events were expected to include most entertainment activities.

Cumulative Earnings Potential

More education generally equates to higher incomes.[5] The Census Bureau (2009) publishes data on the premium paid to workers with an associate's degree or some college compared to workers with only a high school diploma. American Community Survey data for 2008 were not available for all locations so the data for the nearby Abilene MSA were used to estimate the WTC students' earnings premiums. Abilene has a positive education premium of $3,201 annually, which is smaller than the Texas premium of $6,559. The Abilene economy is likely to more closely reflect the economy of the WTC service area.

Methodology

Reported expenditures were converted to an annual basis and modeled using IMPLAN Version 3.0 (MIG, 2009). IMPLAN is an economic assessment tool based in input-output analysis. Expenditures by the college, students, students' visitors, and event attendees were entered as direct inputs to estimate the total output, value added, labor income, and employment generated by WTC.[6] Cumulative incomes of students who remain in the region post-graduation are also considered. Additionally, the college's contribution to surrounding metropolitan areas is also studied.

College Expenditures

The 2009 expenditure data provided by WTC were checked for appropriate matches to IMPLAN sectors and entered into IMPLAN. For discussion purposes, farm and museum expenditures were entered separately from other college expenditures. These two enterprises are features that may not be matched by other community colleges. The museum sector had to be added to both the Scurry County and service area models because it did not exist in the default models for those regions. Similarly, the college reported purchasing farm equipment locally so the farm equipment manufacturing sector had to be added to the county model.

Student Expenditures

The college's expenditures account for the academic activity of all students, regardless of full-time, part-time, campus, or online enrollment status. However, economic contribution analysis should include only the living expenses of those students who spend in the study region primarily because they attend school. Students who attend school because they happen to live or work in the region were considered "casuals" in event impact terminology and should not be attributed to the school (Crompton 2006; RR&C 2007). Thus student expenditures were based on the 527 full-time students (those enrolled in at least 12 hours) who were enrolled in at least one campus section.

Reported expenditures were averaged over all respondents with blank responses counted as zero. Average expenditures for each item were multiplied by 527 students and eight months (the time students spend in the standard, two-semester academic year) to obtain the total amount spent on each item annually. Although some students may remain in classes over the summer, most students reported living in the region for nine months or less annually. Most of the students who did report 12-month residency had also lived in the area prior to attending WTC and may have simply returned home for the summer. The Scurry County totals were entered into IMPLAN to determine the economic contribution to the county. The county totals were added to the totals for the remainder of the service area to determine the contribution to the service area.

Expenditures by Students' Visitors

Visitors were averaged over respondents and again multiplied by 527*8 to estimate the annual

[5] This is not always the case. For example, Lubbock high school graduates make a reported $27,146 while workers with some college or an associate's degree make only $26,841.

[6] The analysis-by-parts method is appropriate given that even the private college sector (392) does not exist in the model, and the state government sector (432) is much too broad to capture the college activity.

number of visitors in the full-time campus body. One-day visitors were considered mostly day-trip travelers, and their expenditures were based on 0.75 person-days, consistent with Shifflett (2005) estimations. The adjusted annual number of visitor-days was then multiplied by the average leisure traveler expenditures for transportation (here, gasoline), food and beverage, shopping, and lodging (here, hotel) (DK Shifflett and Associates 2005).[7] The annual expenditures of students' visitors were then entered into IMPLAN. All restaurant and shopping expenditures were assumed to be local, but only 20 percent of gasoline expenditures were included in an effort to reflect the proximity of Snyder to other trade centers and the ability of travelers to purchase gasoline en route to an event.

Expenditures by Attendees at College Events

The costs of hosting events at the coliseum and other college venues were included in the WTC expenditures. However, those expenditures do not capture the spending by visitors attending those events.[8] The number of visitors from outside a 100-mile radius was calculated and multiplied by the number of days over which the event occurred to establish visitor-days. Visitor-days were multiplied by the Shifflett (2005) daily travel expenditures for transportation (gasoline), food and beverage, shopping, lodging, and other expenses.[9] Events were categorized as business or leisure trips and the corresponding expenditures data were applied. Due to the nature of the events at the coliseum, some lodging expenses were attributed to RV parks rather than hotels. Expenditures were then entered into IMPLAN by sector. Again only 20 percent of gasoline expenditures were included in the model while other all expenditures were assumed to be made in Scurry County.

Spending by locals was not included in the overall economic contribution analysis (Crompton, 2006). However, it was recognized that the college serves as an anchor keeping locals from driving outside the county for entertainment. Snyder is within 100 miles of four metropolitan areas (Abilene, Lubbock, Midland, and San Angelo), so residents can easily travel to events in these locations. Spending by locals at WTC events was calculated in a separate model. Thirty percent of locals attending events were assumed to have remained in Snyder rather than travelling outside the county for entertainment. However, only one third of locals' expenditures on food and beverage were attributed to the event, suggesting that they made a special visit to a restaurant as part of attending the event. Gasoline purchases were

[7] Many of the students' visitors likely stayed with the students. However, some parents may have opted for a hotel. Hotel expenditures were included in the analysis because the Shifflett (2005) survey includes travelers across various rooming arrangements including non-paid lodging, and they estimate only $9.14 per person-day in hotel expenditures. Given that a Snyder hotel room costs $55 per night, one in 6 visitors might spend the night in a hotel.

[8] Some events at the college were hosted by outside groups hosting events, and their expenditures are inappropriate for this study. However, attendees came to Snyder because of the college facility. Furthermore, the majority of events were hosted by WTC.

[9] Other expenses were excluded from students' visitors' expenditures in an attempt to reflect expenditures by relatively poor college-aged individuals and parents who may visit the college repeatedly and thus not spend in a true tourist pattern. For event attendees, shopping is considered miscellaneous retail (IMPLAN sector 330), including gift shops, antique stores, and other specialty shops, while other expenditures were entered into the general merchandise retail sector (IMPLAN sector 329), which includes superstores as well as department, discount and dollar, and home and auto supply stores. Admittedly, "other expenditures" include a range of goods and services from mechanics to medical care. However, there is no "catch-all" sector in IMPLAN.

handled as a quarter of a tank (4.5 gallons) per 2.5 travel companions (DK Shifflett and Associates 2005). This method was used because locals were expected to travel fewer miles and in a different pattern than do nonlocal travelers.[10] No shopping, hotel, or other expenditures were included for local attendees.

Regional Spillovers

The Abilene, Lubbock, Midland, and San Angelo, Texas, MSAs are all within 100 miles of Snyder. Students can reach these destinations in roughly 90 minutes and frequently travel to these larger cities for shopping and recreation opportunities. The city of Snyder and WTC also have close economic ties to these larger regional trade centers. Regional spillover effects on the four MSAs include two components: direct student expenditures and the trade effects of WTC operations and visitors as estimated by the IMPLAN Version 3.0 multi-region analysis feature.

Students recorded their spending in each of the MSAs while on pleasure trips. These expenditures were averaged over respondents, and multiplied by 8 months and 527 full-time, on-campus students. The gasoline, restaurant, recreation, clothing, and other expenditures were then entered into appropriate sectors of the IMPLAN model.

IMPLAN Version 3.0 has a multi-region analysis component based on Bureau of Economic Analysis trade flows. Expenditures made in Scurry County were analyzed using the trade flows to estimate the contribution to the four nearby MSAs. Somewhat higher expenditures made in the entire WTC service area were not subjected to the trade flows model for several reasons. Jones County in the service area lies within the Abilene MSA. Event attendees were classified based on residency in a 100-mile radius, which would include the MSAs. Students may also not be aware of county borders when they reported spending in the service area. For example, Dickens County borders the Lubbock MSA, and Runnels County borders the San Angelo MSA's primary county.

Cumulative Earnings Potential

The earnings premium due to attainment of an associate's degree or some college above a high school diploma was combined with the percent of students who believed they would remain within a 100 mile radius of the WTC after graduation. Full- and part-time students were considered equally likely to remain in the area, as were online and on-campus students. Concurrent high school students and prison system students were excluded from the earnings potential analysis because they were likely to have different earnings influences. The present value of students' earning potential was considered for a 40-year working lifetime at a discount rate of two percent.

Results

Direct Contributions

College Expenditures

Western Texas College spent $15,432,561 in 2009. Table 1 provides a breakdown of expenditures by category; itemized breakdowns were not provided to avoid disclosure concerns in some sectors. The largest expenditure was compensation for non-student employees at $7,762,008.[11] The college spent $2,156,061 for fixed property expenditures such as contract services, insurance, and real estate payments. Other expenditures were each less than $1 million. Expenses associated with the WTC farm totaled $75,703, and museum expenditures were $17,000.

[10] Using the Shifflett (2005) travel expenditures data, locals would have spent more than $186,000 on transportation to local events versus the conservative $45,000 result of the carpooling calculations.

[11] The reader will recall that student employee compensation was excluded from the analysis by parts. However, it is part of the college's expenditures and is reported in Table 1.

Expenditures by Students

Average student expenditures are reported in Table 2. Students reported spending an average of $594.26 per month in Scurry County and an additional $225.91 in the remainder of the WTC service area. Gasoline was the students' largest expenditure category at $93.02 and $40.12 per month, in Scurry County and the rest of the service area respectively. Students spent $92.36 per month on groceries in Scurry County and $24.98 in the remainder of the area. Housing expenditures were $64.34 in Scurry County and $19.27 in the remainder of the area, but the housing expenses of students living in campus housing were not reported as those costs were included in the college expenditures. The only category in which expenditures were lower in the county than in the remainder of the service area was medical expenses; students reported spending $16.03 in Scurry County and $25.93 in the remainder of the service area. However, this anomaly is the result of a few large medical expenditures outside Scurry County; twice as many students reported having medical expenses in the county as beyond it.

Average expenditures by category were multiplied by 8 to capture time spent in the region during the two-semester academic year. The annual average spending per student was then multiplied by the 527 full-time, on-campus students. Total annual expenditures by all full-time, on-campus students were estimated at $2,505,414 in Scurry County and $952,423 in the remainder of the area for a total of $3,457,836.

Expenditures by Visitors

On average, students reported having .54 one-day visitors, .45 two-day visitors, and .34 longer term visitors for a total of 1.33 visitors each month. When these numbers were combined with the DK Shifflett and Associates (2005) travel expenditure data, students' visitors spent an estimated $21,400 on transportation, $133,093 on food and beverage, $58,839 on shopping, and $46,043 on lodging (Table 3). In sum, these visitors' spent $259,374 on trips to see WTC students.

Events at the coliseum resulted in 29,931 visitor-days, and non-coliseum events accounted for an additional 4,842 visitor-days. Based on Shifflett (2004) travel data, visitors spent $2,075,544 as a result of coliseum events, and locals spent another $250,291 (Table 4). Visitors spent $385,387 when attending other college events, and locals spent an additional $120,217. Food and beverage and lodging expenses were the largest expenditures of visitors.

Economic Contributions

The total economic contribution of WTC was estimated in IMPLAN Version 3.0 based on the direct contributions detailed above. The indirect and induced effects were modeled and summed with the direct effects to determine the total effect. The direct effects were $20,658,280 for Scurry County and $21,610,702 across the entire WTC service area. The only difference was additional student expenditures in the larger service area. Total economic contributions for Scurry County are in Table 4. Total contributions for the service area are in Table 5.

Western Texas College was associated with a total output contribution of $28.3 million in Scurry County for 2009. The college's contribution to gross regional product (value-added) was $16.2 million. The total employment contribution of 296 jobs corresponded with a labor income contribution of $12.6 million. The college's output contribution across the service area was $30.3 million. The value-added contribution was $16.7 million, and the labor income contribution was $12.9 million. The college supported an estimated 319 jobs in the area. Across the region, the output contribution of residents attending local events rather than events outside the area was estimated to be $423,240. This local contribution is not included in the reported contributions reported above.

Regional Spillovers

Students most often travelled to Lubbock and Abilene for pleasure trips. Abilene and Lubbock are the nearest and largest MSAs. Lubbock has 100,000 more residents than any of the other MSAs and is home to Texas Tech University, which is attended by many West Texas students. They reported spending an average of $132.16 in Lubbock, $83.40 in Abilene, $35.40 in San Angelo, and $27.03 in Midland each month (Table 6). Over the estimated 527 full-time campus students and 8 school-year months, these expenditures totaled an estimated $557,177 in Lubbock; $351,622 in Abilene; $149,235 in San Angelo; and $113,961 in Midland. The largest expenditure category in Lubbock and Abilene was clothing while gasoline was the largest expenditure on trips to San Angelo and Midland.

Student expenditures in each MSA stimulated additional economic activity in the respective metropolitan economies. Table 7 shows the total employment, labor income, value added, and output contributions on each MSA. Student expenditures in Lubbock were associated $874,659 in total output. Lubbock had the largest share of student out-of-town expenditures and was also the largest economy with the greatest economic linkages and thus the largest multipliers. Abilene had a total output contribution of $487,427. Midland and San Angelo had output contributions of $148,507 and $197,532, respectively.

Results of the multi-regional trade flow analysis were more modest (Table 8). Population estimates are included in Table 8 to facilitate an understanding of the size of the MSA economies. Expenditures by WTC, students, and visitors in Scurry County resulted in total output of $474,654 in Lubbock and $137,933 in Abilene. Again, Lubbock is a regional trade center with a large economy, supporting strong economic linkages. The trade-induced total outputs for Midland and San Angelo were $59,789 and $14,728, respectively.

Cumulative Earnings Potential

Forty-three percent of student survey respondents indicated that they intended to remain in the area. The college had 1,567 students outside the high school and prison systems. Thus, 674 students would likely remain within 100 miles of Snyder. Given an education premium of $3,201, these students could boost the region's income by a collective $2.15 million. Using a discount rate of two percent over a 40 year working lifetime, the present value of the earnings premium accrued by the current group of students could be $58.87 million. Only 30 percent of survey respondents were in the second or post-second year at WTC. When only about 36 percent of students continue past their first year, the annual earnings premium for each entering class (based on current enrollment levels) would be $1.36 million, or a discounted $38.08 million over a 40-year working lifetime.

Conclusion

This study has attempted to comprehensively analyze the economic contribution of a rural community college. It included college expenditures, expenditures by students and visitors, and the cumulative earnings power of graduates. The trade flows feature of IMPLAN Version 3.0 was used along with student spending data to estimate the economic effect of the rural school on nearby MSAs. This data may be beneficial in securing political and financial support for college activities. This framework combines elements of several college contribution studies and may be helpful to other rural community colleges in Texas and beyond.

Western Texas College contributes $28.3 million in output to the Scurry County economy and $30.3 million to the economy of the WTC service area. The college also supports jobs and income within the region. In addition, the college and its students contribute to the economies of four nearby metropolitan areas: Abilene, Lubbock, Midland, and San Angelo. Because rural counties have fewer business and economic linkages, they may be more closely linked to relatively proximate metropolitan areas. Identifying economic ties to these regions may be helpful in cultivating regional relations. As studies of other community colleges are completed, comparisons of spending patterns in rural and urban areas are likely to prove interesting.

Of course, these are only the financial benefits of the college. The social contribution of WTC's museum; college on the square; and theatrical, athletic and other events is not captured by the economic analysis. Consumer utility measurement (e.g., willingness to pay) is outside the scope of this study. However, social benefits associated with colleges are non-trivial and may be even more important in rural locations where residents may have few other cultural centers.

This study has not considered economic effects on specific industries. Analysis of college expenditures and local vendors could be valuable in supporting local purchases. In small rural economies, college expenditures directed to local businesses have a large potential economic contribution, especially as small local businesses may be more likely to employ local workers and use local suppliers. Some local vendors may qualify as historically underutilized businesses (HUB). Small business development centers (SBDCs) or state Cooperative Extension Services may be able to help vendors achieve HUB status and thereby help community colleges to purchase from local vendors while meeting HUB quotas.

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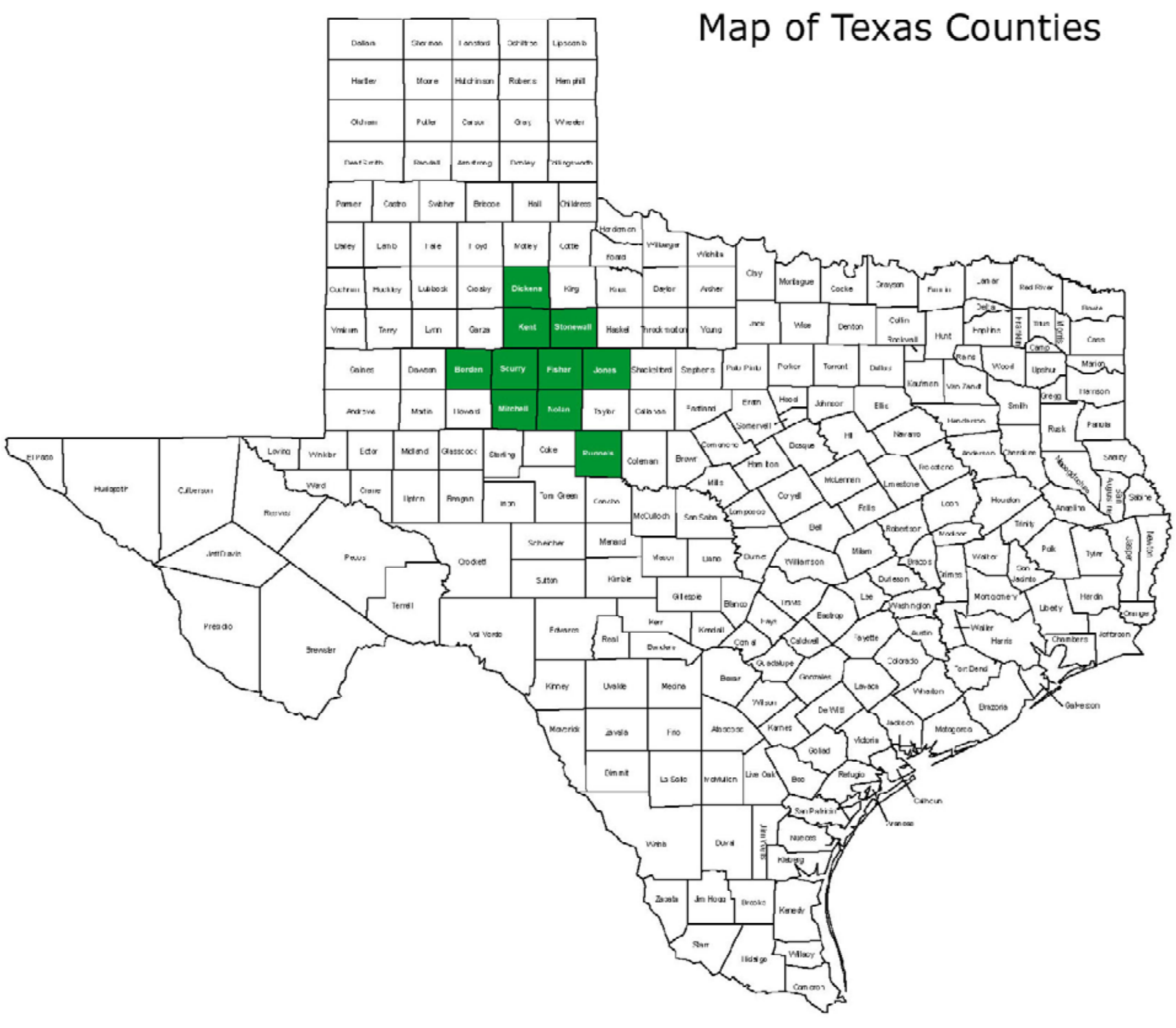

Figure 1. Western Texas College Service Area (Texas Higher Education Coordinating Board 2006)

Table 1. College Expenditures with IMPLAN Sectors.

Expenditure Category	IMPLAN Sector Numbers	Amount
Fixed Property Expenses (e.g., contract services, insurance, rent)	357, 360, 388, 387, 340	$2,156,061.17
Utilities	31, 32, 33, 390, 351	$927,162.12
Office Equipment and Supplies (except computer)	105, 113, 210, 212, 275, 301, 313, 339, 427, 365, 416, 417	$365,482.28
Computer and Communications Equipment	234, 235, 236, 238, 239, 240, 345, 416	$653,818.37
Classroom and Public Space Equipment (except computer equipment)	301, 254, 417	$97,827.30
Library Operations (except computer equipment)	341, 342, 343	$35,184.91
Athletic Goods	87, 93, 311	$84,222.21
Motor Pool	115, 276, 277, 278, 362, 414	$247,187.34
Other Retail Expenses	319, 324, 329, 331	$612,272.04
Professional Services (except computer services)	367, 368, 374, 376	$375,121.69
Computer and Information Services	350, 352, 353, 371, 372, 373	$227,410.70
Advertising	113, 341 ,342, 344, 345, 348, 349, 350	$81,629.55
Travel and Business Hosting	332, 336, 383, 411, 413	$497,551.25
Facility Maintenance	39, 40, 87, 130, 131, 138, 204, 417	$406,033.11
Construction	36, 38	$668,714.10
Non-Student Employee Compensation	5001	$7,762,008.26
Student Employee Compensation	--	$159,171.56
Operations Total		***$15,356,857.96***
Museum	406	$17,000.00
Farm Operations	1-6, 8-14, 19, 31, 32, 42, 115, 130, 131, 203, 379, 417,	$75,702.56
College Expenditure Total		**$15,432,560.52**

Table 2. Student Expenditures with IMPLAN Sectors.

Expenditure Category	IMPLAN Sector Numbers	Average Expenditures: Scurry County Amount	Average Expenditures: Remainder of Svc Area Amount	Total FT On-campus Student Spending: Scurry County Amount	Total FT On-campus Student Spending: Remainder of Svc Area Amount
Gasoline or Diesel	115	$93.02	$40.12	$392,190.91	$169,146.84
Auto Repair	414	$25.58	$8.62	$107,846.57	$36,360.70
Recreation (e.g., movies)	346	$32.18	$11.21	$135,685.24	$47,268.91
Clothing	327	$35.85	$23.34	$151,150.04	$98,404.02
School Supplies	329	$39.01	$2.98	$164,451.62	$12,565.15
Groceries	324	$92.36	$24.98	$389,409.28	$105,307.95
Other Expenses	329	$55.03	$19.19	$232,027.28	$80,914.06
Restaurants and Bars (off campus)	413	$59.23	$25.33	$249,719.02	$106,799.20
Off-campus housing	360	$64.34	$19.27	$271,260.02	$81,227.04
Electricity	31	$25.93	$7.14	$109,303.02	$30,101.14
Water/Sewer/Trash	33	$8.28	$2.06	$34,924.68	$8,690.67
Natural Gas	32	$10.87	$4.19	$45,823.69	$17,674.06
Cable/Internet	349	$14.67	$5.08	$61,840.80	$21,412.31
Medical (doctor/dentist)	396	$16.03	$25.93	$67,566.46	$109,303.02
Insurance through Local Agencies	358	$21.87	$6.46	$92,214.97	$27,247.51
Totals		**$594.26**	**$225.91**	**$2,505,413.60**	**$952,422.57**
Service Area Total			**$820.17**		**$3,457,836.17**

Table 3. Expenditures by Visitors and Locals.

	Gasoline	Shopping	Restaurant	Hotel	RV Park	Other	Total
Students' Visitors	$21,399.59	$58,838.79	$133,092.54	$46,043.37	--	--	**$259,374.28**
Coliseum Event Attendees	$127,962.20	$699,327.70	$790,480.22	$253,431.62	$22,037.53	$182,305.04	**$2,075,544.31**
Other Event Attendees	$27,981.69	$111,045.51	$123,621.10	$97,587.51	--	$25,151.19	**$385,387.00**
Total Visitor Expenditures							**$2,720,305.60**
Local Coliseum Attendees	$83,127.49	--	$167,163.36	--	--	--	**$250,290.84**
Local Attendees of Other Events	$45,509.19	--	$74,708.01	--	--	--	**$120,217.20**
Total Local Event Expenditures							**$370,508.04**

Table 4. Total Scurry County Economic Impacts.

	Impacts			
	Employment	**Labor Income**	**Value Added**	**Output**
College Expenditures	276.8	$10,502,924	$12,579,300	$22,061,568
Farm	0.1	$14,261	$23,920	$90,671
Museum	0	$501	$860	$18,432
Total College Expenditures	276.9	$10,517,686	$12,604,080	$22,170,671
Student Expenditures	36.6	$877,191	$1,689,186	$2,887,228
Expenditures by Students' Visitors	6.4	$119,060	$195,203	$342,319
Coliseum Event Attendees	46.9	$907,801	$1,466,530	$2,486,474
Other Event Attendees	8.2	$165,322	$273,799	$461,582
Total Visitor Expenditures	61.5	$1,192,183	$1,935,532	$3,290,375
Total WTC Impact	375.0078453	$12,587,060	$16,228,798	$28,348,274

Table 5. Total Economic Impacts Across WTC Service Area.

	Impacts			
	Employment	**Labor Income**	**Value Added**	**Output**
College Expenditures	282.5	$10,599,340	$12,843,247	$22,729,710
Farm	0.7	$13,843	$22,758	$92,840
Museum	0	$518	$1,012	$18,819
Total College Expenditures	283.2078453	$10,613,701	$12,867,017	$22,841,369
Student Expenditures	46.7	$1,095,662	$2,018,251	$4,111,059
Expenditures by Students' Visitors	7.1	$115,481	$184,627	$347,773
Coliseum Event Attendees	52.2	$888,602	$1,407,359	$2,531,487
Other Event Attendees	9.1	$160,673	$260,184	$469,547
Total Visitor Expenditures	68.4	$1,164,756	$1,852,170	$3,348,807
Total WTC Impact	398.3078453	$12,874,119	$16,737,438	$30,301,235

Table 6. Student Expenditures in Nearby MSAs

	Average Expenditures				Total FT On-campus Student Spending			
	Abilene	Lubbock	Midland	San Angelo	Abilene	Lubbock	Midland	San Angelo
Gasoline	$21.68	$32.75	$7.31	$11.33	$91,408.03	$138,062.03	$30,837.55	$47,775.20
Restaurants and Bars	$19.56	$29.26	$6.75	$7.01	$82,478.95	$123,350.22	$28,444.19	$29,548.82
Recreation (e.g., movies)	$10.59	$14.11	$4.41	$2.64	$44,627.00	$59,502.67	$18,594.59	$11,138.34
Clothing	$22.42	$35.96	$5.57	$11.27	$94,537.82	$151,610.31	$23,473.36	$47,499.04
Other Expenses	$9.15	$20.08	$2.99	$3.15	$38,569.96	$84,651.39	$12,611.18	$13,273.96
City Totals	**$83.40**	**$132.16**	**$27.03**	**$35.40**	**$351,621.76**	**$557,176.62**	**$113,960.87**	**$149,235.35**

Table 7. Total Economic Impacts from Student Expenditures in Nearby Metropolitan Areas.

	Impacts			
	Employment	**Labor Income**	**Value Added**	**Output**
Abilene	5.8	$123,388	$216,612	$487,427
Lubbock	9.8	$260,186	$484,582	$874,659
Midland	1.6	$40,272	$72,562	$148,507
San Angelo	2.1	$54,129	$101,531	$197,532

APPENDIX

Student Expenditure Survey

Western Texas College

WTC is currently assessing the contribution of the college and its students and visitors to the regional economy. As part of this effort, we are asking students to estimate and report their monthly expenditures. All of your answers are anonymous. Thank you for your responses!

Classification: First Year Second Year Post-second Year
Gender: Male Female

	Yes	No
Do you live in Scurry County (Snyder) during the school year (dorm or off-campus housing; your permanent/parents residence may be outside the county)?		
If yes, how many months of the year do you live in Scurry County?	___ months	
If you don't live in Snyder/Scurry Co, do you live within 50 miles of Snyder during the school year (your permanent/parents residence may be outside the region)?		
If yes, how many months of the year do you live within 50 miles of Snyder?	___ months	
Did you finish high school within 100 miles of Snyder or live in within 100 miles of Snyder as a permanent resident for at least a year before starting classes at WTC?		
Do you plan to remain within 100 miles of Snyder after graduation?		

Please fill out your monthly expenditures in each category. In the Snyder column, fill out what you spend in Snyder. In the 50 Mi column, fill out your expenditures within 50 miles of Snyder but not including purchases made in Snyder.

	Snyder	50 Mi		Snyder	50 Mi
Gasoline or Diesel	$	$	***Off-campus*** housing	$	$
Auto Repair	$	$	Electricity	$	$
Recreation (e.g., movies)	$	$	Water/Sewer/Trash	$	$
Clothing	$	$	Natural Gas	$	$
School Supplies	$	$			
Groceries	$	$	Cable/Internet	$	$
Other Expenses	$	$	Medical (doctor/dentist)	$	$
Restaurants and Bars (off campus)	$	$	Insurance through Local Agencies	$	$

Please fill out the number of pleasure trips you take each month to Abilene, Lubbock, Midland-Odessa, and San Angelo and fill out your monthly spending in each city. Do not include trips made to visit family in those cities. Only include trips to shop or attend recreational activities.

	Abilene		Lubbock		Midland-Odessa		San Angelo	
	# Trips	Monthly Spending	# Trips	Monthly Spending	# Trips	Monthly Spending	# Trips	Monthly Spending
Gasoline		$		$		$		$
Restaurants and Bars		$		$		$		$
Recreation (e.g., movies)		$		$		$		$
Clothing		$		$		$		$
Other Expenses		$		$		$		$

Number of people (friends, family) who visit you from outside 100 miles of Snyder each month and stay in Snyder:

One Day	Two Days	More than Two Days
____ visitors/month	____ visitors/month	____ visitors/month

Again, thank you for your responses. If you have any questions or concerns about this study, please contact Rebekka Dudensing, Texas AgriLife Extension Service, at rmdudensing@ag.tamu.edu

MID-CONTINENT
REGIONAL
SCIENCE
ASSOCIATION

Development and Application of a County-Level Disaster Impact Model for the Texas Gulf Coast

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Abstract. Natural disasters result in property losses as capital and inventory are destroyed. At the same time, many people temporarily flee the region, resulting in reduced expenditures by both households and businesses. Production and sales levels tend to remain depressed as the region rebuilds. However, direct losses account for only a portion of the total economic loss. Regional officials can aid recovery efforts by rapidly anticipating the economic losses resulting from a storm. This study develops a disaster impact model (DIM) to quantify the economic losses to the eight Texas counties affected by Hurricane Ike in 2008. Actual county sales data is modeled for a period of years, accounting for trends over time and between fiscal quarters. Deviations from this trend in the aftermath of Ike constitute the region's recovery path. IMPLAN input-output multipliers are applied to the direct loss values to estimate losses over the lifetime of the recovery period. Stochastic estimates of these total impacts are generated using Simetar. Losses are reported at the county and state levels for individual industries and the regional economy as a whole. The DIM is designed to enhance both risk management and storm recovery efforts.

Key Words: Disaster impact model, Hurricane economic impact

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Introduction

When Hurricane Ike hit the Texas Coast in September 2008, it resulted in devastating losses of lives and property. As a result, many industries faced sales losses in the aftermath of the storm. In many cases, production and sales levels remain depressed as the region rebuilds. However, direct losses account for only a portion of the total economic loss attributable to Ike. Each sale that does not occur triggers wider losses as businesses buy fewer inputs from suppliers and/or lay off employees. In turn, supply businesses and former employees reduce expenditures as well.

County and state officials, as well as coastal residents, want to restore the local environment and the local economy as quickly as possible following a storm. Ideally, they also attempt to limit potential losses. This study develops a disaster impact model (DIM) to quantify the economic losses to the eight Texas counties directly affected by Hurricane Ike in 2008. The DIM is intended to be a county-level tool to enhance risk management and storm recovery efforts. As such, the study considers the county-level impact of the storm on output, total value added (contribution to gross regional product), labor income, employment, and indirect businesses taxes. When the model is complete, county officials should be able to identify industrial sectors that are critical to economic recovery and estimate the probably recovery period. They can then prepare these sectors for an oncoming storm and prioritize the restoration of the sectors post-storm.

Brief Introduction to the Disaster Impact Literature

Okuyama (2007) provided a thorough discussion of the history of disaster impact analysis. He notes that the use of input-output models to measure the economic impact of disasters dates to World War II bombing studies. The input-output models are popular because they reflect the linkages within the local economy. Even if one sector is affected directly by the storm (for example, if offshore oil drilling is suspended as a hurricane approaches), other sectors are impacted indirectly.

West and Lenze (1994) enumerated the challenges to calculating the regional impacts of disasters: the size of the event is not well known, the wide range of industries affected sets the stage for double-counting, the event is neither exclusively supply- nor demand-driven, reactions of households are not well-understood, and the expected effects of wealth change may not be applicable given loss of shelter and physical possessions. West and Lenze identified potential direct impacts of disasters, including shifts in local demand relationships, labor imbalances, disrupted links between income and spending, altered investment links, housing supply and demand shifts, and possible work-force and migration changes. They noted in particular that sector demand may be atypical following a storm (e.g., an increase in construction) and that jobs created may be temporary and attract migrant workers. Impact models do not generally account for these scenarios. West and Lenze modeled the regional economic impact of Hurricane Andrew and found that regional purchasing patterns shifted but were difficult to quantify. Models were run under different scenarios to test assumptions. Reduction in property income and changes in migration and population dispersion resulted in significant impacts. Uninsured losses and tradeoffs between repair and replacement of damaged property had relatively modest effects. West and Lenze suggested that modeling could be improved by using historical experience with other disasters.

Rose (2004) noted that, devastating as economic losses from disasters were, they would be worse without preventative actions to mitigate impacts before, during and after the event. Rose modeled a water disruption simulation using a CGE model to study resilience, which he defined as behavioral resourcefulness in the face of disaster. Losses varied based on industries affected and the extent of mitigation and resilience. He identified complementarities between preventative mitigation and resilience but noted that ignoring resilience when modeling losses would result in inflated estimates of impacts.

Other work has focused on the effects of disasters over time. Okuyama et al (2004) attempted to incorporate dynamic aspects of disasters in a quarterly sequential interindustry model. Previously Cole (1988, 1989) had extended input-output models to include lagged expenditures to account for the lag times in goods production and labor market adjustment. Donaghy et al (2007) proposed a continuous time regional econometric input-output model to describe both short- and long-term effects of disasters. Still, Swenson (2010) noted that it is difficult to identify whether economic changes over time are attributable to a specific event, such as a natural disaster.

Mantell (2005) argued that disasters require immediate attention and that models that provide immediate results are needed, even though more complicated models may provide refined results at a later point. This study aims to provide such a rapid-response model while building a data set and model that is continually refined as more data becomes available.

Data

The study required annual or quarterly sales data to produce regressions for stochastic sales forecasts. Data availability drove the selection of input variables. Hurricanes tend to affect multiple states, and therefore the DIM is likely to be expanded to other Gulf states. Consequently, similar data sources must be available across multiple states to produce comparable results.

For most industries, county-level sales data from the Texas Comptroller of Public Accounts (Combs, 2010) was used to produce sales trends for each industry. Tax agencies in other states collect sales tax data for their respective counties or parishes so the data set could be expanded easily as additional states are added to the DIM. Quarterly sales for each county were available from 2002 until the first quarter of 2009. No other input variables were recorded for non-agricultural industries.

Deviations from trends are evident when browsing the data. Some industries, including the mining and oil sector, which is important to Texas coastal counties, experienced substantial setbacks. Sales in the mining sector declined by $17 million (42 percent) in first quarter 2009 as compared to first quarter 2008 (Figure 1). Meanwhile other industries, such as construction and information services, were buoyed by post-hurricane activity. Galveston County construction sales increased by almost $25 million (31 percent) from first quarter 2008 to first quarter 2009 as households and businesses began reconstruction efforts (Figure 2).

Recession data were collected, but no quarters were coded as recessionary. The 2001 recession ended before the sales tax data set began (National Bureau of Economic Research, 2008). Texas remained insulated from the recession that began in December 2007 until 2009. The recession in Texas was not severe by the first quarter of 2009, which is the only post-hurricane quarter currently used in the study.[1] At the same time, the recession hit different industries and different counties at different times. Recessionary effects will be explored more fully in a multi-state data set.

Most agricultural production and price data were obtained from the US Department of Agriculture—National Agricultural Statistics Service (2009). Agricultural statistics are available for all states at the county or parish level for each year back to 1968. Production and price data for the past eleven years (1999 to 2009) were collected. The 1999 to 2008 data were used to estimate

[1] A recessionary code for quarters after 2009 will not change the estimated coefficients and will affect only the stochastic predictions for those quarters.

production coefficients. Productivity has changed rapidly over time, and ten years was deemed to reflect current farming practices and policy while providing a sufficient time series from which to estimate future production. The 2009 data was the only year of post-hurricane comparison data available. National average prices were used, reflecting the global market for agricultural products and simplifying the future addition of counties and states to the model. Historical price data for goats and sheep were not published by USDA. Those annual prices were obtained from the Livestock Marketing Information Center (Anderson, 2010).

Deviations from the expected production levels account for losses to each crop. For most crops and livestock, the deviation was noted for 2009. By September, most 2008 crops had been harvested. The first livestock inventory after the hurricane occurred in January 2009. Crop losses thus included the loss of production capacity, and livestock losses include animal deaths and decreased livestock inventories.

Data on additional variables was collected and considered for the data set. However, gas prices were not significant in initial estimations. Disaster designations occur on a county basis and additionally have different effects on crops with different maturation cycles. Furthermore, disasters occur with varying levels of intensity. For example, droughts and flooding are both disasters but have different effects. Thus disaster designations were excluded from the data set due to the difficulty of gathering sufficient and meaningful data.

Methods

The first step in quantifying the economic losses to the eight counties in the study area was to identify the sales trend for each industry. Sales by each industry or commodity were regressed using the Simetar® Excel add-on (Richardson, Schumann, and Feldman, 2008). Simetar generated stochastic sales forecasts based on the regression coefficients. The stochastic element reflected production and price risk and the variability of production across years. These stochastic estimates were then combined with IMPLAN (MIG, 2009) multipliers to estimate total economic losses following Hurricane Ike.

The county-level sales data from the Texas Comptroller of Public Accounts (Combs, 2010) was used to establish a trend for sales based on the previous seven years and produce a stochastic sales forecast for the next eight quarters (two years).[2] Actual county sales data were modeled for a period of seven years with quarterly sales as the exogenous variable. Years and quarter dummies were the endogenous variables accounting for trends over time and between fiscal quarters. A recession dummy was included in the model for future use, but no quarters were coded as recessionary. Sales for the eight quarters from first quarter 2009 (September to November 2008) until fourth quarter 2010 (June to August 2010) were stochastically forecasted for each sector[3].

The sales of major agricultural products were estimated with year from the base year 1999, year from base squared, and previous year's price as the endogenous variables. Products that had only been grown a few times or that had not been grown in the last two years were not modeled. Commodities included in the model were corn, cotton, grain sorghum, rice, soybeans, wheat, beef cattle, goats, and sheep. Data from 1999 to 2008 were used to estimate coefficients for each commodity. Two additional years were stochastically forecasted for each product.

[2] The Texas fiscal year begins September 1. Hurricane Ike occurred at the beginning of the 2009 fiscal year.

[3] Haas, Kates, and Bowden (1977) found that reconstruction required a two to ten year period. Given that Hurricane Ike occurred in 2008, this study considers the first two years of recovery. Additional time will be added as needed.

Comptroller data was available only at the two-digit sector level. However, IMPLAN (MIG, 2009) uses more precise sector breakdowns in calculating industry multipliers. Weighted multipliers were used to capture the major industries within each two-digit sector. IMPLAN output data were used to identify the top three IMPLAN industries in each sector and determine their relative proportions within each county. The industry relative shares were multiplied by the respective industry multipliers for the county and the results summed to construct the weighted multiplier for each two-digit sector. Agricultural commodities used the multipliers for their respective IMPLAN-assigned industry.

The weighted multipliers were taken times the stochastic industry forecasts for each quarter to generate total economic effects. The eight quarterly total economic effects reflected the economic linkages associated with each industry and the indirect and induced effects of final demand sales. Agricultural commodities' multipliers and annual forecasts generated annual total economic effects for each economy. The total economic effect forecasts for each industry/commodity and quarter/year were then simulated using Simetar. The minimum, maximum, and mean total economic effect forecasts from the simulations were recorded as the average and bounds of the forecasted industry sales. Only the summary statistics were used to facilitate conversion to a Web-based delivery format and to aid comprehension by the general public. Stochastic effects were assigned a lower bound of zero as negative sales are precluded.

As noted in the previous section, only data for the first quarter 2009 were immediately available. Actual sales data for this quarter was multiplied by the weighted sector multiplier to produce an estimated actual economic effect. The first quarter 2009 total effects were subtracted from the non-negative forecasted negative effects to produce a minimum, maximum, and average losses attributable to Hurricane Ike. Negative losses, such as those experienced in many counties' information services sectors, indicated that the sector experienced higher than expected sales post-hurricane. As additional quarterly sales data becomes available, annual losses will be calculated as well. That feature is built into the model but irrelevant given that data was consistently available for only one quarter when the model was constructed.

States also have an interest in determining the state-wide impact from a storm. Summing county-level impacts leads to an under-representation of state-wide effects. Therefore, Texas state multipliers were used with the county industry shares and stochastic forecasts to calculate impacts across the entire state. The modeling process was identical to that used for the county-level models. Only the multipliers differed between the county and state models. Because IMPLAN is a linear model, summing the state multiplier results across counties produces an accurate estimation of statewide impacts.

Results

The model produces a large volume of results tables. To simplify discussion in this paper, only the Galveston County results are presented. Galveston was at the center of Hurricane Ike's final landfall and sustained severe damage. The Galveston economy is also large enough to sustain a measurable presence in all industry sectors, which is helpful in discussing the model's outcomes.[4] The results reflect changes in total economic impacts (i.e., direct, indirect and induced effects). Reported outcomes include output, total value added, labor income, employment, and indirect businesses taxes.

Most sectors experienced an average loss in the first quarter of 2009 compared to trend forecasts

[4] Smaller counties lacked some sectors. This did not pose a problem in the model; these sectors were excluded in results tables.

for the sectors' respective total economic output effects (Table 1). Manufacturing was the county's largest sector, and manufacturing triggered the largest absolute loss of total output ($4 billion). However, diminished sales in the utilities sector prompted the largest relative economic loss (57.7%). The construction, wholesale, finance, and transportation and warehousing sectors initiated average gains in total output, which may be attributable to the hurricane recovery efforts. Across the eight counties, wholesale and finance and insurance were most likely to experience gains rather than losses, although many counties did experience losses in these sectors. A $4 billion average loss across the entire county is estimated, although the figure may be as high as $20 billion. On the other hand, the county could have gained $3 million in output as a result of the mitigation and recovery efforts associated with the hurricane. Although the range of loss estimates was calculated, county and state officials are likely base actions on average or above-average losses.

Value-added, labor income, employment, and indirect business taxes are calculated as shares of output. Therefore, the same sectors that experienced average gains in output experienced average gains in other outcomes. The overall loss to Galveston County's value added or gross regional product was estimated to be more than $627 million (Table 2). The average total loss of labor income was estimated at $279 million (Table 3). About 3,900 Galveston County jobs were lost in the first quarter of 2009 (Table 4). In the quarter following the hurricane, the county likely lost more than $43 million in tax receipts (Table 5).

Conclusions

The results of the disaster impact model for Hurricane Ike validated that the storm did result in economic losses across Texas counties. The DIM also identified sectors that were most vulnerable to disruption and sectors that were positively affected by the storm. This should enhance disaster preparedness efforts and help officials to request and target disaster assistance. Local and state officials may be able to work with vulnerable sectors in mitigating storm damage. Officials may be able to promote rapid economic recovery by encouraging coordinated disaster planning across all sectors.

For the initial study, only first quarter 2009 post-hurricane data was available. As the project progresses, the recovery path of total economic impacts back toward the trend line will be analyzed to predict losses over the lifetime of the recovery period. This data will help officials to estimate likely impacts from potential or oncoming storms. The results can be (and in fact are currently being) adapted for a Web-based delivery system accessible by the general public. Additional counties can be added quickly as hurricanes threaten to make landfall. The model is also easy to update as new sales become available.

As more data is obtained following additional Gulf coast hurricanes, the data set and estimations should become more robust. However, such an enhanced data set will also require additional variables to represent past natural and man-made disasters. Weather experts are also predicting an active 2010 hurricane season, and the modeling of the Hurricane Ike recovery will be complicated should hurricanes strike the study area prior to the region resuming its trend sales levels. In addition, the April 2009 oil spill in the Gulf coast will complicate the modeling of the Hurricane Ike recovery should the spill reach the Texas coast. These issues will become even more important as the data set is expanded to Gulf states beyond Texas. As more information becomes available on the recession beginning in December 2007, recession data will also need to be added to the data set.

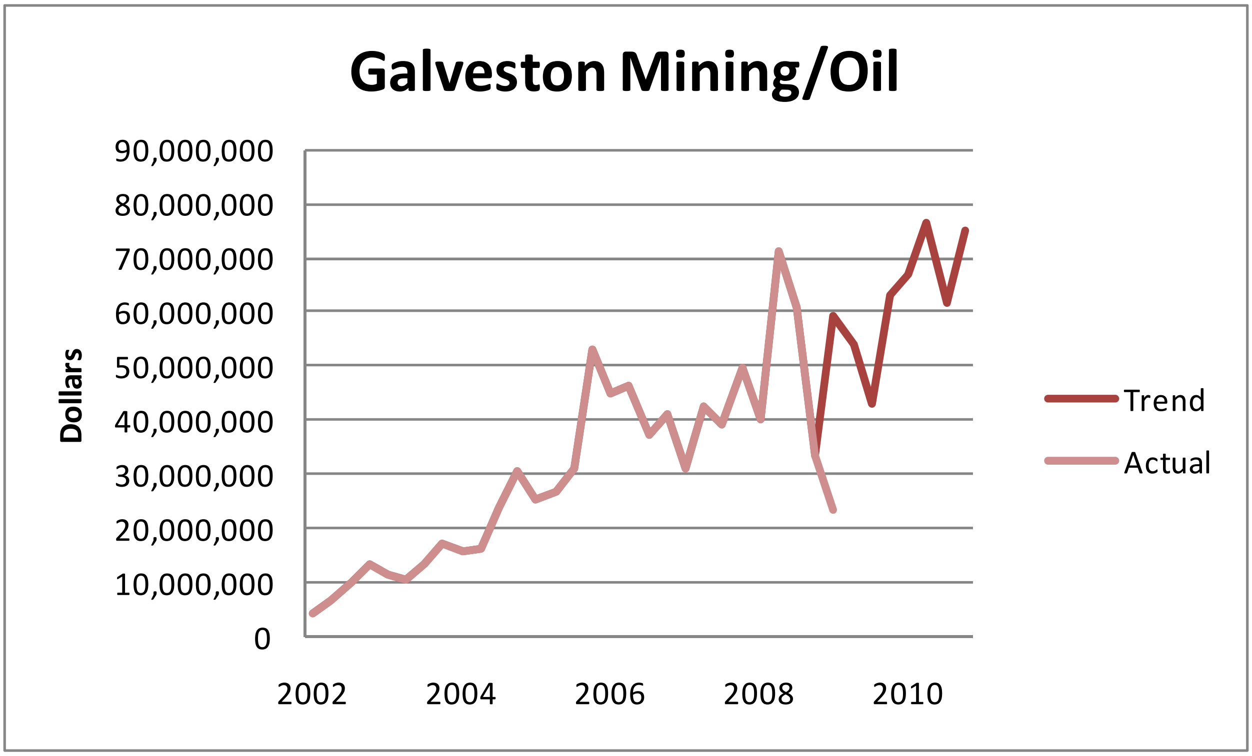

Figure 1. Trend versus actual sales for the Galveston County mining and oil sector (Combs, 2009).

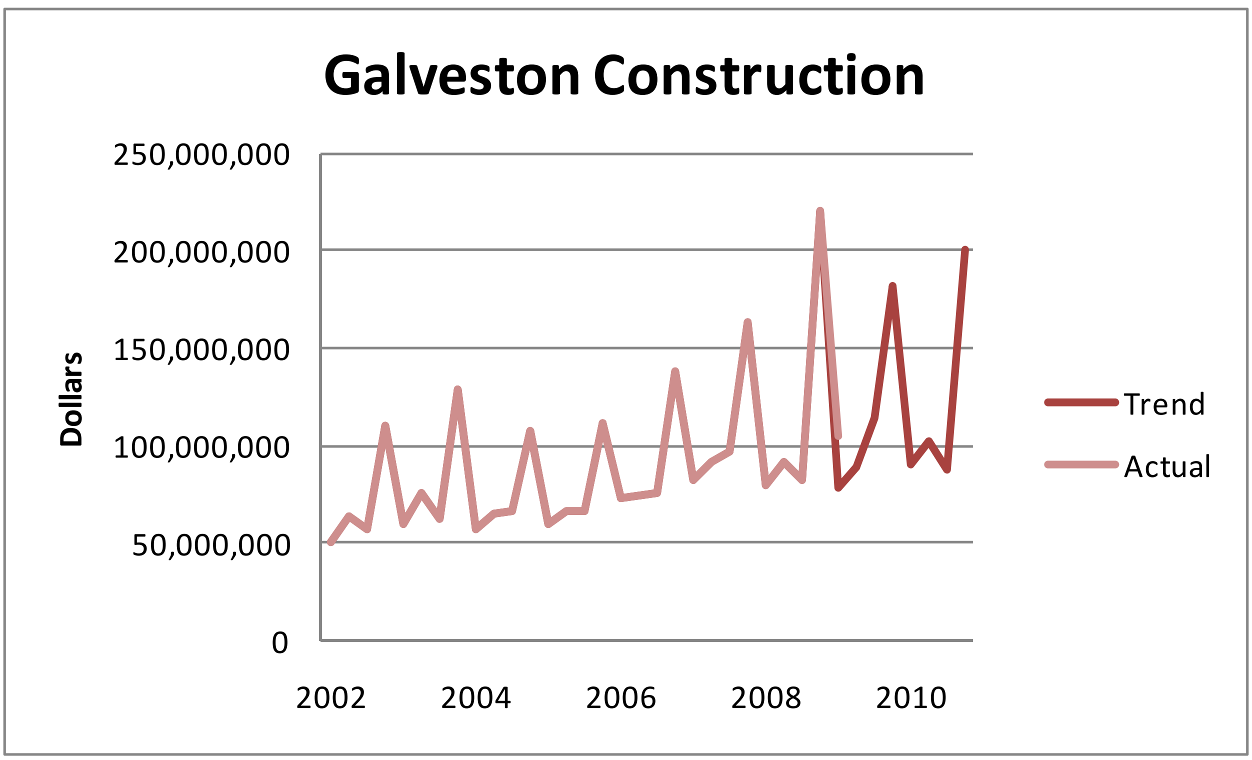

Figure 2. Trend versus actual sales for the Galveston County construction sector (Combs, 2009).

Table 1. Galveston County Output Forecasts, Figures, and Losses, First Quarter, 2009, Dollars.

		Agriculture Support	Mining/Oil/ Gas	Utilities	Construction	Manufac- turing	Wholesale	Retail Trade	Transport/ Warehouse
	Min	737,172	26,823,997	0	52,375,174	3,185,542,130	0	874,755,099	0
Simulated	Mean	1,434,991	64,503,939	44,839,176	134,170,301	9,779,393,651	0	974,112,066	16,803,575
	Max	2,127,574	102,873,187	276,598,669	216,414,550	16,859,834,725	8,099,376,955	1,075,237,220	44,650,913
	Actual	1,273,844	27,902,277	18,987,858	145,215,069	5,659,564,238	186,797,350	926,162,987	18,550,329
	Min	-536,672	-1,078,280	-18,987,858	-92,839,895	-2,474,022,109	-186,797,350	-51,407,888	-18,550,329
Loss	Mean	161,147	36,601,662	25,851,318	-11,044,768	4,119,829,413	-186,797,350	47,949,078	-1,746,754
	Max	853,730	74,970,910	257,610,810	71,199,481	11,200,270,487	7,912,579,605	149,074,232	26,100,584

		Information	Finance/ Insurance	Real Estate	Professional Services	Manage-ment	Adminis- tration	Education	Health Services	Entertain- ment	Hotel/Food	Other Services	Public Admin.
	Min	0	0	34,685,171	18,903,659	0	51,380,534	255,928	1,470,049	6,326,230	128,559,477	24,735,033	4,561,918
Simulated	Mean	15,264,490	3,428,326	45,272,251	42,582,501	3,183,153	93,878,342	2,449,594	4,582,435	21,573,445	171,399,070	92,770,348	5,242,233
	Max	43,681,262	7,413,497	55,558,699	62,728,674	9,446,125	145,679,868	4,477,836	8,093,247	37,608,155	197,898,128	164,361,777	6,005,708
	Actual	14,271,169	6,331,650	35,321,635	40,205,564	2,452,065	68,766,318	1,223,231	4,037,145	16,754,654	159,474,746	72,892,335	5,278,891
	Min	-14,271,169	-6,331,650	-636,464	-21,301,905	-2,452,065	-17,385,784	-967,303	-2,567,096	-10,428,424	-30,915,269	-48,157,302	-716,972
Loss	Mean	993,322	-2,903,323	9,950,616	2,376,937	731,087	25,112,024	1,226,363	545,290	4,818,791	11,924,324	19,878,013	-36,658
	Max	29,410,093	1,081,847	20,237,063	22,523,110	6,994,059	76,913,550	3,254,605	4,056,102	20,853,501	38,423,382	91,469,443	726,818

		Corn	Cotton	Grain Sorghum	Rice	Soybeans	Wheat	Beef Cattle	Goats	Sheep	**Total**
	Min	0	0	0	0	0	0	0	0	0	4,411,111,572
Simulated	Mean	0	0	0	0	0	0	14,129,506	0	0	11,531,013,395
	Max	0	0	557,655	2,884,301	0	0	31,814,104	0	0	27,455,322,830
	Actual	0	0	0	0	0	0	7,129,423	0	0	7,418,592,780
	Min	0	0	0	0	0	0	-7,129,423	0	0	-3,007,481,208
Loss	Mean	0	0	0	0	0	0	7,000,083	0	0	4,112,420,615
	Max	0	0	557,655	2,884,301	0	0	24,684,681	0	0	20,036,730,050

Table 2. Galveston County Total Value Added Forecasts, Figures, and Losses, First Quarter, 2009, Dollars.

		Agriculture Support	Mining/Oil/ Gas	Utilities	Construction	Manufac- turing	Wholesale	Retail Trade	Transport/ Warehouse
	Min	517,371	16,789,882	0	24,945,268	491,496,351	0	557,513,018	0
Simulated	Mean	1,007,123	40,374,800	29,378,607	63,902,683	1,508,859,748	0	620,836,801	9,198,827
	Max	1,493,201	64,391,174	181,227,320	103,074,005	2,601,298,903	5,124,265,506	685,287,514	24,443,372
	Actual	894,025	17,464,807	12,440,836	69,163,089	873,212,489	118,181,833	590,277,122	10,155,058
	Min	-376,654	-674,925	-12,440,836	-44,217,821	-381,716,138	-118,181,833	-32,764,104	-10,155,058
Loss	Mean	113,098	22,909,993	16,937,772	-5,260,406	635,647,259	-118,181,833	30,559,679	-956,230
	Max	599,176	46,926,367	168,786,484	33,910,916	1,728,086,414	5,006,083,672	95,010,392	14,288,314

		Information	Finance/ Insurance	Real Estate	Professional Services	Manage-ment	Adminis- tration	Education	Health Services	Entertain- ment	Hotel/Food	Other Services	Public Admin.
	Min	0	0	26,370,203	10,772,371	0	34,275,644	147,097	911,817	2,289,443	66,703,809	13,125,901	1,725,153
Simulated	Mean	7,189,654	2,251,961	34,419,276	24,265,911	1,801,717	62,625,675	1,407,928	2,842,314	7,807,361	88,931,373	49,229,546	1,982,424
	Max	20,574,100	4,869,696	42,239,785	35,746,336	5,346,663	97,182,160	2,573,680	5,019,940	13,610,272	102,680,559	87,220,280	2,271,143
	Actual	6,721,794	4,159,064	26,854,090	22,911,398	1,387,910	45,873,595	703,064	2,504,091	6,063,456	82,744,370	38,681,072	1,996,286
	Min	-6,721,794	-4,159,064	-483,886	-12,139,027	-1,387,910	-11,597,951	-555,967	-1,592,274	-3,774,014	-16,040,562	-25,555,171	-271,133
Loss	Mean	467,860	-1,907,103	7,565,186	1,354,513	413,808	16,752,079	704,864	338,223	1,743,905	6,187,003	10,548,473	-13,863
	Max	13,852,306	710,632	15,385,695	12,834,938	3,958,754	51,308,564	1,870,616	2,515,849	7,546,816	19,936,188	48,539,207	274,856

		Corn	Cotton	Grain Sorghum	Rice	Soybeans	Wheat	Beef Cattle	Goats	Sheep	**Total**
	Min	0	0	0	0	0	0	0	0	0	1,247,583,329
Simulated	Mean	0	0	0	0	0	0	3,032,266	0	0	2,561,345,996
	Max	0	0	272,542	1,409,641	0	0	6,827,472	0	0	9,213,325,265
	Actual	0	0	0	0	0	0	1,530,011	0	0	1,933,919,463
	Min	0	0	0	0	0	0	-1,530,011	0	0	-686,336,134
Loss	Mean	0	0	0	0	0	0	1,502,254	0	0	627,426,534
	Max	0	0	272,542	1,409,641	0	0	5,297,461	0	0	7,279,405,802

Table 3. Galveston County Labor Income Forecasts, Figures, and Losses, First Quarter, 2009, Dollars.

		Agriculture Support	Mining/Oil/ Gas	Utilities	Construction	Manufac-turing	Wholesale	Retail Trade	Transport/ Warehouse
	Min	551,601	6,247,236	0	20,013,031	227,817,052	0	348,933,561	0
Simulated	Mean	1,073,756	15,022,791	9,219,482	51,267,695	699,382,568	0	388,566,345	6,351,436
	Max	1,591,993	23,958,884	56,872,061	82,693,972	1,205,746,996	2,916,526,366	428,904,447	16,877,207
	Actual	953,175	6,498,364	3,904,135	55,488,001	404,749,079	67,264,359	369,439,800	7,011,676
	Min	-401,574	-251,128	-3,904,135	-35,474,970	-176,932,027	-67,264,359	-20,506,239	-7,011,676
Loss	Mean	120,581	8,524,427	5,315,346	-4,220,307	294,633,489	-67,264,359	19,126,545	-660,240
	Max	638,818	17,460,520	52,967,926	27,205,971	800,997,917	2,849,262,007	59,464,646	9,865,531

		Information	Finance/ Insurance	Real Estate	Professional Services	Manage-ment	Adminis-tration	Education	Health Services	Entertain-ment	Hotel/Food	Other Services	Public Admin.
	Min	0	0	6,358,657	4,715,544	0	23,862,398	118,482	716,793	1,238,164	40,704,208	4,922,163	1,181,086
Simulated	Mean	2,945,178	1,078,503	8,299,533	10,622,265	1,236,423	43,599,436	1,134,039	2,234,386	4,222,335	54,267,982	18,460,892	1,357,220
	Max	8,427,999	2,332,181	10,185,295	15,647,756	3,669,132	67,657,353	2,073,013	3,946,251	7,360,634	62,658,053	32,707,273	1,554,885
	Actual	2,753,524	1,991,848	6,475,337	10,029,335	952,449	31,936,788	566,295	1,968,504	3,279,206	50,492,529	14,505,255	1,366,711
	Min	-2,753,524	-1,991,848	-116,680	-5,313,790	-952,449	-8,074,390	-447,813	-1,251,711	-2,041,042	-9,788,322	-9,583,092	-185,625
Loss	Mean	191,655	-913,344	1,824,196	592,930	283,974	11,662,648	567,744	265,882	943,129	3,775,452	3,955,637	-9,491
	Max	5,674,475	340,334	3,709,958	5,618,422	2,716,683	35,720,565	1,506,718	1,977,747	4,081,428	12,165,523	18,202,018	188,174

		Corn	Cotton	Grain Sorghum	Rice	Soybeans	Wheat	Beef Cattle	Goats	Sheep	**Total**
	Min	0	0	0	0	0	0	0	0	0	687,379,976
Simulated	Mean	0	0	0	0	0	0	683,457	0	0	1,321,025,723
	Max	0	0	72,112	372,976	0	0	1,538,877	0	0	4,953,375,715
	Actual	0	0	0	0	0	0	344,857	0	0	1,041,971,226
	Min	0	0	0	0	0	0	-344,857	0	0	-354,591,250
Loss	Mean	0	0	0	0	0	0	338,600	0	0	279,054,497
	Max	0	0	72,112	372,976	0	0	1,194,020	0	0	3,911,404,489

Table 4. Galveston County Employment Forecasts, Figures, and Losses, First Quarter, 2009, Dollars.

		Agriculture Support	Mining/Oil/ Gas	Utilities	Construction	Manufac-turing	Wholesale	Retail Trade	Transport/ Warehouse
	Min	19	55	0	348	2,695	0	13,142	0
Simulated	Mean	37	131	107	892	8,275	0	14,635	145
	Max	55	209	660	1,440	14,266	48,812	16,154	387
	Actual	33	57	45	966	4,789	1,126	13,915	161
	Min	-14	-2	-45	-618	-2,093	-1,126	-772	-161
Loss	Mean	4	74	62	-73	3,486	-1,126	720	-15
	Max	22	152	615	474	9,477	47,686	2,240	226

		Information	Finance/ Insurance	Real Estate	Professional Services	Manage-ment	Adminis-tration	Education	Health Services	Entertain-ment	Hotel/Food	Other Services	Public Admin.
	Min	0	0	233	83	0	449	6	12	58	2,014	174	22
Simulated	Mean	46	22	304	186	19	820	61	39	199	2,685	652	25
	Max	131	47	374	274	56	1,272	112	68	347	3,101	1,155	29
	Actual	43	40	238	176	15	600	31	34	155	2,499	512	26
	Min	-43	-40	-4	-93	-15	-152	-24	-22	-96	-484	-338	-3
Loss	Mean	3	-18	67	10	4	219	31	5	44	187	140	0
	Max	88	7	136	98	42	671	81	34	193	602	643	4

		Corn	Cotton	Grain Sorghum	Rice	Soybeans	Wheat	Beef Cattle	Goats	Sheep	**Total**
	Min	0	0	0	0	0	0	0	0	0	19,311
Simulated	Mean	0	0	0	0	0	0	206	0	0	29,487
	Max	0	0	17	88	0	0	464	0	0	89,517
	Actual	0	0	0	0	0	0	104	0	0	25,561
	Min	0	0	0	0	0	0	-104	0	0	-6,250
Loss	Mean	0	0	0	0	0	0	102	0	0	3,926
	Max	0	0	17	88	0	0	360	0	0	63,956

Table 5. Galveston County Indirect Business Tax Forecasts, Figures, and Losses, First Quarter, 2009, Dollars.

		Agriculture Support	Mining/Oil/ Gas	Utilities	Construction	Manufac-turing	Wholesale	Retail Trade	Transport/ Warehouse
Simulated	Min	20,720	1,698,566	0	1,099,841	39,393,410	0	112,747,846	0
	Mean	40,334	4,084,559	4,552,028	2,817,479	120,935,039	0	125,554,041	335,506
	Max	59,801	6,514,201	28,080,016	4,544,548	208,493,987	968,069,111	138,588,138	891,517
	Actual	35,805	1,766,846	1,927,628	3,049,411	69,987,941	22,326,748	119,373,848	370,383
Loss	Min	-15,085	-68,280	-1,927,628	-1,949,570	-30,594,531	-22,326,748	-6,626,002	-370,383
	Mean	4,529	2,317,714	2,624,400	-231,932	50,947,098	-22,326,748	6,180,193	-34,876
	Max	23,996	4,747,356	26,152,388	1,495,137	138,506,046	945,742,363	19,214,291	521,134

		Information	Finance/ Insurance	Real Estate	Professional Services	Manage-ment	Adminis-tration	Education	Health Services	Entertain-ment	Hotel/Food	Other Services	Public Admin.
Simulated	Min	0	0	3,759,821	434,718	0	1,414,610	7,050	35,471	234,658	7,699,662	1,055,535	55,954
	Mean	892,474	83,919	4,907,445	979,250	69,342	2,584,660	67,475	110,570	800,219	10,265,404	3,958,852	64,298
	Max	2,553,925	181,468	6,022,480	1,442,542	205,774	4,010,861	123,343	195,283	1,394,991	11,852,481	7,013,921	73,662
	Actual	834,397	154,987	3,828,813	924,588	53,416	1,893,276	33,694	97,413	621,477	9,551,234	3,110,584	64,748
Loss	Min	-834,397	-154,987	-68,992	-489,870	-53,416	-478,666	-26,645	-61,942	-386,819	-1,851,572	-2,055,049	-8,794
	Mean	58,077	-71,068	1,078,632	54,661	15,926	691,385	33,780	13,157	178,742	714,170	848,268	-450
	Max	1,719,529	26,482	2,193,668	517,953	152,358	2,117,585	89,649	97,870	773,515	2,301,247	3,903,337	8,915

		Corn	Cotton	Grain Sorghum	Rice	Soybeans	Wheat	Beef Cattle	Goats	Sheep	**Total**
Simulated	Min	0	0	0	0	0	0	0	0	0	169,657,861
	Mean	0	0	0	0	0	0	367,776	0	0	283,470,668
	Max	0	0	7,794	40,310	0	0	828,088	0	0	1,391,188,242
	Actual	0	0	0	0	0	0	185,571	0	0	240,192,804
Loss	Min	0	0	0	0	0	0	-185,571	0	0	-70,534,943
	Mean	0	0	0	0	0	0	182,205	0	0	43,277,864
	Max	0	0	7,794	40,310	0	0	642,516	0	0	1,150,995,438

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Mid-Continent Regional Science Association

An Examination of Recent Migration to Arizona

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Abstract: In the decades leading up to the current recession Arizona's population growth was among the fastest in the nation, with net domestic inmigration a major source of growth. In this paper we use Internal Revenue Service county migration data to examine migration flows to Arizona between 2006 and 2007. We examine both inmigration and net migration for Arizona counties and focus on the attraction of Arizona to outmigrants from other counties in the United States as well as from other states as a whole. We also examine migration flows with respect to distance from Arizona and location-specific factors in the origin and destination counties that impact migration decisions.

Introduction

Arizona's history has been characterized by continuing and significant levels of migratory population flows both into and out of the State. Inmigration to Arizona from other states has exceeded the numbers for most states for several decades, and the influx of new residents has been a key contributor to Arizona's growth. IRS migration data indicate that domestic migration into Arizona reached 202,706 persons over the 2006-2007 timeframe, well above the 148,816 residents who left Arizona for other U.S. states. The level of migration flows has been attributed to numerous causes, including the low cost of housing, job availability, and quality of life.

The number of inmigrants is smaller than the numbers of new migrants in earlier years of the decade, and the number of migrants has continued to drop in more recent periods as migration in general has slowed with the downturn in the U.S. economy. Nevertheless, the gains in population over the past decade will result in an increase of one or two congressional seats for Arizona after the completion of the 2010 Census.

Among its many inmigrants, and perhaps the most recognized, are the large numbers of retirement-age persons Arizona attracts each year. A number of variables play a significant role in the migration decisions for this group of movers. In a study conducted for the Arizona Department of Commerce, Rex (2002) hypothesizes that the location decision is initially a function of the impression of a community that future migrants developed during the time of a previous tourist-related visit to the area.

Rex cites a number of other factors to explain Arizona inmigration including the distance from their current residence and from family and friends, the presence of a warm year-round climate with mild seasons, scenic beauty and recreational opportunities, proximity to urban areas in order to gain access to medical care, the presence of numerous cultural amenities which may not be available in smaller locations, and a general ability to obtain housing at average to below-average costs relative to other areas. Most observers will agree with Rex that Arizona's growth in retirement-age population has been fueled by a relatively low cost of living across much of the warmer portions of the state along with relatively low tax burdens on residents and a generous presence of numerous cultural amenities in the State's two largest metropolitan areas.

In considering movement among the entire population, the migration literature has fully documented examples that address the factors that lie behind the decision to migrate, and confirms that existing conditions in places of origin and destination are important along with other factors including the age of the migrant, ties to friends and family and a personal attachment to the location where the individual currently resides (Muth, 1971; Greenwood, 1975, 1985; and Partridge and Rickman, 2006).

The presence of a favorable climate and the existence of natural amenities were modeled as long ago as the 1950's by Ullman (1954). More recently, the role of amenities in the migration decision has generated considerable research, particularly as lifestyle changes have become more important. Vias (1999) investigated changing preference patterns to include environmental amenities and a rural lifestyle as opposed to reasons aligned with improving economic opportunities. Vias also recognized the importance of nonemployment income in the migration decision for those persons who are motivated to relocate but who are not seeking employment.

In addition to the specific impacts of climate, other factors comprising the quality of life also have been shown to be significant by Cushing (1987), Cebula (2005), and Cebula and Payne (2005) as has the role of location-specific amenities (McGranahan, 1999; Green, 2001; Deller et al., 2001; Graves (1973, 1979, 1980); and Gunderson and Ng, 2006.) Climate and quality of life take on different meanings as people age, and thus people will migrate for quite different reasons over the course of their life cycle (Whisler et al., 2008), and Plane and Jurjevich (2008) use age-specific migration flows to examine the relative propensities of persons to migrate up or down the urban hierarchy.

The factors noted above play primary, but general, roles in the decision as to whether or not to migrate, and may serve as general macro indicators concerning what is important to the migrant. However, a more specific set of factors may emerge when the decision reaches the local (micro) level. The decision to move to Arizona may be based upon climate factors; however, a separate decision occurs when the migrant must consider factors such as job opportunities or the cost of housing which may vary across cities and counties within the state.

Some migrants will weigh the tradeoffs that exist among the numerous economic and amenity variables that are present in a region (Porell, 1982). In other instances, the pull of favorable environmental factors has outweighed economics considerations (Roback, 1982; Blanchflower and Oswald, 1994).

This paper examines domestic migration flows of United States residents into Arizona for the 2006-2007 time period. While elderly migration is clearly an important component of this migration, we will examine migration for all ages. Migration flows are analyzed on the basis of spatial components with a focus on the characteristics of the counties of origin for many of these migrants. In the following sections, we will summarize flows by Arizona county, then focus on the origin locations of inmigrants, examine migration to Arizona in the context of movement within the urban hierarchy, and, finally, examine gravity models describing the inmigration flows as a function of distance, sending county population, and selected economic characteristics.

Data and Summary of Flows by Arizona County

The data used for this paper are largely based on the Internal Revenue Service Statistics on Income County-to-County migration dataset for 2006-2007. Population movements are tracked by the IRS using changes in addresses linked to individual tax returns from one year to the next. Thus, the data for this study are based on tax returns filed in 2007 that reflect migration flows occurring between 2006 and 2007.

During this twelve month period net migration into the State was 53,890 persons, reflecting the difference between the 202,706 persons moving in and 148,816 persons moving out of Arizona. Only Texas and Florida experience significantly larger net migration flows, with Georgia and North Carolina experiencing similar levels of net inmigration.

In order to gain a better grasp of the effect of conditions in the destination state of Arizona, it is useful to first examine the urban geography of Arizona, which is summarized in Figure 1, the Census Bureau map of metropolitan and micropolitan areas. The Phoenix metropolitan area consists of the two counties of Maricopa, with over three million residents, and Pinal, with another quarter million residents. The other major metropolitan area, Tucson, consists of the single county of Pima with about one million residents. In addition, Arizona has the less-known metropolitan areas of Flagstaff, Prescott, and Yuma, each of which is a single county. Six of the remaining counties comprise the five micropolitan statistical areas, and only three counties are neither metropolitan nor micropolitan.

Figure 1. Arizona Metropolitan and Micropolitan Areas.

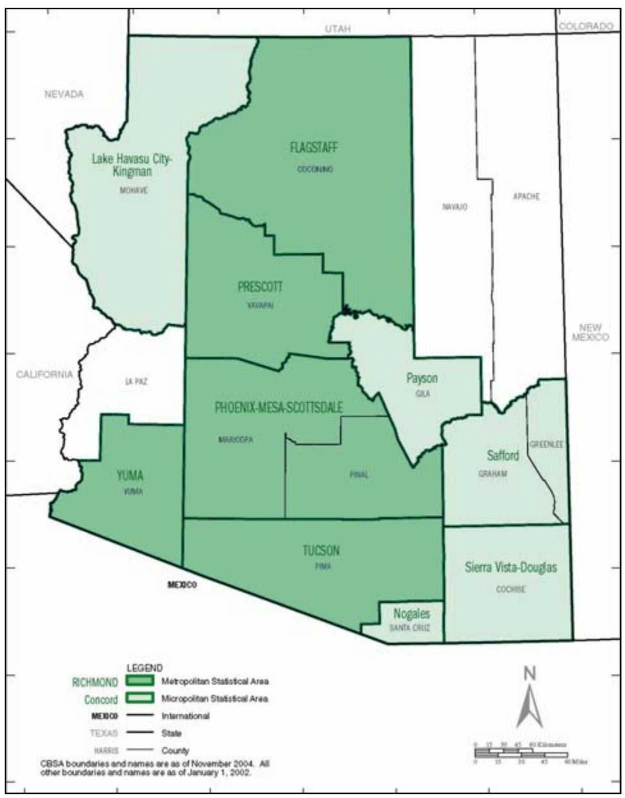


Figure 2 provides a picture of total out-of-state inmigration to Arizona for 2006-2007. Maricopa County received over 119,000 persons, or 59 percent of the total new migrants. Pima County received 13 percent. Each of the remaining 13 Arizona counties experienced smaller numbers of domestic migrants from other states. (See Table A1 in the appendix for specific migration flows for each of the counties.)

Figure 2. Out-of-State Inmigration by Arizona County.

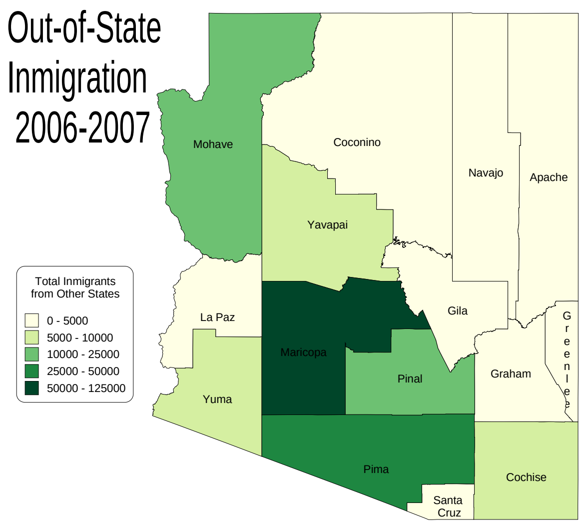
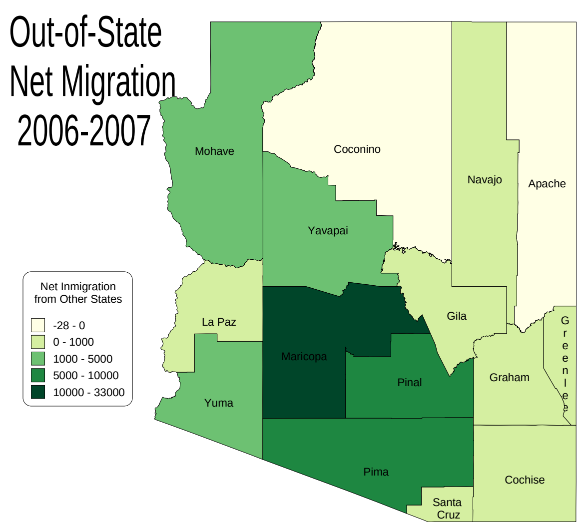


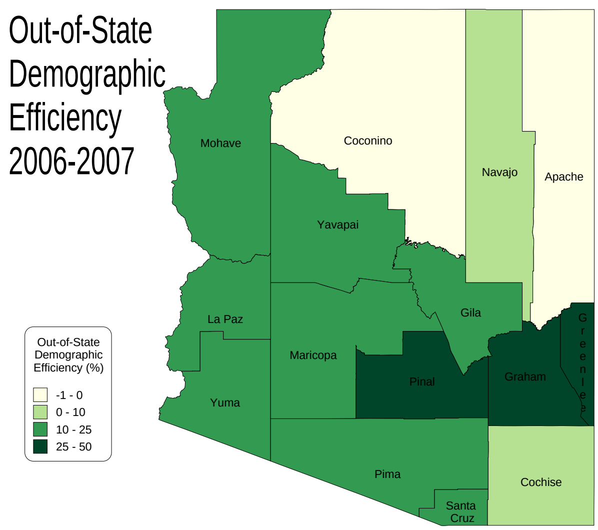
Figure 3. Net Out-of-State Inmigration by Arizona County.



Net migration patterns are shown in Figure 3. These numbers are important since they represent a proxy for the relative attractiveness of Arizona counties for persons moving in and out of Arizona. Overall, Arizona experienced net inmigration of 53,890 domestic residents; however, Maricopa County accounted for 32,000 of this number or about 60 percent of the net gain to the state. Pinal County, which borders the eastern side of Maricopa, received 13 percent of the net gain, and the Tucson region (Pima County) was the recipient of almost 11 percent of the net migration numbers. Ten of the 12 less-populous counties experienced positive net migration; however, Apache and Coconino counties recorded net population losses as a result of the migration flows.

We obtain a clearer picture of the relative attraction of counties when we examine demographic efficiency, where net migration is compared to the sum of in- and out-migration. Using this measure, Pinal County's demographic efficiency exceeds 40 percent, greatly exceeding the efficiency ratio for Graham County (27%), the second largest percentage. The demographic efficiency in each county is highlighted in Figure 4. A casual review of the numbers shows that demographic efficiency is generally higher for the southern and western counties in the state. These counties typically include the warmer climate regions of the state, while the two counties that experienced negative demographic efficiency are from higher-altitude, colder regions.

Figure 4. Demographic Efficiency of Out-of-State Inmigration.



Sources of Migrants by Outflow from Major Destination States

When we turn our attention to the sources rather than the destinations of migration to Arizona, we find another interesting pattern of movement. The Top 10 states in terms of sending the highest numbers of migrants to Arizona over this period, based on county migration flows of at least 10 IRS tax returns, are shown in Table 1. California was the largest sending state as almost 56,000 Californians relocated to Arizona. Texas was the second highest sending state with over 12,000 residents moving to Arizona. Illinois, New Mexico and Washington round out the top five sending states, with each sending over 8,000 residents during the year.

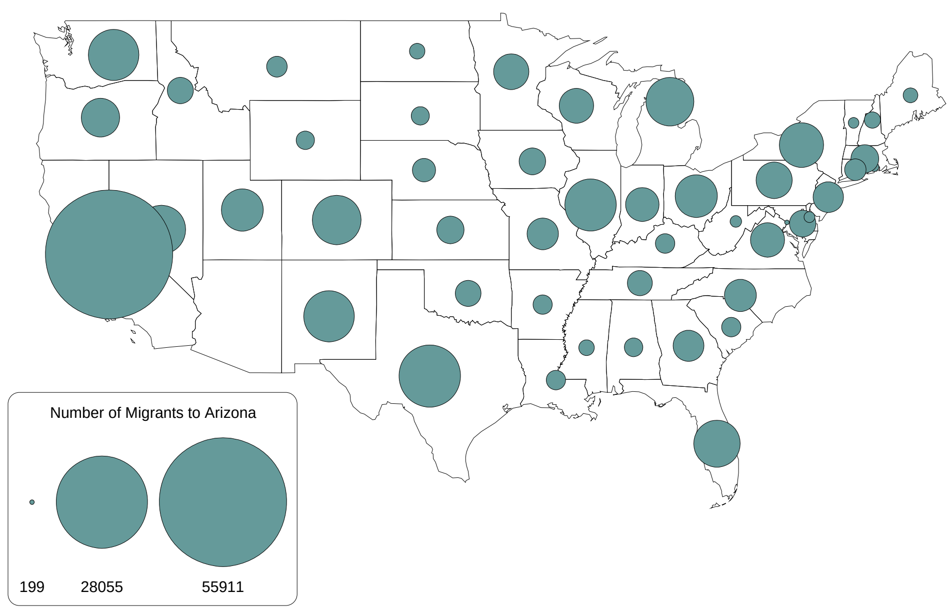
Table 1. Number of Inmigrants to Arizona Ranked by Top 10 Sending States.

California	55,911
Texas	12,178
Illinois	8,342
New Mexico	8,025
Washington	8,010
Colorado	7,420
Nevada	7,292
Michigan	7,172
Florida	6,674
New York	6,022

Source: Internal Revenue Service Statistics on Income State-to-State Migration 2006-2007.

Flows from all states are shown in Figure 5. We find significant magnitudes from additional North Central states such as Minnesota and Wisconsin in addition to several more populous east coast states. Despite similar or smaller sending-state populations, we see larger migration flows from the Northern plains and mountain states compared to northern New England and several Deep South states.

Figure 5. Arizona Inmigration by State of Origin.

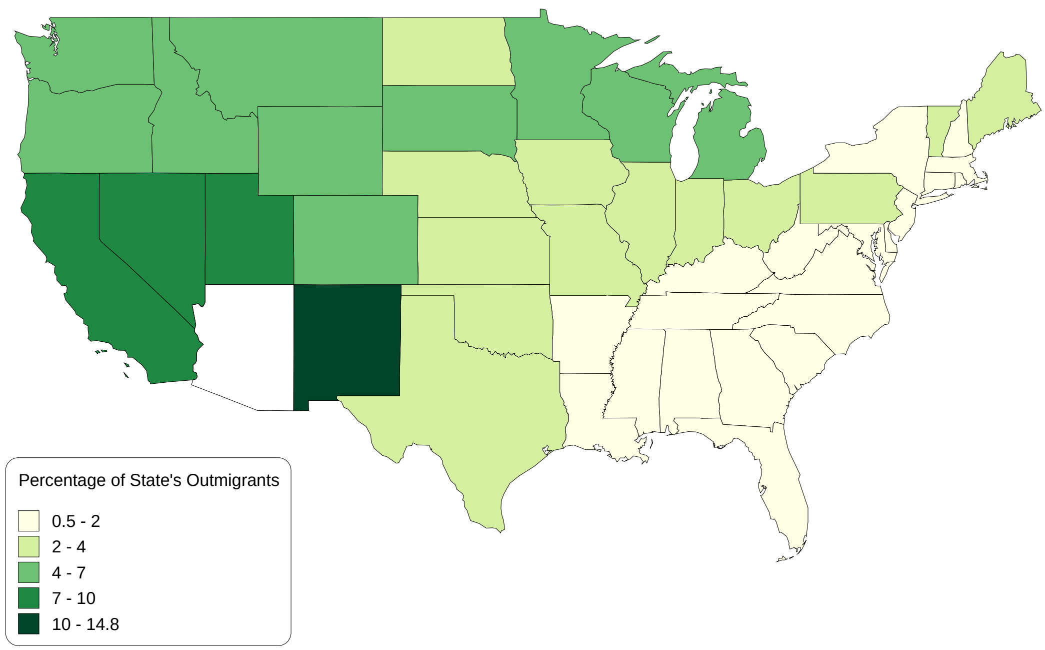


1. Arizona Migration as a Percentage of Total State Outmigration

If viewed from a simple gravity formulation, none of the existing patterns is too surprising, i.e., higher levels of migration from nearby and more populous states. However, we can gain further insight by filtering the gross migration numbers through additional procedures. First we consider the flow of migrants to Arizona as a percentage of all outmigrants from a state.

The results are shown in Figure 6. Since this standardization largely controls for population, we expect to see a major distance effect, which is evident on the map. However, the pattern is more complex than a simple distance effect. For the closest states, New Mexico has a much stronger link with Arizona, sending almost fifteen percent of outmigrants to Arizona, a full five percentage points higher than California. In the second grouping of states, seven to ten percent, the absence of Colorado and Texas, considerable migration magnets themselves, stands out. In the four to six percent bracket, the extension eastward to include South Dakota, Minnesota, Wisconsin, and Michigan captures what is most likely an amenity effect and historical migration link.

Figure 6. Percentage of State's Outmigrants Moving to Arizona.

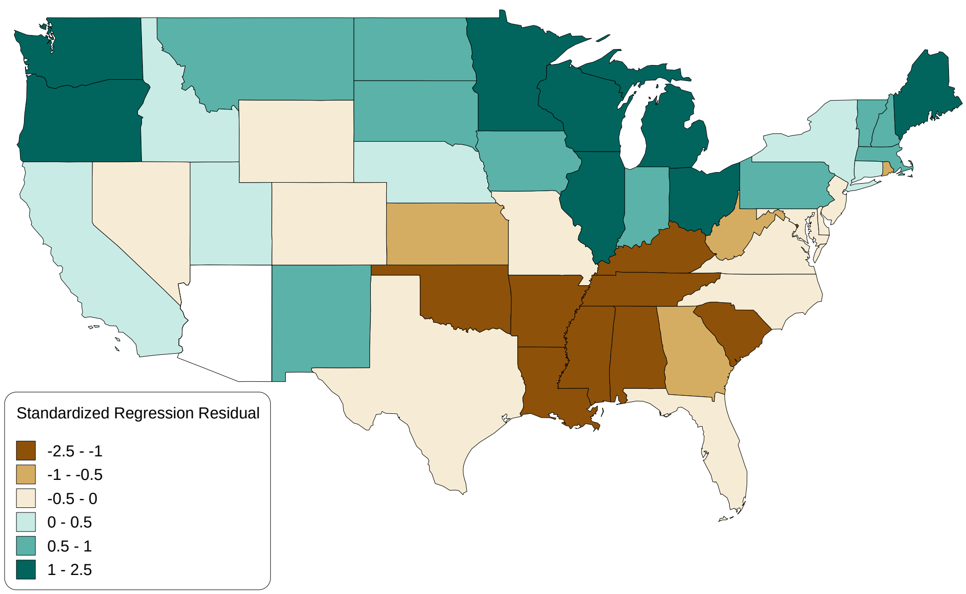


When one examines the lower percentages, the north/south split of the eastern U.S. is also fascinating. The exceptionally low percentages from the Deep South and Appalachian states and the mid-Atlantic and southern New England again capture weaker associations of those states' populations with Arizona or, if one prefers, arguably a stronger attachment to alternative migration destinations.

If we consider a simple association between distance from Arizona and the percentage of a state's migrants moving to Arizona, the effect of other factors can be further examined. A simple regression in logarithms with the percentage of migration to Arizona as the dependent variable and the distance between state population centroids as the independent variable explains about half of the migration percentage. The residuals from the regression yield insight into the more exceptional cases with relatively more or less attachment to Arizona as a destination.

The standardized residuals are mapped in Figure 7. The lighter shades capture those states with the least deviation from the predicted values of the distance regression. The darker positive shades indicate percentages greater than predicted based on the regression. Three clusters stand out in the most extreme category: Northwest, North Central, and extreme northern New England. In addition, several other northern states are under-predicted. The most extreme overprediction captures the Deep South, but also includes Tennessee, Kentucky, Arkansas, and Oklahoma, a region that spreads further north and west than might be expected.

Figure 7. Residual from % Outmigrants as fn(Distance) Regression.



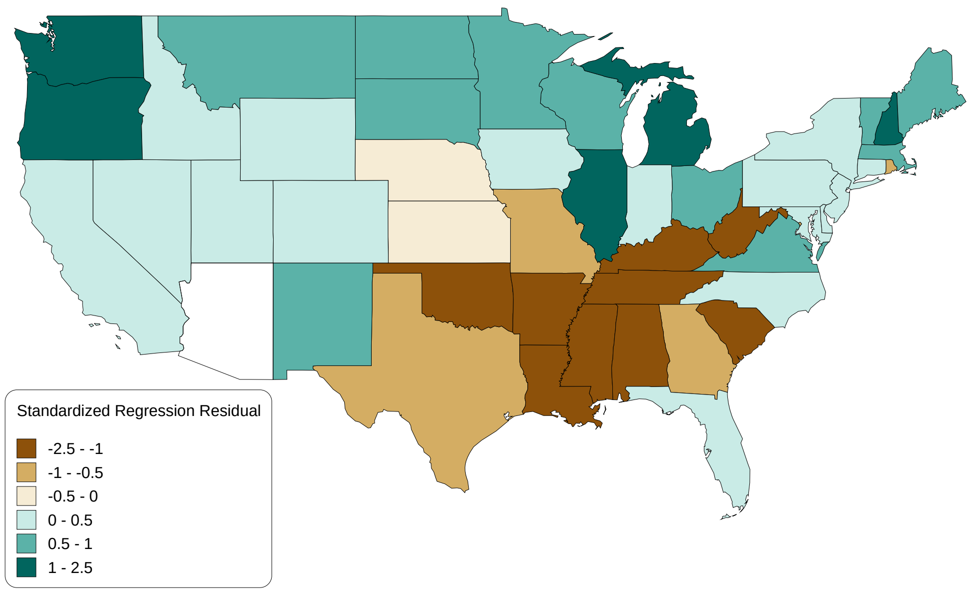
Note: Negative (brown) indicates lower percentage than predicted; positive (blue) means higher than predicted.

2. A State-to-State Gravity Model Perspective

Much the same pattern emerges if one addresses population differences in sending states by using a more formal gravity model formulation. A basic gravity formulation of $M_{ij} = k\frac{P_i P_j}{d_{ij}^{\beta}}$ is used for the model, where M_{ij} is the inmigration flow from the other state to Arizona, P_i is the other state's population, P_j is Arizona's population, d is the distance between the state population centroids, β is the distance decay parameter, and k is a constant. The natural logs of migration flow, distance, and populations were used to transform the model into a functional form suitable for OLS regression: $\ln(M_{ij}) = \alpha + \gamma_1\ln(P_i)+\gamma_2\ln(P_j)+\beta\ln(d_{ij})+ \varepsilon$. Since all flows are to a single place, the Arizona population term is incorporated into the constant, leaving two independent variables. Alaska and Hawaii were excluded from the regression. The model explains about ninety percent of the variation in migration flows and indicates a distance decay parameter point estimate of -1.18.

The residuals of the regression are shown in Figure 8. The North Central and northern New England clusters are not as pronounced, but one still sees the clear northern tier of underpredicted states. Among the overpredicted states, Texas and Missouri are now more prominent. Interestingly, Virginia and North Carolina are now underpredicted.

Figure 8. Residual from Gravity Model Regression.



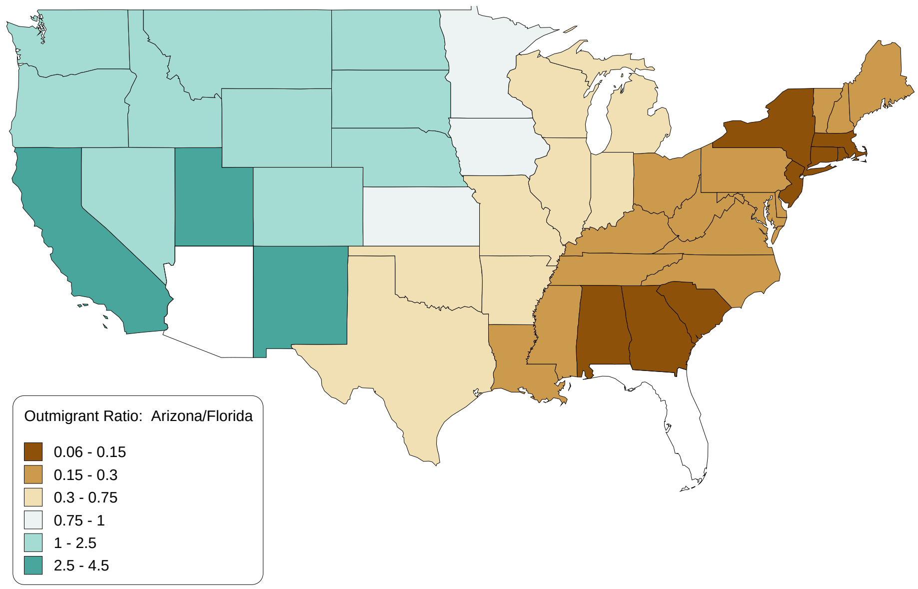
Note: Negative (brown) indicates lower percentage than predicted; positive (blue) means higher than predicted.

3. Arizona vs. Florida

These findings, especially the low levels of migration from southeastern states, invite speculation about the elderly migration split between Arizona and Florida. While other destinations are gaining in popularity, these two states remain the leading destinations for elderly migration. According to the most recent American Community Survey state-to-state estimates (2004-2005) for both gross and net inmigration, Florida had by far the most elderly inmigrants (68,160) followed by Arizona and Texas (27,140 and 26,640, respectively), but the *net* elderly inmigrant split was much closer, (18,630, 13,790, and 12,480 for Florida, Arizona, and Texas, respectively).

Focusing on the Arizona/Florida comparison, we can see a clear geographic split in Figure 9, which examines the ratio of elderly migrant flows to Arizona and Florida. Among Arizona's neighbors, it is interesting to note that Nevada and Colorado fall into the second grouping, between a 1 to 2.5 ratio of Arizona migration to Florida migration, rather than the higher group comprised of California, Utah, and New Mexico. The other western states send more migrants to Arizona than to Florida, as do the Dakotas and Nebraska. Kansas, Iowa, and Minnesota send more to Florida, but their ratio of Arizona to Florida migrants is between 0.75 and 1. Keeping in mind that Florida has a population about three times the size of Arizona's, which could justify a greater attraction to Florida, this range might be considered somewhat neutral between the states.

Figure 9. Ratio of Outmigrants to Arizona vs. Outmigrants to Florida.

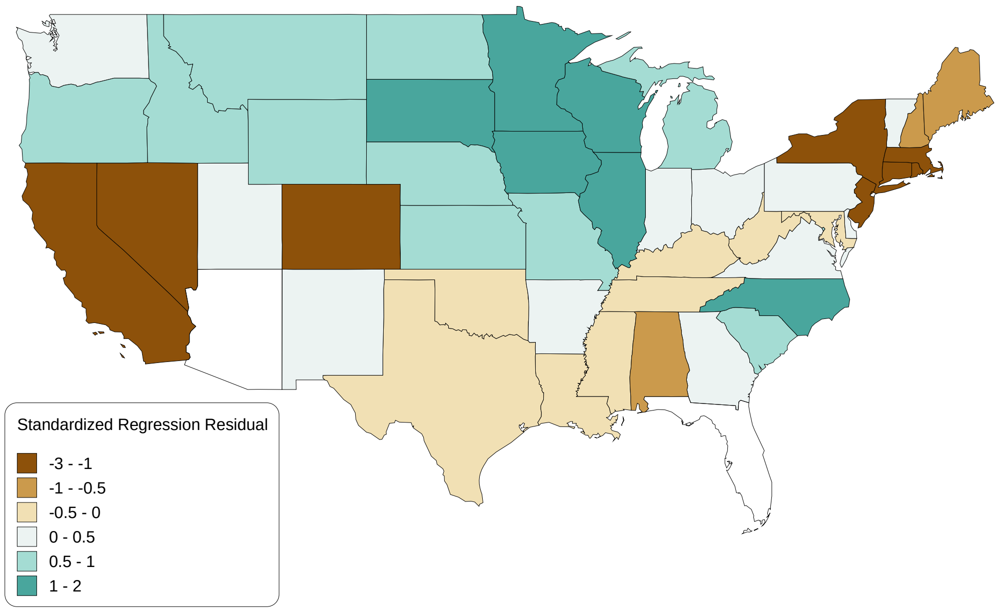


Among the other states, a couple of southwest to northeast diagonal groupings appear, with the Texas to Michigan corridor ratio of Arizona to Florida migrants being between 0.3 and 0.75, and states further east sending much higher numbers to Florida than Arizona. Within the eastern grouping, we see evidence of the strong ties between Florida and New York/New Jersey/southern New England.

We fit another simple regression to examine the relationship between the relative distances and the relative numbers of migrants to Arizona and Florida, with the migrant ratio (migrants to Arizona/migrants to Florida) as a function of the distance ratio (distance from state to Arizona/distance from state to Florida), with both variables transformed into logarithms to allow for a nonlinear relationship. About ninety percent of the variation was explained.

The residual pattern that emerged from this model was quite fascinating. In addition to the expected cluster around New York, we also found that the ratios for California, Nevada, and Colorado all were seriously overpredicted by the model, i.e., less attraction to Arizona than the model would predict. We again find a north central cluster but also observe a Virginia/Carolinas grouping that exhibits a greater link to Arizona than the model predicted based on relative distance.

Figure 10. Residual of AZ/FL Migrant Ratio as fn(AZ/FL distance ratio).



Note: Negative (brown) residual indicates lower ratio than predicted; positive (blue) indicates higher ratio than predicted.

4. Migration from Other States to Specific Arizona Counties

The state-to-state figures, while fascinating, do not capture the different attractions that may apply to the various counties of Arizona, so migration from other states to the individual counties of Arizona was also examined, as summarized in the left-hand column of numbers in Table 2. These numbers are followed by additional columns that show the percentage of migrants arriving by particular states of origin. The final column in the table shows the percentages of county out-of-state inmigrants coming from the top eight sending states to Arizona. For example, in Apache County, over 90 percent of persons moving to the county originated in New Mexico, while 29.5 percent of movers to Maricopa County originated in California. However, it is critical to remember that these percentages only provide partial information since detailed information on migration movements is suppressed in order to protect the identity of individual persons where outmigration flows were recorded in fewer than ten IRS returns. Therefore, the specific county-to-county outmigration flows that are available in the dataset only capture 79.5 percent of or 161,155 of the 202,737 of the total new migrants to the state. The percentage of migrants actually reported varies by county; and the reader is cautioned to note that in smaller sized counties (Gila, Graham, Greenlee, La Paz) where 100 percent of new migrants appear to have originated from a single state, we only are accounting for migration flows where there were sufficient numbers of IRS returns to disclose the information.

Table 2. Out-of-State Migration to AZ Counties By Primary Sending States (2006-7).

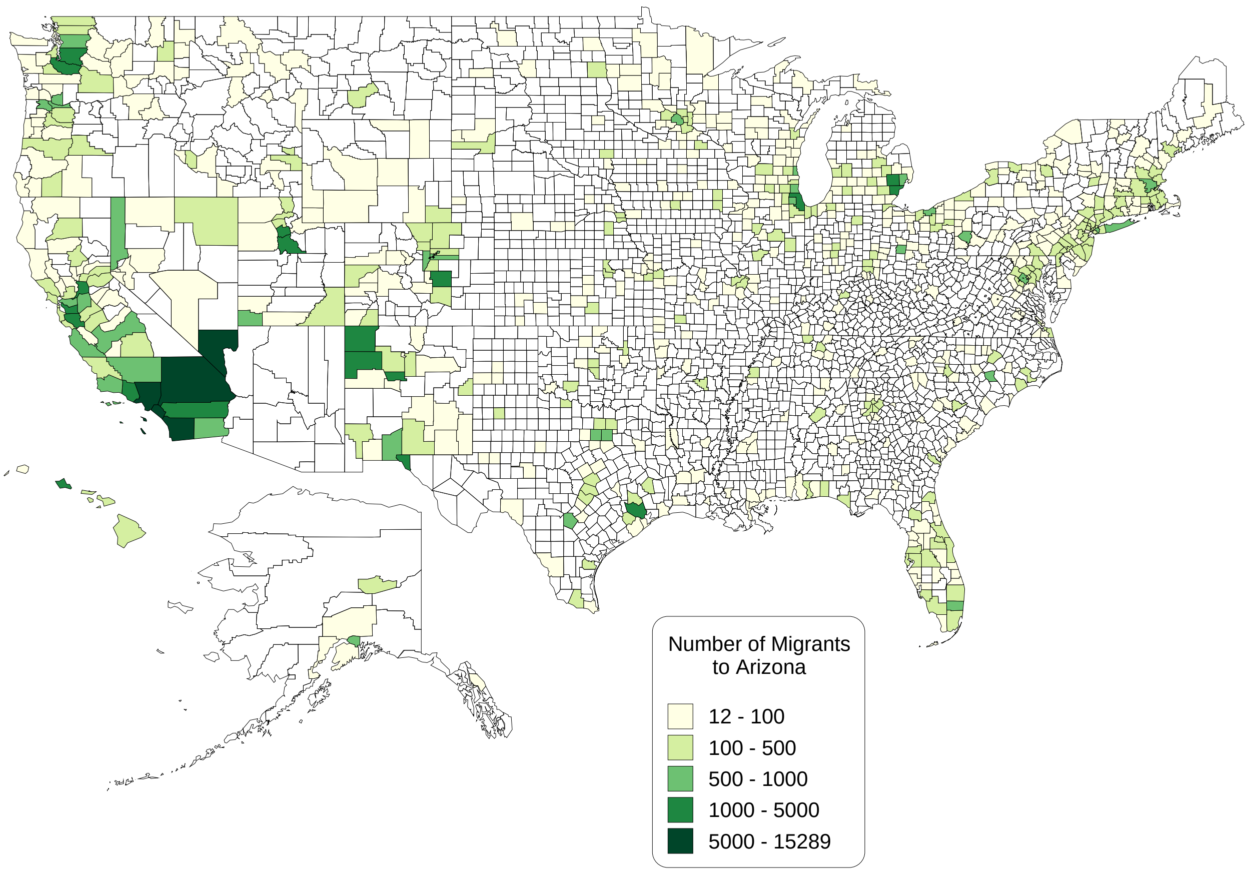
County	County-Specific Inmigration	Percentage of County Out-of-State Inmigrants Coming From: California	Nevada	New Mexico	Texas	Total From Top 8
Apache	2011	3.2	1.0	90.1		100.0
Cochise	2636	20.6	2.5	0.9	16.5	54.2
Coconino	1639	32.8	14.6	20.1	3.1	93.4
Gila	184	100.0				100.0
Graham	38			100.0		100.0
Greenlee	46			100.0		100.0
La Paz	188	100.0				100.0
Maricopa	110801	29.5	2.9	2.8	5.8	56.7
Mohave	6460	61.7	22.6	0.5	1.0	95.8
Navajo	874	27.8	8.1	49.8		100.0
Pima	20262	27.8	3.4	3.8	8.5	58.9
Pinal	7200	50.4	5.8	1.9	4.4	79.4
Santa Cruz	242	84.7	15.3			100.0
Yavapai	3985	62.7	8.3	1.4	2.0	86.0
Yuma	4589	70.8	3.1	0.4	5.3	88.8
State	161155	33.3	4.1	4.2	5.8	62.5

Source: Internal Revenue Service Statistics on Income County-to-County Migration 2006-2007.

Migration from U.S. Counties to Arizona

Turning the focus to the source counties of migration rather than source states provides another interesting perspective on migration to Arizona. Figure 11 shows the origins of migrants from all U.S. counties into Arizona. From the map, it is apparent that the largest number of persons moving into the state originated from locations in southern California as well as the Las Vegas region. Counties in northwest New Mexico also provided large numbers of new migrants along with the Chicago, Denver, Seattle and Houston areas. Other metropolitan areas are also evident upon closer inspection.

Figure 11. Origin of Inmigrants to Arizona by County (2006-2007)



1. Urban Hierarchy Effects

While metropolitan origins stand out on the county migration map, the effect of migrants' situations within the urban hierarchy extends well beyond the metropolitan areas. Place within the urban hierarchy is a potentially important factor in migration decisions, and much recent literature has focused on migration flows between levels of the urban hierarchy. While numerous ways of defining the hierarchy exist, we have chosen to use the Rural-Urban Continuum Codes (RUCC), also known as Beale Codes, developed by the Economic Research Service of the USDA. Table 3 provides a summary of the nine codes, which range from a top category of counties in metropolitan areas of one million or more people to a bottom category of completely rural or less than 2,500 urban population, not adjacent to a metropolitan area.

Table 3. Rural-Urban Continuum Code Descriptions.

2003 Rural-urban Continuum Code	Description
Metro Counties:	
1	metro area with 1 million population or more
2	metro area of 250,000 to 1 million population
3	metro area of fewer than 250,000 population
Nonmetro Counties:	
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500-19,999, adjacent to a metro area
7	Urban population of 2,500-19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adj. to metro area
9	Completely rural or less than 2,500 urban population, not adj. to metro area

Source: Economic Research Service, U.S. Department of Agriculture.

Migration to differing county types to Arizona counties is shown in Table A2, organized by the RUCC of the receiving county. In addition, the percentage migrating to each RUCC level is summarized for the group. As one would expect, inmigrants to the large metropolitan areas tend to migrate from other metropolitan areas, with almost two-thirds relocating from other large metropolitan areas and almost one-third from smaller metropolitan areas. None of the remaining five percent migrated from rural counties. Inmigrants to mid-sized metropolitan counties were even more likely to come from metropolitan counties in other states, with only three percent migrating from non-metropolitan counties, none of them rural. For these counties, two-thirds of inmigrants were actually moving to smaller metropolitan areas, while a quarter were moving within the same class of county.

Inmigrants to smaller metropolitan areas were likewise overwhelmingly coming from metropolitan origin counties. In this case, eighty-five percent of inmigrants were moving to smaller metropolitan areas. Similar to the situation in the larger counties, there was no reported migration from rural counties.

Inmigrants to urbanized counties adjacent to metro areas (RUCC 4) followed a pattern remarkably similar to the metropolitan destinations, with only four percent migrating from non-metropolitan areas. Even allowing for data suppression having a stronger effect on flows from smaller counties, the numbers suggest an attraction to Arizona that transcends typical tendencies to move upward in the urban hierarchy.

Not until the RUCC 6 category (urban population of 2,500-19,999, adjacent to a metro area) do we observe a majority of inmigrants from non-metropolitan counties. For this group, a little less than half of inmigrants came from metropolitan counties, with a similar number from the largest non-metropolitan counties. Only two percent came from similar counties in other states while four percent migrated from smaller counties.

The location pattern percentages described for the groups are far from uniform, as shown in Table

A3. For the two large metro area counties, for example, three-fourths of the Pinal County inmigrants moved from other large metropolitan areas, compared to the 62% of Maricopa County inmigrants from large metropolitan counties. About fifteen percent of the Maricopa inmigrants came from small metropolitan counties or smaller counties, while only four percent of Pima inmigrants came from that grouping. Among the three smaller metropolitan counties Yavapai County had a much higher percentage from larger counties. There is even greater variation among the counties in the larger non-metropolitan group adjacent to metropolitan areas (RUCC 6). While Gila and Santa Cruz Counties received all of their inmigrants from large metropolitan counties, and Mohave received almost all of its inmigrants from large and intermediate metropolitan counties, Navajo and Cochise Counties had a more dispersed distribution of inmigrants among origin counties.

Regression Modeling of Migration Influences

Regression modeling was employed in order to bring together spatial effects and the relative attractiveness of destinations of different sizes. Initially, a traditional gravity/spatial interaction model was fit. Distances were measured as highway miles, as provided between all pairs of U.S. counties by the Center for Transportation Analysis. The July 1, 2006, U.S. Census estimate of population for the Arizona and origin counties was used.

The basic gravity formulation of $M_{ij} = k\frac{P_i P_j}{d_{ij}^{\beta}}$ is used for the initial model, where M_{ij} is the inmigration flow from the out-of-state county to an Arizona county, P_i is the out-of-state county population, P_j is the Arizona county population, d is the distance between the counties, β is the distance decay parameter, and k is a constant. The natural logs of migration flow, distance, and populations were used to transform the model into a functional form suitable for OLS regression: $\ln(M_{ij}) = \alpha + \gamma_1\ln(P_i)+\gamma_2\ln(P_j)+\beta\ln(d_{ij})+ \varepsilon$. The initial model with origin and destination county population counties entered separately revealed very similar coefficients, so the product of the population was used in all of the models shown here. The number of observations was pared back to exclude the Alaska and Hawaii observations, for which distance data were not comparable, leaving 1,465 observations.

The basic model, using only population and distance, revealed highly significant coefficients on both variables in the expected directions (Table 4). The distance decay parameter, while negative, was only -0.8, revealing only a somewhat modest effect. The gravity model explained a bit more than half of the variation among the migration flows.

In order to investigate any possible effect of the urban hierarchy beyond that captured by population, two versions of RUCC differences between counties were used. In the first, the origin (out-of-state) RUCC was subtracted from the destination (Arizona) county RUCC, generating possible values from -8 (from a rural county to a large metro county) to 8 (the opposite movement). If movement tends to be up the urban hierarchy, we would expect negative coefficient values, although it is clear that much migration actually occurs between similar counties or adjacent types. To allow for the similarity effect, the absolute value was also used as an explanatory variable, with the expectation that larger absolute differences would generate smaller migration flows.

The results of the expanded regressions with the RUCC terms have population and distance decay parameters similar to the simple model. The RUCC coefficient in Model 2 is positive and significant, capturing the observed tendency to actually move down the urban hierarchy when moving to Arizona. The absolute value coefficient in Model 3 has the expected sign and is statistically significant. However, both regressions provided only a slight gain in predictive power over the simple model, with the absolute difference measure slightly superior.

An additional model was fit to allow for the effect of two traditionally important summary economic measures of economic vitality. The first economic variable is the difference in unemployment rate between the origin and destination counties (Arizona county minus out-of-state county). The unemployment rates for 2006 were obtained from the Bureau of Labor Statistics website. Differences in per capita income were also included. The per capita income data, also for 2006, were obtained from the Bureau of Economic Analysis' Regional Economic Information System website. Including the new variables entailed the loss of 18 observations.

Table 4. Regression Results for State Gravity Models.

Variable	Model 1: Basic Gravity Model		Model 2: Add RUCC Difference		Model 3: Add RUCC Difference Abs. Value		Model 4: Add Economic Variables	
Intercept	-5.50905		-5.45728		-4.11444		-4.31381	
	-15.41	***	*-15.26*	***	*-10.75*	***	*-10.84*	***
ln(Distance)	-0.8043		-0.79324		-0.83083		-0.8326	
	-27.78	***	*-27.11*	***	*-29.27*	***	*-29.1*	***
$\ln(Pop_iPop_j)$	0.57226		0.56778		0.53302		0.54076	
	41.15	***	*40.54*	***	*37.37*	***	*36.83*	***
$RUCC_i-RUCC_j$			0.02155					
			2.44	**				
Abs. Value of $RUCC_i-RUCC_j$					-0.11121		-0.10804	
					-8.83	***	*-8.26*	***
$Unemp_i-Unemp_j$							0.01152	
							1.47	
PCI_i-PCI_j							-8.83E-07	
							-0.55	
F Value	954.22	***	640.3	***	695.67	***	418.98	***
R^2	0.5662		0.5680		0.5882		0.5925	
Adjusted R^2	0.5656		0.5671		0.5874		0.5911	
n	1465		1465		1465		1447	

*Note: Numbers in italics are t-statistics. *** Indicates 0.0001 significance; ** indicates 0.01 significance.*

The new model (Model 4 on Table 4) included the distance and population measures, the absolute RUCC measure, and both economic measures. The coefficients on the previously used variables changed little. The per capita income variable was negative, contrary to expectations as we would expect people to be more likely to migrate to counties with significantly higher per capita incomes (i.e., with higher values of destination minus origin per capita income). The unemployment variable coefficient was positive, also unexpected. Neither variable, however, was statistically significant. The percentage of explained variation was only trivially increased through the addition of the economic variables.

A final set of regression models was run on the individual counties to see if they differed significantly in terms of population and distance effects. Given the small amount of explanation added through the RUCC and economic variables, we elected to keep the models simple, involving only the destination county population and distance. All of the variables were kept in logs for the county estimations. We chose to run these models on only those counties with at least twenty reported flows from out-of-state locations.

The county estimation results, summarized in Table 5, revealed some interesting differences in coefficients. With the exception of the Cochise County model, which had a very poor fit and odd parameter values, the county models seem reasonable, typically having significant coefficients for both independent variables. The distance decay parameters varied from about -0.75 to -1.14. The largest counties had lower distance decay coefficients, as expected given the presumed stronger appeal of larger urban areas. Maricopa County had the largest population coefficient, 0.87, and the next three most populous counties (Pima, Pinal, and Yavapai) had the next largest population coefficients. Several of the county models had R^2 values well in excess of 0.5, the highest being in Maricopa County, where almost eighty percent of the variation in migration flow magnitude is explained through a simple gravity specification.

Table 5. County-Specific Gravity Models.

		Coefficients			
	N	Intercept	ln(Distance)	ln(Pop_j)	R^2
Cochise	46	6.57	-0.26	-0.07	0.05
Coconino	30	6.10	-0.91	0.25	0.53
Maricopa	767	-0.30	-0.82	0.87	0.78
Mohave	50	5.70	-1.14	0.42	0.62
Pima	316	2.09	-0.75	0.56	0.61
Pinal	106	2.39	-0.75	0.50	0.63
Yavapai	62	3.11	-1.01	0.55	0.75
Yuma	49	8.06	-0.77	0.07	0.43

Conclusion

The domestic influx of new residents to Arizona has been a key contributor to the State's long-term growth. Arizona's low housing costs, widely available job opportunities, and a favorable quality of life are often cited as pull-factors among migrants moving to the state. Our study employs data for state and county migration patterns for movers from all counties across the United States to Arizona and its individual counties for use in descriptive analysis and a traditional basic gravity model regression-based analysis to produce our findings.

Descriptive analysis revealed interesting differences among Arizona's counties in terms of overall net migration and origin states. While distance effects were clear, maps of the residuals from regression models showed regional clusters indicating other factors affecting migration to Arizona. Comparisons of flows classified according to origin and destination urbanization showed that there is a tendency to actually move down the urban hierarchy when migrating to Arizona.

In the state-level gravity models, the coefficients for the distance and population variables were highly significant in the expected directions. Almost 56 percent of the variation among migration activity was explained by the basic model. ERS Rural-Urban Continuum Codes were added in two follow-up models as a means of analyzing the effects of individuals moving up and down the urban hierarchy. The positive value of the coefficient in Model 2 indicates a tendency for migrants to move down the urban hierarchy when moving to Arizona. The coefficients in both Model 2 and Model 3 were significant; however, the predictive power of both models was only slightly above the results in the initial model.

Model 4 added two traditionally important economic variables – the differences in unemployment rates as well as differences in per capita incomes in origin and destination counties. The sign on the per capita income variable was negative. This was unexpected since this would have indicated migrants are moving to areas with lower per capita incomes; however, neither of these two variables was significant in this model.

Finally, regression models using the population and distance variables were tested for each of the individual Arizona counties as a means to ascertain whether these variables differed significantly across counties. With one exception, the results for the counties for both the population and distance variables were significant, and the distance decay coefficient was higher for the larger counties, which also was expected given the greater appeal of a larger metro region for many movers.

This study has produced some preliminary analysis of population movement into Arizona; however additional research is suggested in order to better capture prevailing trends over a longer period of time or a broader geographic region, and perhaps a comparison of similar movements for multiple jurisdictions across the nation. Introducing more formally defined amenities could also be useful for capturing some of the 'residual' patterns noted in the descriptive analysis.

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Appendix

Table A1. County Migration by In-State and Out-of-State Destination.

	Total				With Other States				Within State			
County	Out	In	Net	Efficiency	Out	In	Net	Efficiency	Out	In	Net	Efficiency
State	224,947	278,837	53,890	10.7	148,816	202,706	53,890	15.3	76,131	76,131	0	0.0
Apache	4,817	4,829	12	0.1	2,711	2,690	-21	-0.4	2,106	2,139	33	0.8
Cochise	8,521	8,495	-26	-0.2	6,023	6,355	332	2.7	2,498	2,140	-358	-7.7
Coconino	8,383	7,890	-493	-3.0	4,123	4,095	-28	-0.3	4,260	3,795	-465	-5.8
Gila	2,247	2,807	560	11.1	808	1,026	218	11.9	1,439	1,781	342	10.6
Graham	1,060	1,852	792	27.2	364	634	270	27.1	696	1,218	522	27.3
Greenlee	480	677	197	17.0	132	310	178	40.3	348	367	19	2.7
La Paz	911	953	42	2.3	519	671	152	12.8	392	282	-110	-16.3
Maricopa	122,333	140,371	18,038	6.9	86,900	119,417	32,517	15.8	35,433	20,954	-14,479	-25.7
Mohave	9,279	11,622	2,343	11.2	7,435	10,078	2,643	15.1	1,844	1,544	-300	-8.9
Navajo	5,207	6,098	891	7.9	2,089	2,194	105	2.5	3,118	3,904	786	11.2
Pima	29,493	35,012	5,519	8.6	20,776	26,652	5,876	12.4	8,717	8,360	-357	-2.1
Pinal	13,420	34,334	20,914	43.8	5,207	12,240	7,033	40.3	8,213	22,094	13,881	45.8
Santa Cruz	1,821	1,831	10	0.3	534	808	274	20.4	1,287	1,023	-264	-11.4
Yavapai	9,086	12,907	3,821	17.4	5,472	7,705	2,233	16.9	3,614	5,202	1,588	18.0
Yuma	7,904	9,190	1,286	7.5	5,738	7,862	2,124	15.6	2,166	1,328	-838	-24.0

Table A2. Migration by Sending and Receiving County Rural-Urban Codes.

	Receiving County Rural-Urban Continuum Code								
	1	2	3	4	5	6	7	8	9
RUCC1 Counties:									
Maricopa	69547	24217	10241	2860	2225	1067	628	0	16
Pinal	5509	1452	181	0	30	28	0	0	0
Totals	75056	25669	10422	2860	2255	1095	628	0	16
Group Percentage	63.6%	21.8%	8.8%	2.4%	1.9%	0.9%	0.5%	0.0%	0.0%
RUCC2 Counties:									
Pima	12675	5035	2028	149	193	120	62	0	0
Group Percentage	62.6%	24.8%	10.0%	0.7%	1.0%	0.6%	0.3%	0.0%	0.0%
RUCC3 Counties:									
Coconino	885	389	210	121	0	34	0	0	0
Yavapai	3074	728	149	20	0	14	0	0	0
Yuma	2429	1117	895	0	124	24	0	0	0
Totals	6388	2234	1254	141	124	72	0	0	0
Group Percentage	62.5%	21.9%	12.3%	1.4%	1.2%	0.7%	0.0%	0.0%	0.0%
RUCC4 Counties:									
Cochise	1096	1101	284	48	87	20	0	0	0
Gila	184	0	0	0	0	0	0	0	0
Mohave	5222	737	426	22	29	24	0	0	0
Navajo	314	119	169	234	0	0	38	0	0
Santa Cruz	242	0	0	0	0	0	0	0	0
Totals	7058	1957	879	304	116	44	38	0	0
Group Percentage	67.9%	18.8%	8.5%	2.9%	1.1%	0.4%	0.4%	0.0%	0.0%
RUCC6 Counties:									
Apache	86	113	652	1073	0	42	45	0	0
Graham	0	0	0	0	0	0	38	0	0
La Paz	188	0	0	0	0	0	0	0	0
Totals	274	113	652	1073	0	42	83	0	0
Group Percentage	12.2%	5.1%	29.1%	48.0%	0.0%	1.9%	3.7%	0.0%	0.0%
RUCC7 Counties:									
Greenlee	0	0	0	0	0	0	46	0	0
Group Percentage	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%

Table A3. Migration Percentages to Receiving County Rural-Urban Codes.

	County	*Receiving County Rural-Urban Continuum Code*								
County	RUCC	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Apache	*6*	4.3	5.6	32.4	53.4	.	2.1	2.2	.	.
Cochise	*4*	41.6	41.8	10.8	1.8	3.3	0.8	.	.	.
Coconino	*3*	54.0	23.7	12.8	7.4	.	2.1	.	.	.
Gila	*4*	100.0	.	.	.	.	.	.	.	.
Graham	*6*	.	.	.	.	.	.	100.0	.	.
Greenlee	*7*	.	.	.	.	.	.	100.0	.	.
La Paz	*6*	100.0	.	.	.	.	.	.	.	.
Maricopa	*1*	62.8	21.9	9.2	2.6	2.0	1.0	0.6	.	0.0
Mohave	*4*	80.8	11.4	6.6	0.3	0.4	0.4	.	.	.
Navajo	*4*	35.0	13.3	18.8	26.1	.	.	4.2	.	.
Pima	*2*	62.4	24.8	10.0	0.7	1.0	0.6	0.3	.	.
Pinal	*1*	76.1	20.1	2.5	.	0.4	0.4	.	.	.
Santa Cruz	*4*	100.0	.	.	.	.	.	.	.	.
Yavapai	*3*	77.1	18.3	3.7	0.5	.	0.4	.	.	.
Yuma	*3*	52.9	24.3	19.5	.	2.7	0.5	.	.	.
State	*NA*	63.0	21.7	9.5	2.8	1.7	0.9	0.5	0.0	0.0

2010 MCRSA Conference Proceedings

Mid-Continent Regional Science Association

Studio Teaching and Interdisciplinary Education: Reflections on Experience

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Abstract. In our field of regional science there is a need to educate and train the next generation of scholars who are grounded in practice as well as academics. This aspect of a student's development can occur through work experience after earning degrees, internships and cooperative education, and other means. The focus of this paper is on one way that is not often used in political science for giving students experience working in teams with students and faculty from other disciplines on real-world problems.

The purpose of this paper is to reflect on my experience teaching in an interdisciplinary studio at the University of Cincinnati (UC).[1] This experience came about through a unique opportunity for faculty in Arts & Sciences at UC through The Charles Phelps Taft Research Center, a research foundation at UC. The objective of the paper is to address the opportunities and challenges in educating and training university students at a variety of levels in community and economic development.

Introduction

I am completing my second of two, separate one-year fellowships that required me to teach and write papers based on my experience in the Niehoff Urban Studio, an interdisciplinary program that involves faculty and students to work on community issues in and around Cincinnati, Ohio. The studio is in a building two short blocks from the main campus of the university in an urban neighborhood. Receiving the second award gave me the opportunity to try to address some aspects of the first year's experience[2] that I perceived as opportunities for improvement or for trying different things.

This two-year experience has given me insights into the practical issues involved in offering students opportunities for realistic experience in applying classroom-based knowledge to actual problems in the community; brought out some of the challenges of multi-disciplinary team teaching in a university environment; and given me an enhanced appreciation for different types of teaching (and some improvisation) to accommodate a range of student needs, which change constantly.

I will comment on some of the differences in the structure and content of the studio between the two years and how those changes mattered in terms of student learning, community involvement, and course management. I will also use these studio experiences to reflect on previous courses at another university that had some of the same objectives of educating students and giving them practical experience in addressing problems or needs identified by a "client", but did not have the interdisciplinary character of the current situation.

This is limited by being based on one faculty member's observations and reflections based on particular experiences. Thus, it will necessarily be

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subject to the author's biases, incomplete knowledge, and limited perspective. To attempt to address these limitations, the author will incorporate observations of the previous Taft-Niehoff Faculty Community Scholar (Dr. Martha Rees, an anthropology professor), who wrote a paper based on her experience in the same program a year before my appointment to this fellowship.

This paper will be structured around a few broad themes; offer lessons or understandings; and suggest ways in which this means of teaching can be encouraged and facilitated better or at least hampered less by cultural norms, institutional structures, and other constraints. This paper will pose some questions that might be considered in the conception and design of educational experiences similar in intent to the educational initiative described in this paper.

Re-cap of Two Years

It will help the reader to understand that there were some differences between the two years. Some of these differences had to do with staffing[3] at the studio (different players), different types of projects, and different ways the studio was run. Other differences were because of conscious attempts that I made to do things differently. The changes were designed to address what I perceived to be barriers to success in the first year. This section will only address features of the two years that I think are relevant to this discussion.

Organizational aspects

There were some organizational differences between the first and second years of my experience. Because this was a new experience for me, I had several meetings with the director of the studio, an architect, starting in the spring before the year in which my fellowship began. He introduced me to the previous year's (inaugural) fellow to gain her perspective and insights into the experience. The studio director and I exchanged some emails over the summer. We met many times during the fall quarter to prepare for the winter quarter, including some meetings with the engineering faculty member of the team. In the winter quarter there were four of us faculty teaching (an engineer, two architects [one from the School of Planning, the director of the studio], and myself). We met on a regular basis, discussed student assignments, graded and commented on students' work, jointly developed assessment tools for student projects, and talked about lectures we would give.

A notable difference between the two years was in how faculty related to team projects. In the first year I was assigned by the studio director to work with two specific teams of students on particular projects in which I have specialized expertise (i.e., community-based stakeholder analysis and local government financing of projects). The students on these teams, tended not to be in the class I was teaching, but I actually worked more closely with those teams than with the students taking "my" class (POL 532).[4]

The second year was in some ways the opposite experience. Instead of my focus being diverted to work with select project teams, my attention was much more on the students who were taking my suite of classes (See "Classroom integration" below). I still was present and available to comment on, assist, and critique students working on projects at the studio, but I felt much less "ownership" or association with those projects because I had no particular role vis-à-vis those projects. On the other hand, I felt much more connected to the students who were taking my class(es) and my connection to various projects was *through* them. In other words, I would advise my students who were on teams about sources of material, comment on their work, attend the presentations of the teams to which they belonged, and so on.

Another difference between the two years is that the engineering, architecture, and planning students were not "required" to work with the political science students in the second year. This had been decided by the faculty from other disciplines who had listened to feedback from their students that they did not want to be forced into teams. Some students had complained that they did not want their grades (on team projects) to be in jeopardy because a political science student did not deliver on time. This seems to me to be a legitimate concern because in the first year the students taking the political science class were at the studio far fewer hours than the other students. [5]

The second year the students in my class(es) were much better able than the previous year's students to fit into teams and be full-fledged partners. (A political science student who donned a hard hat and went through a decrepit building being considered for re-use comes to mind. Her part in the project was not engineering- or design-oriented, but brought in the social sciences perspective; thus, it did exactly what the interdisciplinary studio experience was meant to do. Several students had similar experiences.)

Classroom integration

One of the most challenging issues I had to confront was how to blend traditional classroom teaching to students enrolled in "Community and Economic Development: Theory and Practice" (POL 532, for short) with teaching at the studio. The first year I advertised the class by posting flyers and sending messages with attached flyers to directors of graduate and undergraduate programs (e.g., economics, planning, sociology, political science) with students I thought might be interested in taking this class at the studio. It was the first time the class had been offered, so I did not expect a large enrollment and I had capped enrollment to a small number to enhance interaction and discussion.

The main problem was that the students who took POL 532 (for 3 credits) were at the studio far fewer hours than the planners, engineers, and architects. In addition, the time slot was not compatible with that of the other students. (This partly reflects differences across colleges at UC in terms of the norms for when classes meet.) Third, there was a zero-sum problem in that any time I spent separately teaching these students (which I felt obliged to do because they had signed up for a particular class) took time away from the studio and vice versa. Fourth, the fact that the POL 532 students were only committed to be at the studio for three hours a week (compared to all afternoon four days a week for the others) made interdisciplinary teamwork virtually impossible for many of my students – unless they were able to fit the extra time in within their schedules.

So, the next time I had the opportunity to teach in the studio I addressed these problems in a variety of ways. First, I invested considerable time on recruitment of students the quarter before I taught at the studio. I did "marketing" as I had done the year before, but I focused on students who had previous coursework in urban politics or public administration and public policy who seemed interested in applied topics and were more (and this is subjective) open to trying new approaches (students who had worked on "portfolios" relating academics to practice in a previous class, for example).

Second, I went to great lengths to forewarn potential students that the studio experience would be quite different from their usual political science classes. I promised them an interdisciplinary experience where they would work on teams with students from engineering, planning, and architecture; that they would hear lectures from faculty from these other disciplines; that they had to be very flexible and understand that things are somewhat unpredictable and that I would not be "in charge" of things (as the studio has a director). Thus, I tried to "weed out" (as much as I could) students who liked a routine, predictable environment in which I could tell them exactly what would happen at what time.

Third, I worked with my department's undergraduate coordinator and department head to think through how we could encourage our students to spend more time at the studio so they could be fully integrated in the experience. The solution was to offer students up to 10 credit-hours with me as the teacher of record – POL 532 (3 credits) + the capstone in political science, POL 490 (3 credits) + Independent Study (1-4 credits). Thus, if a student wanted to schedule most of their afternoons at the studio, they could earn up to ten credits accordingly. I, as the instructor, made sure that they did an appropriate amount of work if they signed up for more than the basic menu item of POL 532. Essentially, each student and I had a contract about what the student needed to do to earn a certain number of credits.

Fourth, I had learned from the first experience to do whatever I could to "protect" a certain amount of time with my students. Therefore, I assigned one book (Edward J. Blakeley and Nancy Green Leigh, *Planning Local Economic Development: Theory and Practice*, 4th edition, 2010. Sage) as a common reading. We had three class discussions of approximately thirds of the book. Students were required to write very short reaction or analysis papers based on the readings before the class in which each third of the book was to be discussed. I supplemented the book with brief lectures.

Lecturing

The first time I taught at the studio each instructor had a small number of lectures they were asked to prepare and deliver to the entire group of students and faculty (from all the disciplines). We also gave impromptu presentations as needs arose. A good example of an impromptu lecture was a talk I gave on the structure of government in the United States. The need for this lecture arose after (mostly) engineering students made poster presentations about research in which they demonstrated that they did not understand differences between towns, communities, neighborhoods, and municipalities. They made comparisons as if they were making apples-to-apples comparisons. So, without any notice, the studio director called on me to give a lecture on types of local governments, what they do, and how many there are (including special districts, general-purpose local governments, and so forth).

The second time I taught at the studio there were some changes that I had no say in, but that I think were improvements. First, each faculty member was asked to prepare a certain menu of lectures and particular dates were reserved for concurrent lectures to be given by different faculty. The topics and dates were announced in advanced and students had to sign up for particular lectures. In other words, attending a lecture was not optional; but students had choice in *which* lectures to attend. Second, because of this different approach (speaking only for myself) lectures were more thought out and well developed. I developed a lecture on the structure of governments in the United States and tied it into Ohio and the Cincinnati region with tables and examples.

Table 1 is my subjective attempt to summarize some of the differences I perceived between the two years that I taught at the studio.

Table 1
Synopsis of Key Differences between Two Years of Teaching in Studio

Features of the studio experience (from my perspective)	**Year 1**	**Year 2**
Preparation and coordination with studio staff	Met many times with director of studio and several times with co-instructors before the quarter	Met once with director of studio and never with co-instructors (2 of them different from previous year) before the quarter
Meetings	Met most Fridays with faculty teaching the studio during the quarter	Met some Fridays with faculty teaching in the studio during the quarter
Integration of classroom teaching	Attempted to teach "Community and Economic Development" (POL 532) within studio	Offered a variety of flexible options: • POL 532 • Capstone in political science • Independent study (graduate and undergraduate)
Team projects	Students were required to work in teams	Students self-selected to work on teams
Lecturing to entire studio	A couple of lectures to whole studio attended by all students and faculty	A menu of concurrent lectures by faculty that students signed up to attend

Students' Evaluations

Ideally I would have comparable student evaluation data to assess students' perceptions about different approaches. Unfortunately, this was not possible. Remember that in the first year I taught POL 532 as a stand-alone class within the studio space. So, I administered my department's standard evaluation form at the end of the quarter. But, that form is to judge teaching effectiveness of the *instructor* and did not attempt to get at students' evaluation of the *studio experience*.

This year, if I could have done it, I would have had an evaluation of the studio *experience* from all of the students in the studio (approximately 75) to ascertain how they perceive the interdisciplinary, hands-on nature of this educational modality. When I raised this idea among my colleagues teaching at the studio, one of them liked the idea very much and said we should do one such assessment mid-quarter and another one at the end; one member of the teaching team expressed on opinions on the idea. But, the idea never came to fruition because other instructors on the team raised concerns about whether these assessments might end up in front of a faculty member's review committee and about authorship if anything were published based on this. There was not enough time to resolve issues, so I withdrew the idea.

Instead, I added a one-page addendum to my department's standard class evaluation form. Appendix 1 is a table with the verbatim responses of the students to the questions on the addendum. Because I had students enrolled in a variety of options – and these options overlapped – I chose to have students complete just one of these forms. It made no sense to have the students using the studio experience to write their capstone paper and do an independent study paper to complete separate evaluations since these components all came from the same studio experience. The purpose of this additional page on their course evaluation was to obtain feedback from these students on their experience taking a studio course, which is nontraditional for them as political science students.

The feedback was generally very positive. Students noted several differences between this experience and their "typical" political science courses. These comments mentioned things like flexibility, being able to "pitch in" on what you want to work on and with whom you want to work. They mentioned the less structured nature of the studio. They also commented that things are more "self-directed".

As for the "best" parts of taking a political science course at a studio, students mentioned things like "getting out of the classroom", working with various disciplines, understanding all of the "puzzle pieces", "getting outside experience", seeing how students from outside their discipline work, and the fun of getting off campus.

Among the least desirable parts about the studio were things like forcing oneself to work on their own and some disorganization (partly due to inclement weather during the winter), and the "hard schedule" and always feeling behind. One student said that it was a long way to the studio. (Author's comment: This seems odd to me because it takes longer to walk across campus than to get from the edge of campus to the studio. It is two short blocks off campus.)

Students generally expressed that they would take another studio course if there were one offered on a topic that interested them. Their comments were very enthusiastic and they used words like "enjoy" to describe working with a team and doing "hands-on" work.

Students also offered comments in response to one open-ended question. There were some interesting ideas expressed, including the opportunity to hear more lectures by non political science professors. Some of the comments, to me, show the tradeoffs of any attempt to solve an issue. A couple of comments mentioned that they wanted more specific grading criteria and totally clear evaluation methods. My comment is that they are good suggestions and ideas, but I wonder if, in addressing them, the experience would lose some of the freedom and flexibility that they rated positively.

Summary and Conclusions

I was the recipient of a fellowship that required me to teach in an interdisciplinary urban design studio for one quarter in consecutive academic years. Receiving the second award gave me the opportunity to try to address some aspects of the first year's experience that I perceived as needing improvement.

My assessment is that the changes were largely successful, but there are still some areas that could be handled differently. There are other aspects of this type of endeavor that are challenging, but will always require adaptation and improvisation in view of the students, faculty, university calendar, the community, timing issues, and politics. These variables constitute essential elements of the situational context.

There is no "perfect" way to make the studio experience meaningful and educational for students. Likewise, as realistic as projects that are generated by community members are, there will be limits on how well studio classes can meet those needs. Universities have scheduling constraints; students are, by definition, "in training." Universities have to downplay expectations by community members, lest they will be disappointed that the students and faculty did not solve their problem in a quarter or academic year.

The two studio experiences that formed the basis for the present paper do not represent the first time I had attempted to blend scholarship and real-world experience in the classroom. As a professor at Bowling Green State University in Ohio (BGSU), I taught a community and economic development course in the Political Science department two times. In those classes we also had common readings, a series of guest lectures from practitioners (government officials, heads of nonprofit economic development organizations, private developers, an economic developer working for a utility company), and real-world externally requested projects. The class was a simulated consulting firm in which students performed as teams of consultants for clients (people with whom I had formed relationships as director of a research and outreach center at BGSU). Students learned about teamwork, meeting deadlines, communicating in nonacademic terms, professional interactions, and so on.

One of the things my experiences at BGSU and UC showed was that this kind of course can really benefit students. In order to be successful, the faculty have to be flexible and be willing and able to seize on opportunities without throwing the entire experience off schedule. So, for example, the director of the Niehoff Studio took advantage of a design charrette in which an architectural firm working for governments in the Cincinnati area held its workshops at the studio and made a public presentation to the community at a nearby community college. This was an excellent opportunity for our students to watch and learn from professionals and see the interactions between those professionals and the politicians and administrators with whom they were working. At BGSU, there was an economic development professional who worked for an electric utility and also happened to be in a leadership role for a statewide economic development organization. Through his connections, effort, and dedication, we were able to transport the entire class from Bowling Green (in northwestern Ohio) to Columbus (state capital) where students made formal presentations about two of the projects to a meeting of the professional organization. This gave the students a real taste of what it is like to attend professional meetings and deliver a project on time for an actual audience who had "commissioned" their work as one of the real-world projects.

Finally, there are invariably unpredictable factors beyond the faculty member's control. Recognizing these "givens" helps to moderate expectations for students and the community – not to mention the faculty member – because it allows the faculty member to be open about the limits of what can be accomplished.

Endnotes

[1] The author would like to thank the Charles Phelps Taft Research Center at the University of Cincinnati for its financial support. As the Taft-Niehoff Faculty Community Scholar (2008-2009, 2009-2010) the author received a stipend and funds for travel to professional meetings to present papers based on the fellowship.

[2] The author wrote a paper on that experience for last year's MCRSA conference. Since it was written at the end of the first year and before she knew she would be awarded the fellowship a second time, the present paper has additional reflections on the first year experience. See: Beth Walter Honadle, "Urban Universities and Neighborhood Development: Reflections on a Stakeholder Analysis Studio Project," 2009 Conference Proceedings: Mid-Continent Regional Science Association 40th Annual Conference. May 28-30, 2009, Milwaukee, WI. Available at: http://www.mcrsa.org/Assets/Documents/2009_proceedings.pdf.

[3] In the first year, there was Mr. Francis (Frank) Russell, Field Service Assistant Professor and Director of the Niehoff Urban Studio; Dr. Richard Miller, Professor of Engineering; and Dr. Nnamdi Elleh, Associate Professor of Architecture, and myself instructing at the studio. In the second year, there was Mr. Russell and Dr. Miller, Dr. Michaele Pride, Associate Professor of Architecture; Ms. Juliana Zanotto, Adjunct Instructor (graduate student in Planning), and myself instructing at the studio.

[4] One of those projects was the topic of my paper at last year's MCRSA conference.

[5] It is interesting for me to look at the observations of my predecessor as the Taft-Niehoff Faculty Community Scholar. She had many positive things to say about the experience, but on this relevant point she wrote: "…The anthropology students loved the visual and spatial representations provided by the architecture and planning students, but felt marginalized by some of them. It appears that some architecture and planning students felt that the information provided by the anthropologists came too late (a product of the quarter system) and were not relevant to their task (and grade)." See: Martha Rees, "Introduction to a Community Interdisciplinary Collaboration," *The University of Cincinnati Student Journal of Anthropology*. Vol. 1, Issue 1, October 2008. pp. 1-24. Available at http://www.artsci.uc.edu/collegedepts/anthro/grad/journal/docs/UCSJA_Vol1_Issue_1.pdf.

Appendix 1: Verbatim Responses to Supplemental Questions Regarding Studio Experience

SUPPLEMENTAL QUESTIONS REGARDING STUDIO EXPERIENCE	**VERBATIM RESPONSES**
1. Have you ever taken a "studio class before?	Yes (1)[1] no (9)
2. How would you describe any differences you perceive between your experience in "typical" political science courses and this studio-based course?	• "The biggest difference was that regular political science classes are primarily lecture based, while the studio offers more class discussion and student interaction." • "One main difference would be the openness/flexibility of the studio experience which allows for a much more in-depth learning experience; a lot like OGT (sic.)" • "I like the flexibility of the course which ~~more~~ similar (sic.) to our science. It's not a hard science but our courses are sometimes too structured." • "Much more open in the sense of pitching what you want to work on and who you work with. Able to work with people in other subjects + faculty." • "A lot less structured, which I like. Much easier to get involved in an academic study group." • "They were polar opposites but at the same time the course showed us how many disciplines are needed for planning and how politics came into play in everything." • "There's much less structure in the studio courses" • "The different setting in itself is refreshing, but most importantly how it brings to light the practical aspects of local economic development that would not be highlighted in a typical classroom setting." • "Things are much more self-directed in the studio. You can choose a topic that interests you." • "Working with non-poli-sci majors"

[1] This student indicated that s/he had taken 5 studio classes and noted that they used to be a design major and urban planning major.

3. In your opinion, what were the **best** parts about taking a political science course at a studio?	• "Getting out of a classroom and having more interaction with students." • "The best parts were being able to work with the various disciplines while remaining focused on conceptual goals" • "The interaction with students in other disciplines" • "Multidisciplinary interaction. Able to see where political science fits in in the broader scale." • "The interaction between disciplines was very interesting." • "Discovering how important it is for understanding all of the puzzle pieces of planning and how it was interesting how different majors think." • "The opportunity to get outside experience one couldn't obtain in the classroom and the ability to meet with other disciplines and see different viewpoints." • "The multidisciplinary experience and how that enlightens the understanding of planning for local economic development." • "Seeing what we read about in the book put into practice instead of just talking about it" • "Seeing how non-poli-sci students work" • "Taking a class of[f] campus was fun + different"

4. What were the least desirable parts about taking this course at a studio?	• – • “The least desirable part of the studio experience was also the greatest lesson I learned. There is a definite need for the various components of economic development to incorporate other disciplines to create more sustainable projects.” • “It’s a long way from main campus almost on an island.” • “At times a bit disorganized. Part of this was because of the weather (snow).” • “Forcing myself to work on my own.” • “It could be rather unclear as to what we should be doing” • “Sometimes you feel a little lost with everything going on and having few meetings with all the poli. Science students. Also, everyone else in the studio began at the beginning of the year. If it was a studio class all year, I would find it a much easier transition.” • “none that I’d put as negative or even not as desirable as others in particular” • “The schedule was hard. Always felt behind. Sometimes came to work with planners/architects + they wouldn’t be here or were doing work for class that is difficult to get involved in.”

5. Would you take another studio course is one were offered on a topic that interested you?	Yes (1) no response (1)
	• “I would like to see more distressed communities brought to light and focused on [and gave two examples]” • “Once again, I believe the experience is invaluable and really allows you to get a hands on experience.” • “It would be interesting to further develop projects which I already started on.” • “Enjoyed the experience, learned a lot. Offered opportunities to expand intellectually. Should strongly be considered for PS students studying state and local gov’t or community/economic development.” • “I feel I became more personally involved by working toward a tangible goal.” • “It was interesting to work with students of such different disciplines and the professor was very enthusiastic.” • “It was overall a great experience. I enjoyed being part of a team and doing hands on work.” • “Great in emphasizing practical aspects and enjoyable and enriching multidisciplinary setting” • “I like the change of pace + being in a different learning environment.” • “liked getting to know professors outside our department to see a different teaching style, perspectives, who can provide different resources.”
Any additional comments about the studio experience from your perspective	• “It would be helpful to have specific grading criteria e.g. Attendance (____hrs. outside studio required) = ___% Participation ___% Papers ___%” • “Also would have liked listening to more lectures by the non poli-sci professors, + have less work days b/c the group I was involved in did most of our work outside of class + compiled it + contacted each other via Google Groups + email.” • “Eval. Methods were not totally clear as the studio work is unsure at beg. Of quarter. Each person did something different so it was hard to tell students exactly what they should do/how many hrs. they should participate outside of class/etc.”[2]

[2] This comment was handwritten by a student on the standard course evaluation form below the item, “Fairness of evaluation methods used by the instructor.” The student wrote in “A” (“Excellent”) for that item and wrote in the comment.

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Rural Community Recovery from Natural Disasters

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Abstract. This paper examines the literature concerning economic recovery from natural disasters to determine which variables can be used to indicate whether a community has recovered from a disaster. These variables are used to analyze the recovery status of counties and parishes in Alabama, Florida, Louisiana, Mississippi and Texas affected by hurricanes Katrina and Rita in 2005.

Keywords: disaster recovery, economic recovery, Gulf Coast

Introduction

In 2005, two hurricanes made landfall along the Gulf of Mexico coast (the Gulf Coast). While the majority of the media coverage focused on the city of New Orleans, those storms struck many rural areas as well. Cross (2001) shows while megacities have greater disaster resilience because their size makes a disaster unlikely to affect the entire city, plus they have greater and better resources and political and economic influence. On the other hand, the smaller population sizes of rural communities make them proportionately more vulnerable – a disaster might affect the entire town. This paper examines the status of the more rural parishes and counties along the coast in the years since those hurricanes hit. Unfortunately, a lot of these same areas will now face economic damage from a different type of disaster: the British Petroleum Deep Water Horizon oil spill.

To determine which counties and parishes (Louisiana has parishes, which are similar to counties, so through the rest of the paper the authors will use the general term "counties") were most affected by the hurricanes, the authors used the Federal Emergency Management Agency's listing of counties and parishes as federal disaster areas. Of these, the authors narrowed the focus to ten parishes in Louisiana (some of these stretch the definition of rural, as they border New Orleans and Baton Rouge, the largest cities in the state), two counties in Florida and two Counties in Mississippi. These counties showed the most visible, interesting changes in the time span that covers pre- and post-hurricane years.

Issues Regarding Recovery from Disasters

Mitchell (2004) promotes a holistic disaster recovery that includes infrastructure, safety and business functions of cities as well as cultural, creative and psychosocial functions of cities. The infrastructure, safety and business functions are relatively easy to measure, but the cultural, creative and psychosocial functions are more difficult to measure, particularly for rural areas which may not have museums, artists' conclaves or other manifestations of psychosocial functions. Mitchell also notes that, in terms of recovery policy, the goal can be divided between a return to the community's status prior to the event and using recovery initiatives to bring the community to an improved state beyond the pre-event status.

Handmer and Hillman (2004) indicates that while psychosocial and environmental recovery tends toward restoring the community to pre-event status, infrastructure and economic recovery offer the chance for improvement, for bringing the community to a state better than that prior to the event. Much of this opportunity for improvement presents itself in the replacement of destroyed infrastructure and assets with new, better facilities. Recovery might mean a restructuring of the economy and possibly a loss of local control. Handmer and Hillman further points out that the type and frequency of disasters should be considered when establishing the "normal" state of the community; if hurricanes hit the Gulf Coast once per year at about the same time every year, then hurricane landfall is part of the normal state of things. When analyzing recovery, the type of the disaster, the wealth of the local community and the scale (local, regional, national) should be considered; factors such as the global economy, socio/cultural/ethnic divisions and corruption may complicate analysis (Handmer and Hillman).

Handmer and Hillman divides economic losses into capital stocks/assets and economic flows of goods and services (including employment). The recovery of assets gets the most attention because that type of recovery effort is easily visible and valued. While asset restoration looks good, asset owners may face increased costs from property taxes or insurance on the improved assets. A second impact of asset replacement comes from the boost in economic activity from reconstruction; the economic boom appears because the asset values are not counted in gross domestic product (GDP) but the value of the reconstruction is included in GDP (Handmer and Hillman). Once the houses, school buildings and bridges are rebuilt, the construction jobs will leave the community.

As Handmer and Hillman mentions corruption (which they also call "rent seeking"), Fox Gotham and Greenburg shows similar action in the recovery aftermath of Hurricane Katrina in New Orleans in 2005 and of the World Trade Center destruction in 2001. In New York, recovery assistance did not go to the needs of moderate and low income people affected by the attacks. Instead, emergency deregulation of community development block grants and bond programs led to a luxury-housing boom; during that boom, indicators of economic recovery such as population and income increased, though not for the people most affected by the event. In an illustration of the impact of regional/national/global economy on disaster recovery, Fox Gotham and Greenburg finds that the tax incentives and subsidies offered for rebuilding the New Orleans economy have been hurt by the national economic downturn; rising construction costs combined with a shrinking market of investors to buy tax credits from developers, who then cannot finance projects to rebuild affordable housing and infrastructure projects necessary for the region's recovery.

Findings

Hundreds of counties were designated as federal disaster areas following hurricanes Katrina and Rita. Table 1 shows the counties in focus for this study. Of the 14 counties observed, only three showed the expected decrease in employment and population from 2005 to 2006 – Cameron and Plaquemines parishes in Louisiana and Hancock County in Mississippi. These counties also saw decreases in wage and salary employment in the transition from the event. From 2006 to 2007, population and wage and salary employment increased, though their respective population counts are still well below their pre-event levels. If recovery is defined as a return to status quo ante, then population one could argue that these counties have not yet recovered. If recovery is defined as the "new normal," then one could say that these counties are recovering. More information is needed, and a greater temporal distance from the event will provide more evidence in terms of population growth.

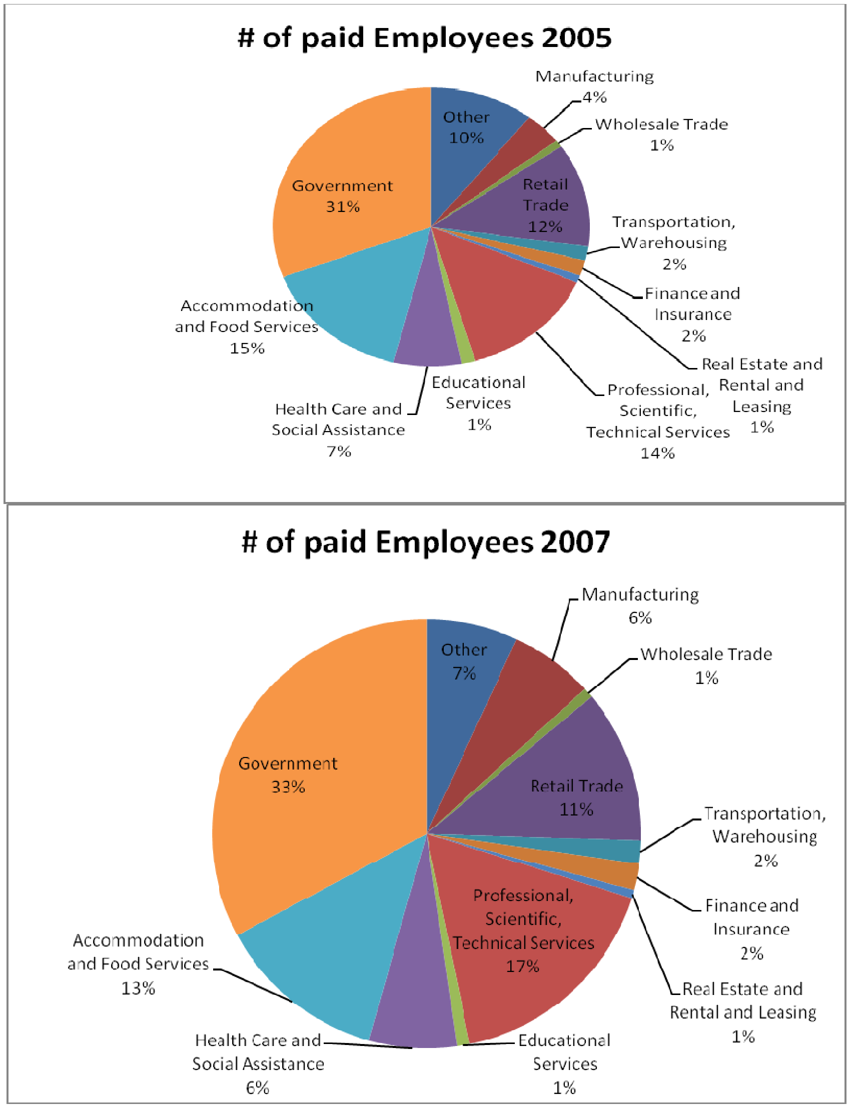
In terms of more information, the authors looked at the structure of the economy before and after the events for each of the counties. The study continues with its examination of Hancock, Cameron and Plaquemines counties. Figure 1 shows the proportions of paid employees for each of the major industries (two-digit NAICS classification) in Hancock county, Mississippi, from 2005 (before the hurricanes) and from 2007 (two years after the hurricanes).

Table 1. Parishes and Counties in the 2005 FEMA Disaster Declarations for Katrina and Rita, Population and Wage and Salary Employment

	2000	2001	2002	2003	2004	2005	2006	2007
Louisiana Parishes								
Acadia								
Population	58,819	58,732	58,803	58,747	58,633	58,768	59,648	59,803
Wage & Salary Employment	16,183	15,972	15,832	15,560	15,484	16,261	16,784	17,141
Calcasieu								
Population	183,518	182,976	182,842	183,590	184,082	184,401	183,204	184,471
Wage & Salary Employment	89,492	88,277	88,637	87,586	87,218	89,209	89,534	91,735
Cameron*								
Population	9,950	9,833	9,733	9,682	9,626	9,560	7,684	7,228
Wage & Salary Employment	4,108	3,895	3,265	3,224	3,105	2,918	2,725	3,122
Iberville								
Population	33,315	33,231	33,038	32,746	32,349	32,203	32,800	32,467
Wage & Salary Employment	16,047	15,388	15,683	15,143	15,057	14,863	14,805	15,185
Jefferson								
Population	454,693	451,981	451,213	451,144	452,116	450,848	422,222	440,339
Wage & Salary Employment	227,062	226,560	224,676	227,438	228,086	212,577	203,670	211,680
Jefferson Davis								
Population	31,399	31,100	30,947	30,874	30,825	30,901	31,204	31,136
Wage & Salary Employment	7,909	8,027	8,390	8,949	8,973	9,119	9,262	9,470
Plaquemines*								
Population	26,737	26,853	27,123	27,652	28,615	28,565	21,610	21,597
Wage & Salary Employment	18,230	18,432	16,724	16,849	16,712	16,035	15,433	15,857
St. Tammany								
Population	192,172	195,693	200,833	205,833	211,488	217,367	223,863	226,263
Wage & Salary Employment	62,035	63,181	65,783	68,660	71,810	71,020	74,922	80,078
Terrebonne								
Population	104,455	104,724	104,912	105,157	105,435	106,167	108,043	108,316
Wage & Salary Employment	48,225	49,577	50,220	50,391	50,595	52,676	57,202	60,384
Vermilion								
Population	43,891	43,775	43,766	43,690	43,748	43,919	44,028	44,995
Wage & Salary Employment	12,712	12,801	12,590	12,173	11,879	11,591	11,624	11,925
Florida								
Franklin								
Population	9,841	9,893	9,945	9,961	9,992	10,068	11,152	11,291
Wage & Salary Employment	3,033	3,245	3,451	3,483	3,491	3,468	3,652	3,703
Alabama								
Montgomery								
Population	297,341	311,689	326,900	341,974	358,360	373,511	392,323	411,254
Wage & Salary Employment	82,876	86,904	89,416	93,284	99,563	114,710	121,924	129,577
Mississippi								
Hancock*								
Population	43,274	43,848	44,435	44,835	45,445	46,088	38,853	39,741
Wage & Salary Employment	15,074	15,061	15,307	15,080	15,310	14,509	13,431	15,332
Smith								
Population	16,187	16,122	15,947	15,860	15,845	15,971	15,977	15,961
Wage & Salary Employment	4,594	4,130	4,315	4,238	3,881	3,823	3,800	3,671

Source: Bureau of Economic Analysis

Figure 1. Proportions of paid employees by industry, Hancock County, MS

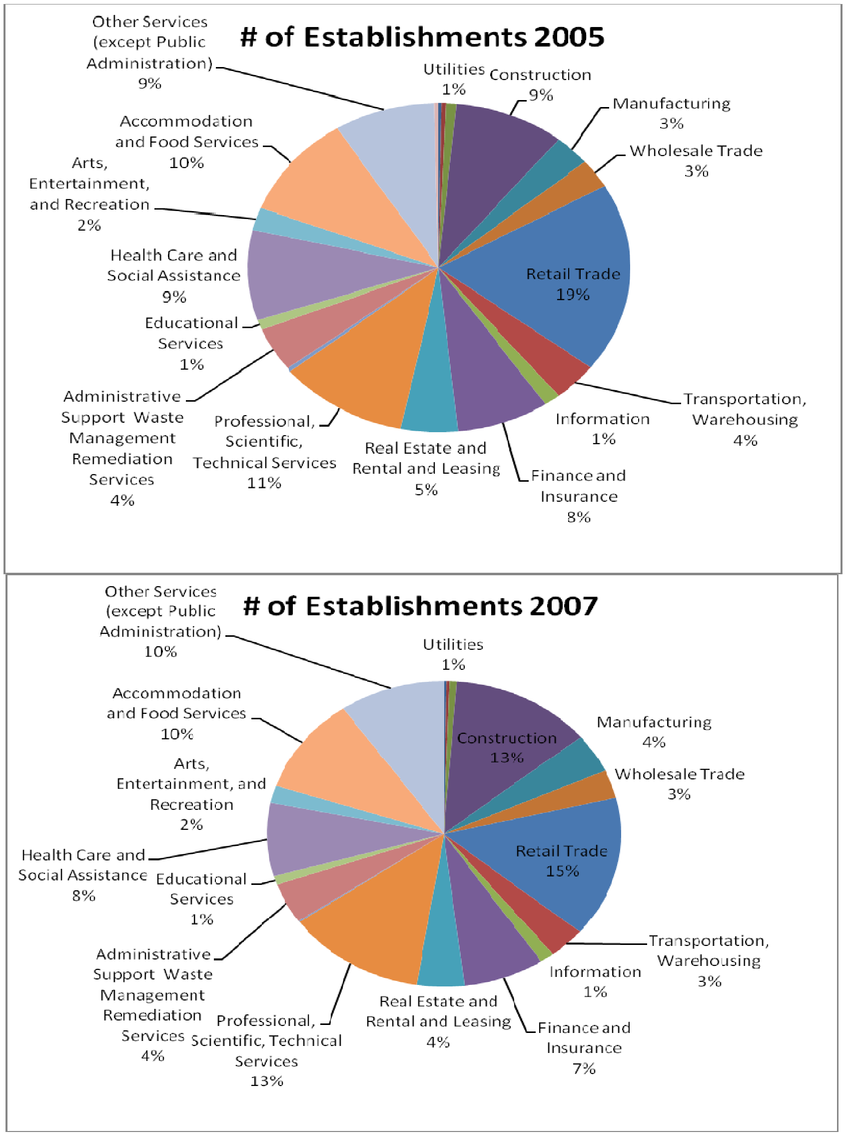


Source: U.S. Census Bureau; U.S. Bureau of Economic Analysis

Note: The Census' County Business Patterns data only includes private enterprise, so the data are supplemented with government employment information from BEA regional income estimates.

In Figure 1, in terms of employment, the structure of the Hancock economy remains relatively unchanged, except for slight adjustments in a few sectors; however, government remained the major employer (as is the case with most rural economies), followed by professional and technical services, accomodation and food services, and retail trade.

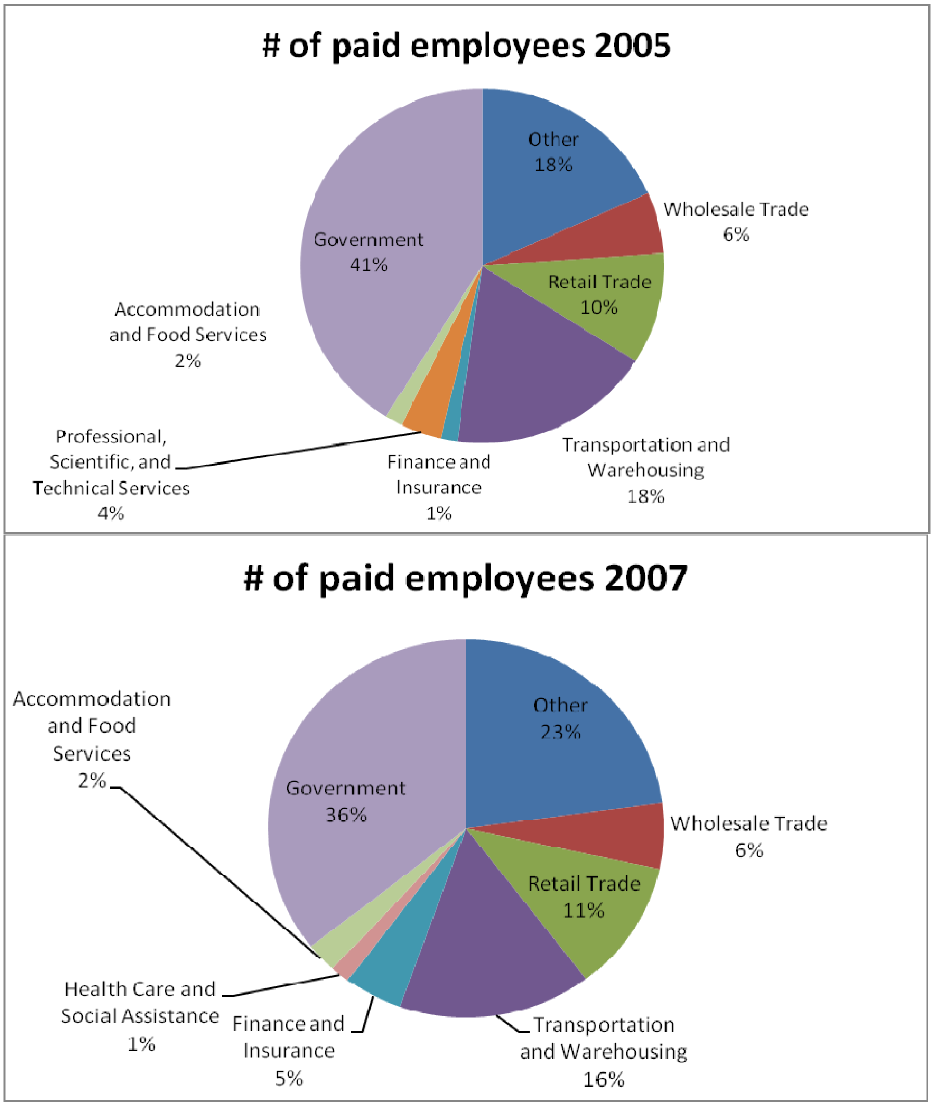
Figure 2. Proportion of establishments by industry, Hancock County, MS



Source: U.S. Census Bureau

Figure 2 shows some minor change in the county's economy in terms of the number of establishments. Retail trade shrank by 4% while construction increased by 4%. This relative shift in industry sizes may be due to construction establishments growing in order to repair homes and structures in the county that were damaged during the storms. The category "Other Services except Public Administration" includes industries such as auto repair, furniture repair, and appliance repair – services which probably saw increase in demand after the storms. Other Services only increased 1% in the interval, but when paired with Construction, the two categories made up almost 25% of the economy by 2007.

Figure 3. Proportions of paid employees by industry, Cameron Parish, LA

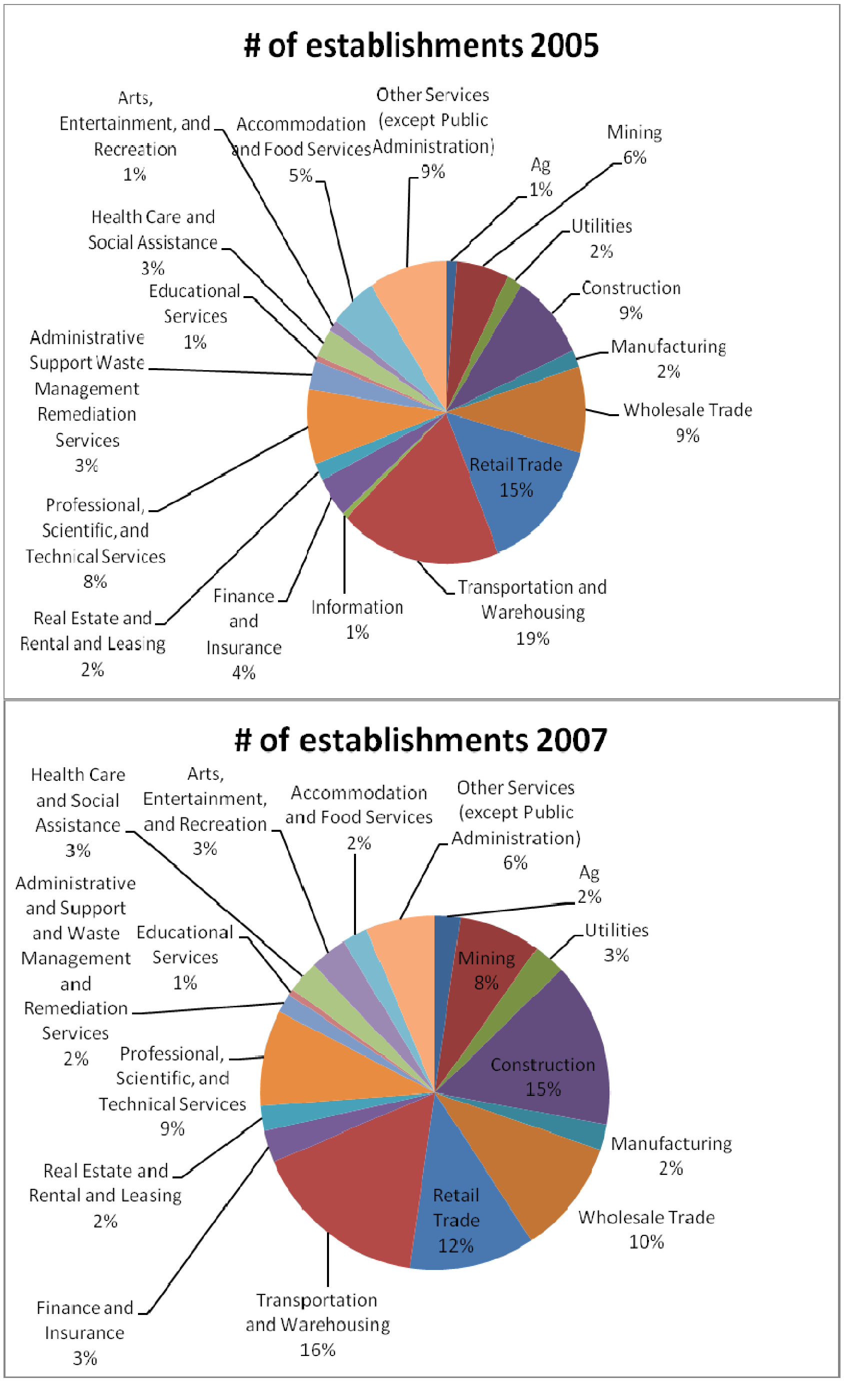


Source: U.S. Census Bureau; U.S. Bureau of Economic Analysis

Figure 3 shows that in Cameron parish, Louisiana, employment shifted some from government sectors to Other Services, perhaps indicating that repair jobs opened up in that parish after the hurricanes.

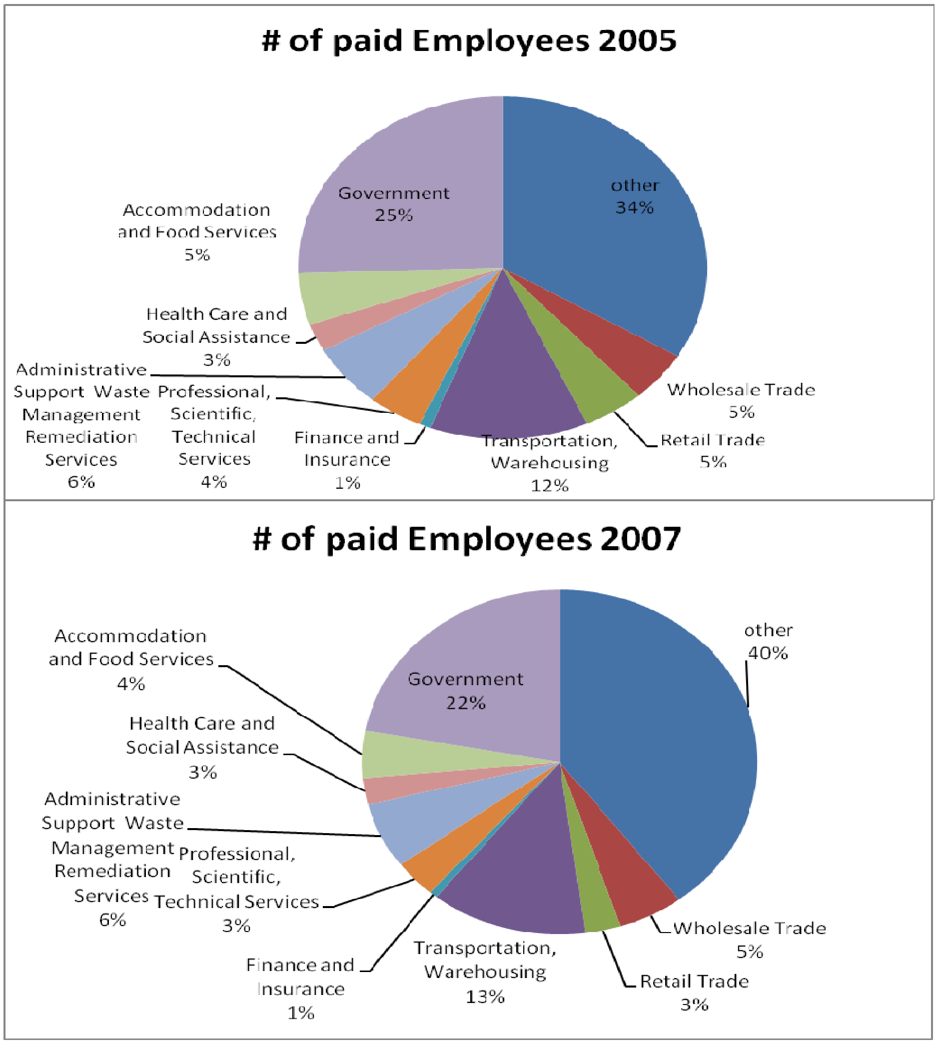
The proportion of establishments remained relatively the same (Fig. 5), except for a 6% increase in establishments in the Construction sector.

Figure 4. Proportion of establishments by industry, Cameron Parish, LA



Source: U.S. Census Bureau

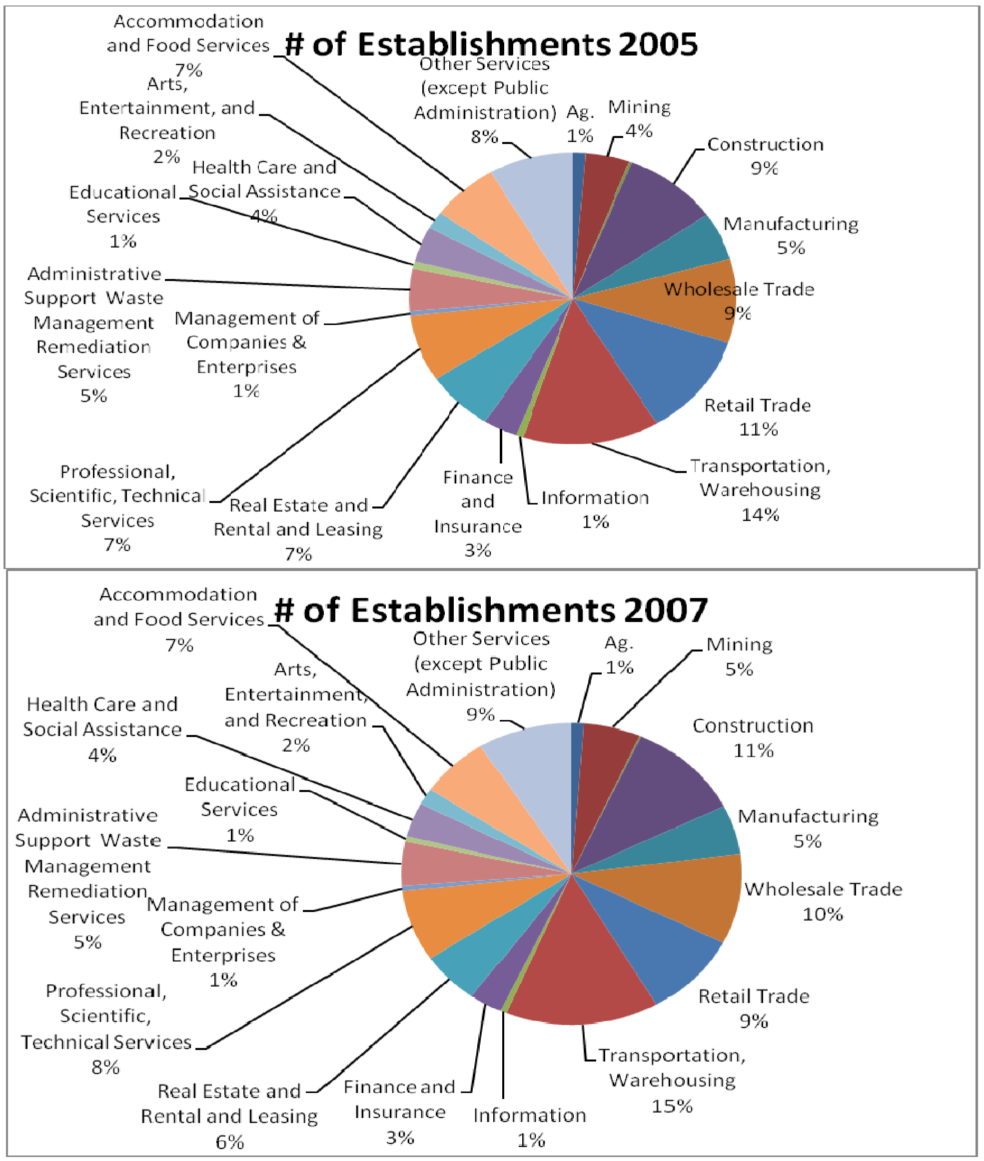
Figure 5. Proportion of employment by industry Plaquemines Parish, LA



Source: U.S. Census Bureau; U.S. Bureau of Economic Analysis

In Plaquemines parish, Louisiana, employment in the Other Services sector, already large in 2005, grew by 6%, again reflecting the demand for repair work after the storms, while Figure 6 shows that Plaquemines' structure remained almost the same – only slight increases in Construction and Other Services.

Figure 6. Proportion of establishments by industry, Plaquemines Parish, LA



Source: U.S. Census Bureau

Conclusions

Given the increases in population and employment in the three counties that had negative changes in those categories following Katrina and Rita, and the minimal change in economic structure in those counties, one could almost argue that they had at least started to recover by 2007. One could also argue that, given similar economic structure pre- and post-events, they had not recovered because the pre-storm state was the "normal" state. As such, only a return to pre-storm norm would constitute a "recovery." Another concern regarding a declaration of "recovered" stems from the changes in the Construction and Other Services (repair services) sectors. The growth and change in relative economic importance in these sectors may only have come from an increase in demand for those services. Destroyed homes and buildings, ruined furniture and carpets, damaged vehicles all needed fixing in large numbers after the storms, hence an increased demand for the outputs of those sectors. A few more years of data will tell a clearer tale regarding recovery; if those sectors continue to grow in subsequent years after the storms, then one could attribute those changes to genuine growth in those sectors; if those sectors shrink to their pre-storm levels, then it could be concluded that they were not part of the recovery those economies – once all the repairs and reconstruction were completed, the demand went away, and those jobs and establishments went away.

We may never get a clear picture of recovery in the Gulf Coast region, insofar as Katrina and Rita are concerned, given the recent oil spill disaster. The impacts of the oil spill will be numerous (damage to fishing industries, tourism industries, etc) and will affect any data that are gathered in the coming years. Instead, analysts will have a new event to measure, and they will have to acknowledge the post-Katrina/Rita world as the "normal" prior to the oil spill.

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The Impact of Levy Systems on the Economies and Agricultural Industries of Rural Communities in Louisiana

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Abstract. Levy systems have been used historically to protect lands from flooding and also to assist with irrigation. This paper looks at issues surrounding the current levy systems in Louisiana. In northeast Louisiana, the Army Corp of Engineers has declared the levy systems around the Ouachita River as unsafe. As a result, the Federal Emergency Management Agency is remapping the flood zones in the areas protected by the levies. The result of these changes means purchases of flood insurance required for property owners in the area. This may affect the location decisions of companies considering relocation to the area, which will impact the region's economy.

Keywords: Levees, flooding, flood insurance policy

Introduction

The Ouachita River Basin covers 16,000 square miles in Louisiana and Arkansas, and stretches from the Red River in the west to the Tensas River in the east, with the Ouachita River in the middle. A system of levees along the Ouachita River extends 74 miles from the City of Bastrop, Louisiana, to Sandy Bayou. Several cities and towns are protected by these levees, including Monroe/West Monroe, Bawcomville and Columbia (U.S. Army Corps of Engineers). In 2008, the Army Corps of Engineers declared that it would decertify a large portion of the levy system, after which the Federal Emergency Management Agency would redraw the Special Flood Hazard Area maps to reflect the increased flood risk to the areas protected by the levy system (KNOE). If FEMA redraws the maps, any granting agency or lender will require the mandatory purchase of flood insurance for any purchase, construction, repair or improvement of buildings (Ouachita Parish Police Jury) – owners of such structures who did not previously have flood insurance would now have to purchase it, and any loans or grants for new construction would require flood insurance as well. Policymakers – the local governments, FEMA, Corps of Engineers – do not agree on who should pay for restoration of the levees to certification standards, and this has spurred the Congressional delegate and representative local groups to try to get the federal government to help (News-Star, KNOE). Local homeowners do not want to carry extra insurance, and economic development stakeholders worry that the flood insurance requirement will scare away businesses looking to relocate. An estimated 48% of homeowners in Monroe/West Monroe live in a floodplain area (MacDonald et al).

Background on Levees

For hundreds of years, American farmers have constructed dams and levees to clear floodplains for production purposes, and as cities and towns located along rivers, local governments also constructed flood protections. After massive floods from the Mississippi River in 1927, Congress ordered the Corps of Engineers to construct and reinforce levees in the Mississippi River's alluvial basin. The Corps oversees 14,000 miles of levees and 2,000 levee systems, but they do not oversee the privately constructed levees, an unknown number, that exist (Ferber). Oversight of floodplains and levee systems is conducted by multiple agencies, each with their own incentives for flood control, and they range from the Army Corps of Engineers to FEMA to state agencies, and even cities may have their own flood control policies (Davis). Some federal policies have required local governments to share the cost of building and maintaining levees with the Corps of Engineers, while in some cases homeowners were exempted from the mandatory flood insurance if their home was located behind a levee. Because of these policies, local governments have paid for levees that just meet federal standards, and development continues in floodplains (Ferber).

Davis says that despite the flood control efforts of local, state and federal agencies, the damage from flooding continues to increase. Ferber lists several events in the last twenty years in which levees failed – Mississippi River floods in 1993 caused $21 billion in damages and killed 48 people. During Hurricane Katrina, the New Orleans levee system failed, and approximately 75% of the city flooded (Link). In reaction, Congress directed the Corps of Engineers to inventory the nation's levees and identify those at risk of failure; Congress also directed FEMA to update their flood maps and accreditation of levees (Ferber).

Flood Insurance, Flood Risk, and Location Decisions

The National Flood Insurance Program (NFIP) was designed to subsidize insurance costs for existing homeowners in floodplain areas, and communities in floodplain areas had to participate or risk losing all future federal funding (Shilling, Sirmans and Benjamin). The NFIP also requires that communities establish land-use planning that limits exposure to flooding (Shilling, Sirmans and Benjamin; Pompe and Rinehart). Pompe and Rinehart includes an overview of major flood policy changes since the 1970s, including attempts to avoid encouraging development in hazardous areas through subsidized insurance premiums. Despite these policy efforts, as studies show that the average number of floods per year has risen, so has the annual property damage from flooding (Brody et al). The subsidized insurance lowers premiums that should be extremely high in the face of flood risk, thus lessening the expense of locating in a high-risk area. The activity at the intersection of human economic development and natural land features may also increase the possibility of flooding (Brody et al; Pompe and Rinehart; Freudenburg et al).

Pompe and Rinehart argue that government covers the increasing costs of subsidized flood insurance through taxes, which are also paid by citizens who do not live in flood-prone areas. In Shilling, Sirmans and Benjamin, NFIP's own estimates showed three dollars of paid claims for every $1 collected in premiums. Shilling, Sirmans and Benjamin studied the effect of NFIP on housing values in the Baton Rouge, Louisiana, area and determined that NFIP actually created a wealth transfer through subsidized flood insurance; because NFIP only applies to existing homeowners and not new ones, new construction must buy private flood insurance, which carries much higher premium costs.

MacDonald et al studied housing location decisions in the city of Monroe and for Ouachita Parish, Louisiana. The authors theorized that the difference in similar homes' sale prices would equal the change in insurance premiums if non-insurable costs are zero, because a homeowner could self-insure against flooding by locating in a low-risk area (they could limit or avoid flood insurance costs by locating outside the flood zone). They determined that sales price differential and change in insurance premiums were nearly equal, so non-insurable costs played only a small role in location decisions. Therefore, a homeowner's location decision between floodplain and non-floodplain sites depends on whether they perceive that a claim will cover the cost of flood damage. Given that almost half of Monroe's population at the time of the study lived in a floodplain area, the perception may be that insurance covers the cost of flood loss.

Current State of the Ouachita River Basin Area

Ouachita Parish faces flooding even with the levee system in place (Ouachita Parish Police Jury), and the Monroe area in particular faces flooding hazard due to the low elevation of the entire urban area (MacDonald et al). A system of canals and channels funnels rain water into the Ouachita River, and the city also employs pumps; these pumps sometimes fail, and rainwater backs up into the city, or the tributaries and bayous in the basin send backwater into the area (MacDonald et al; Ouachita Parish Police Jury). To provide an idea of the frequency of flooding and the damage caused, Table 1 compares Ouachita and nearby parishes with some of the Gulf Coast Parishes affected by Hurricanes Katrina and Rita.

Table 1. Total Flooding Events and Property Damage in Select Louisiana Parishes for the Last 10 Years

Ouachita River Basin Parishes			Gulf Coast Parishes		
Parish	Total Events	Damage $ Millions	Parish	Total Events	Damage $ Millions
Ouachita	29	5.99	Orleans	16	0.36
Union	1	0.1	Plaquemines	3	0.13
Caldwell	8	0.29	Jefferson	16	0.31

Source: National Climate Data Center

The three selected Ouachita River Basin parishes combined had more flooding events with more damage cost during the last ten years than the three selected parishes from the Gulf Coast (and particularly the New Orleans area), which includes data from the 2005 hurricanes that caused so much devastation. Ouachita Parish alone had almost as many flooding events as all three Gulf Coast parishes. This shows the reality of the flood risk in the Ouachita River basin and the need for either secure levees or flood insurance.

Conclusions

Will homeowners relocate as feared if the flood maps are redrawn? It depends on current homeowners' perception of flood insurance. If they believe it will cover the possible damage from flooding events, then they will remain in their current homes and pay the extra cost of flood insurance. It will also depend on whether homeowners perceive the cost of moving is greater than the cost of insurance. Moving costs include not only the direct cost of hiring a truck and/or professional movers but also search costs (time and effort), agent fees, closing costs, etc. Furthermore, once flood maps are changed, new homes will not be eligible for the subsidized flood insurance; only existing homes are eligible. The same choices will apply to business – if they build new facilities in the newly marked floodplain, they will have to pay for unsubsidized flood insurance, an increase in their fixed costs.

The policy options for Ouachita Parish include increasing taxes to pay for upgrades to the levee system. This is probably the least likely option in a highly tax averse region of the state; the levee board in nearby Tensas Parish tabled such a tax increase despite facing the same issue of new flood designations (Hilburn). A second option lies in the creation of zoning restrictions or land use planning that discourages development in floodplain areas. This may work for future development, but with the entire city of Monroe already in the floodplain, too many entities will be grandfathered in to make much difference. Finally, the authorities could switch from structural flood controls such as the canals and levees in place to the more sustainable flood controls adopted in Japan and the

Netherlands (Crichton) – wetlands combined with careful land use planning and insurance incentives; wetlands have some natural flood mitigation properties (Brody, et al). That would require a change in the thinking on the part of those in charge of flood control at the local and state levels. Environmentally, a switch to sustainable methods might restore some of the natural habitat lost to development. The best solution is for local officials to build a better relationship with FEMA and the Army Corps of Engineers, so that local issues with levee upkeep and flood zone declarations can be communicated to the federal agencies.

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The Determinants of Agglomeration in Health Sector Employment in US Cities

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Abstract: There is a tendency of industries to co-locate together in order to reap the benefits from externalities. The basic objectives of this study to identify the factors affecting agglomeration of health sector in US cities. Due to difference in the nature of industries this study has considered to investigate on signal health sector. Moreover, this study used the panel data model in order to capture both cross-section and temporal dimension of the agglomeration. The study has found that factors like local competition, population, input availability, and state research expenditure on health are significant for the agglomeration of health sector. This study has also identified that fixed effect panel data model can also be an appropriate model to estimate the factors affecting agglomeration in health sector. Moreover, panel data model has also captured the dynamic trend of agglomeration of health sectors in Metropolitan Statistical Area of US.

Key words: Agglomeration, Health sector, Employment, US cities.

Introduction

Cities are the home of millions of people and their concentrated economic activities. City formation itself describes the process of agglomeration where concentration of economic activities built-up along with the time in a relatively small area. City helps to reduce the transaction costs and facilitates to knowledge spillover. Reduction on transaction costs and facilitation of knowledge spillover have positive impact due to externalities. Therefore, urban economists believe that the existence of agglomeration economies. Agglomeration economies can be localization economies i.e. economies arise from the factors within the industry and urbanization economies i.e. economies arise from the factors outside of industry. There have been efforts in the past to determine the factors affecting agglomeration. Most of those studies concluded that the labor, transportation cost, proximity to inputs or output and specific characteristics of cities are the major factors contributing to agglomeration. Additionally, there have also been efforts to figure out the appropriate model for identifying factors that affect agglomeration. Most of those studies were done by taking all of the sectors of the economy. Since the nature of industries are different from each other i.e. some industries are manufacturing some industries are service oriented. Therefore, there is a need of study to identify the factors for the particular sector of an economy. Visualizing that gap, this study has tried to contribute on identifying factors that affect to health sectors' agglomeration with an appropriate model. In this study, health sector is defined as broadly that includes four major sub-sectors Ambulatory Health Care Services, Hospitals, Nursing and Residential Care Facilities and Social Assistance. The definition of health sector is defined as in North American Industry Classification System (NAICS) that included above four subsectors.

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There are three rationales of doing this paper. Firstly, majority of studies done so far are based on the cross sectional data, there is no inclusion of temporal dimension of the agglomeration in the model. In this study panel data are used in order to capture both dimensions i.e. temporal and cross-sectional dimensions of agglomeration. Secondly, previous studies were done based on Standard Industrial Classification (SIC) codes, which is older version of industrial classification system of industries. But, County Business Pattern (CBP) introduces data set under the NAICS from 2001. These two SIC and NAICS coding systems do not match exactly. Besides, there has been lot of technological transformation going on in the health industry over the years; therefore there is a need of updating the knowledge on agglomeration under NAICS regime specifically within the specific sector. Lastly, since the natures of industry are different from one another some are manufacturing oriented while others are service oriented. Factors affecting to agglomeration would likely to be different based on the nature of the industry. In some industries inputs occupies major of portion of the total cost whereas in other industries supply transaction cost occupies major portion of the total cost. Based on those natures, some industries agglomerate near to the input markets and others industries agglomerate to the output markets; therefore there is a need to indentify drivers of agglomeration for health sector. The reason of taking health sector is because health sector is the most important sector of the US economy.

The major objectives of the study are to investigate the factors affecting the health industry agglomeration in the Metropolitan Statistical Area (MSA) of lower 48 states of United States. Specifically, following objectives are analyzed in this study.

- Identify the factors affecting health sector agglomeration in the US cities.
- Examine pattern of agglomeration of the health sector in the US cities.
- Identifying the appropriate model for determining factors affecting health sector agglomeration.

Conceptual Framework

Following simple illustration with very simple assumptions is enough to visualize the general tendency of firms to concentrate in particular place (figure -1). Let's take two firms X and Y and their markets are M_1 and M_2 equal size. For the sake of simplicity, let's say markets arranged in a linear fashion and there is only transportation cost involved and other costs are holding constant for both firms. Firm can earn more profit if it can sell to both of the markets and assumed both firms are operated at same technology. But, transportation cost increases with the distance increase. In the current arrangement, due to the proximity to the respective markets X firm will enjoy market M_1 and Y will enjoy market M_2. If the firm X move slightly toward M_2 market still it is can capture M_1 and able to reduce the distance M_2 market thereby lowering the transportation cost. Similarly, firm Y has also incentive to move toward the M_1 market in order to lower the transportation cost without losing the market M_2. Ultimately, X will move toward the M_2 market and Y will move toward the M_1 until they meet together. Once firm X and Y in same place there is no further incentive to move away from each other.

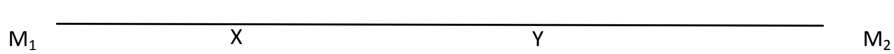

Figure 1: Relative position of firms in linear markets arrangement.

If any one of two firms moves from that equilibrium places, one will lose the market of opposite direction of the movement. Therefore, they do not have incentive to move away from each other. These firms do not have to be agglomerated exactly at the middle of the line. The positions of X and Y are determined by the market size and price of two markets, transportation costs and other specific characteristics and facilities of particular city. This illustration explains the simple supply side story of agglomeration; however this intuition can be applied to explain the demand side as well. In the demand side, firms try to minimize the cost when firm is not a price taker in its output market (competitive market). As long as the firm is a price taker cost minimization would be the strategy of firm to get higher profit.

It is easier to understand the agglomeration of interdependent industries (backward and forward linkage) but the question arise how same kind of firms with homogenous product wanted to be co-locate together. Hotelling spatial game model answer that question. Let us assume there is a beach, which is linear as shown below from [-1, 1] (figure-3). Two ice cream sellers, with homogenous quality of ice-cream, wanted to sell their product along side of beach. For the simplicity let's assume that consumers are distributed evenly along the line of beach.

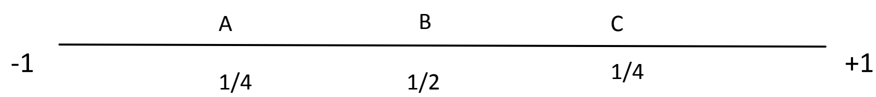

Figure 2: Ice-cream Sellers Location Decision in Linear Market.

If the first seller allowed choosing the place, he/she may choose any place along the line. Everybody has to come to that seller and buy the ice-cream. Let's assume he /she chose the position A and next seller will choose slightly right to the A so that second seller will capture almost 75 percent of the market. If first seller is allowed to move again he/she will choose right of the second seller ultimately these two sellers will end up at the position B. This is the equilibrium position for them. However, this position is not the socially optimal position. Social optimal position is achieved if first seller is on position A and second seller is on position C. In these positions, all consumers have to walk just one-fourth of the total distance. This is how two same firms co-locate together when there is competition occurs.

Relevant Literatures

The earlier contribution on agglomeration was made by *Weber, von Thünen, Christaller, Isard* through the location theory. Marshall (1920) specifically described the determinants of agglomeration economies that arise from the concentration of economic activities. He suggested that there are three causes of localization of economic activities. These three causes are input sharing, labor pooling and knowledge spillover. These three factors can also be summarized functionally as sharing, matching and learning (Duranton and Puga, 2004). In a city upstream and downstream firms co-locate together in order to reduce the transaction cost between these two cities. Besides, there is a sharing of indivisible goods and facilities which is non-tradable between cities, which ultimately triggers the process of agglomeration in particular location (Marshall, 1920). Higher population creates the pool of labor in which there is a better match between an employer's needs and a worker's skills (Ellion and Glaeser, 1999). It also reduces risk for both employer and employee. Spillovers of knowledge also enhance the economies of scale which ultimately triggers the process of localization. This allows workers to learn from each other. Urban economist also viewed that cities formation itself is the most significant manifestation of the agglomeration economies i.e. of concentrated human settlements, intended to share social overhead (Ellion and Glaeser, 1999).

Krugman (1999) also attempted to explain uneven distribution of the economic activities in the due to tug of wars between centripetal and centrifugal forces. He has given the list of centripetal and centrifugal forces as following (table-1). Centripetal forces positively contribute to agglomeration whereas centrifugal forces negatively contribute to the agglomeration. Krugman admits that the list of these variables is not comprehensive; it is merely a selection of some forces that may be important in practice.

Table 1: Forces Affecting Geographic Concentration

Centripetal force	**Centrifugal force**
Market size effect (linkage)	Immobile factors
Thick labor market	Land rents
Pure external economies	Pure external diseconomies

Source: Krugman, 1999. (http://irx.sagepub.com/cgi/reprint/22/2/142)

The centripetal force mentioned in the first column represents the Marshallian sources of external economies. According to his explanation a large market size creates the backward and forward linkages and thick labor market is supported by concentration economic activities. It is because workers easily find employers and employers easily find the workers. Moreover, Krugman further explained that a local concentration of economic activity may create more or less pure external economies through information spillovers. In the centrifugal forces lists, immobile factors (negative) contribute to the dispersion of activities, similarly concentration of economic activity increases land rent thereby discouraging the further concentration and pure external diseconomies such as congestion can be created by the concentrations of activity.

According to Glaeser (2010) due to recent advancement of transportation and communication transportation costs has significantly reduced. Therefore transportation costs has little role (but significant) in determining the agglomeration of the industries. However, in the health industry distance in term of cost may not be important but distance in terms of time is crucial for health industry. In summary, Glaeser wanted to show that location decision of the firm is basically determined by weighing the factors like backward/forward linkage, local competition and local non-tradable inputs and conditions together rather than just distance.

According to McDonald and McMillen (2007) cities are centers of diversified services, production and specialized services. Due to diversified and specialized services of cities agglomeration of economies realized in cities, firms try to concentrate their activities around cities. These authors also categorized the agglomeration of economies into three categories i.e. urbanization economies, industrialization economies and localization economies. In urbanization of economies, the benefits derived from the agglomeration of population, common infrastructures, availability of labor and market size. But, in industrialization economies the benefits derives from the agglomeration of industrial activities, such as being suppliers or customers and activities near a specific facility such as university, transport terminals, or government institutions respectively. Localization economies are external to the firm but internal to its industry. Localization of economies is limited to the geographic extent and should not extend from the central city locations to the suburbs or vice versa, whereas urbanization economies can extend beyond the boundary of metropolitan area (Rosenthal and Strange, 2003).

Health sector is one of major sectors of the US economy in which advanced technologies have been introduced in order to improve the quality of services. People might suspect that distance play little role on determining the agglomeration in this sector due to introduction of advance technologies. But, even in a situation of electronic transmission of much information, physical location matters for knowledge flows because electronic contacts have been found to complement rather than substitute for face-to-face encounters (Gaspar and Glaeser, 1998). For example close physical contact is more important for the knowledge flows in the hospital services industry because many medical procedures require to have visually demonstrated. There have been examples of joint ventures and strategic alliance between the hospitals. According to Bates and Santerre (2005) Day Kimball Hospital and Backus Hospital, both located in eastern Connecticut, agreed to share the cost of mobile MRI unit. Not always agglomeration contributes positively to the productivity of industries. Some empirical researchers have found that an evidence of negative impact on productivity once an increased number of hospitals in the same area (Bates and Santerre, 2005). Too many hospitals in same area unnecessarily compete on cosmetic quality items rather than actual productivity (Bates and Santerre, 2005). Such competition makes hospital to engage on a " medical arms race" thereby spend unnecessarily on items such as cosmetic quality improvements, cost-enhancing technologies, and duplicate facilities as a way of attracting more physicians and patients (Robinson and Luft, 1985).

Most of the previous studies have found that Marshallian three factors i.e. input sharing, labor pooling and knowledge spillover were the most important factors to determine the agglomeration. Moreover, most of these papers have used cross-sectional model in order to determine the factors. But, later Koo (2005) found that there is endogenity problem in the cross sectional model and he used the three-stage least squares (3SLS) in order to resolve that problem. He introduced the following simultaneous system of two equations model to determine the factors affecting agglomeration.

$$FA_{ij} = \beta_0 + \beta_1 KS_{ij} + \beta_2 LP_{ij} + \beta_3 INP_{ij} + \beta_4 P_j + \beta_5 D_i + \varepsilon_{ij} \quad \text{(1)}$$

Where, FA_{ij} is agglomeration of industry i in region j, KS_{ij} is knowledge spillover created by industry i in region j, LP_{ij} is labor pooling for industry i in region j, and INP_{ij} is input availability for industry i in region j, P_j is population in region j, and D_i is an industry dummy variable.

$$KS_{ij} = \alpha_0 + \alpha_1 FA_{ij} + \alpha_2 SE_{ij} + \alpha_3 SP_{ij} + \alpha_4 DV_j + \alpha_5 LC_{ij} + \alpha_6 D_i + \mu_{ij} \quad \text{(2)}$$

Where, SE_{ij} is the percentage of small establishments in industry i in region j, where KS_{ij} is knowledge spillover created by industry i in region ji, FA_{ij} is agglomeration of industry i in region j, SE_{ij} is the percentage of small establishments in industry i in region j, SP_{ij} is specialization of industry i in region j, DV_j is economic diversity of region j, LC_{ij} is the level of local competition of industry i in region j, and D_i is a dummy variable included to capture industry-specific effects.

Simultaneous model does not explain the temporal dimension of agglomeration. Therefore, in order to capture the dynamics of agglomeration along with cross-sectional dimensions panel data model is used in this study. There are also several advantages of using panel data. According to Wooldridge, (2002) panel data is used to solve the omitted variable problem. There are other more advantages of using panel data model than cross-sectional or time series model. According to Baltagi (2001), there are following advantages to use panel data.

a) Large number of data points.
b) Increase degrees of freedom & reduce collinearity.
c) Improve efficiency of estimates and
d) Broaden the scope of inference

Methods and Procedure

Data Source

The health sector[1] employment data of Metropolitan Statistical Area (MSA) is used for the analysis. Since, metropolitan area has geographically compact development pattern. MSAs in this study are only taken for the lower 48 states of US. Employment data of under the heading health care and social assistance are taken from County Business Pattern (CBS) of US Census Bureau. The NAICS code for health care and social assistance is 62. This is broad sector rather than specific industry. This sector includes four major industries i.e. ambulatory health care services, hospitals, nursing and residential care facilities and social assistance. According to Census Bureau, the health care and social assistance sector is arranged on a continuum starting with those establishments providing medical care exclusively, continuing with those providing health care and social assistance, and finally finishing with those providing only social assistance. The selected MSAs were presented in the map with red color (figure-1).

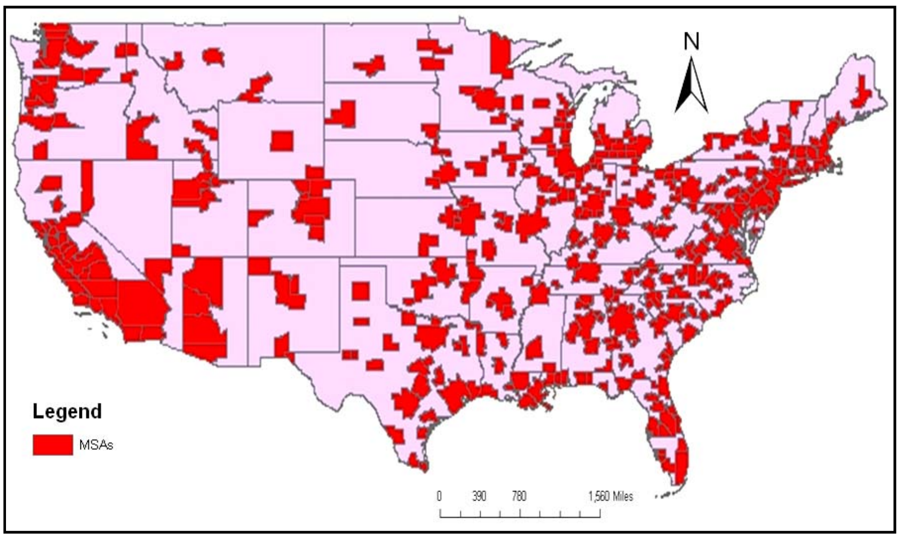

Figure 3: MSAs included in the data points.

Besides, the employment data, population, physical size of MSAs, other demographic variables are also used and are collected from Census Bureau. Moreover, average health expenditure by the state is collected from National Center for Health Statistics, labor force from Bureau of Labor Statistics and national input-output coefficient from Bureau of Economic Analysis. Since this study has used panel data, the data are arranged across the MSAs and of five years time period (from 2003 to 2007).

Analysis

In this paper panel data model is used to determine the factors affecting agglomeration. Since most of the variables are not directly measurable therefore, numbers of indices are calculated. Some of them are proxy indices. The agglomeration of industry i in region j at time t can be measured in the form of relative density of industry employment to the nation employment of that industry. In this study, health sector is only investigated therefore subscript i is not needed therefore it is nor used here. This agglomeration index, which is dependent variable, is calculated as following.

$$HA_{jt} = \frac{E_{jt}}{E_{ust}L_j} \dots\dots\dots\dots\dots\dots\dots (3)$$

Where,
E_{jt}= health sector employment number in MSA j at time t.
E_{ust}= US health sector employment number at time t (in million).
L_j= Physical size of MSA j (sq. mile of in the year 2000)
HA_{jt}=Proxy for agglomeration of health sector MSA j at time t

Most of the explanatory variables indexes, which is already been used, are taken from Koo (2005)'s work. Based on above index agglomeration values are calculated. After examining the calculated value of agglomeration, New York, Los Angeles, Trenton-Ewing, New Haven and San Francisco are found most agglomerated MSAs with rank first to fifth respectively. But, from the year 2005 Boston gained the fifth rank and San Francisco is on the sixth place.

The first explanatory variable is average state expenditure on health research in which MSAj is located. This is a proxy variables used to capture the knowledge spillover on health industry. It is expected to have positive effect on agglomeration.

The second indicator is input availability. According to Koo (2005) this measure evaluates how strong the presence of supplier industries for the health sector is in MSAj. It is expected to have positive effect on agglomeration.

$$INP_{jt} = \sum_{ki=1}^{n} \omega_{kt} LQ_{jt} \quad \dots\dots\dots\dots\dots\dots (4)$$

Where,
INP_{jt}= input availability in health sector MSA j at time t
ω_{kt}=input-output coefficient from industry k to the health industry.
LQ_{jt}= Location Quotient for health industry of MSAj at time t

The third indicator is location quotient that captures the specialization of the health sector in MSAj. This indicator also provides the information about the input distribution and strength of input industry presence. It was expected to have positive effect on agglomeration.

$$LQ_{jt} = \frac{\frac{E_{jt}}{E_{jtot}}}{\frac{E_{ust}}{E_{ustot}}} \dots\dots\dots\dots\dots\dots\dots (5)$$

Where,
LQ_{jt}= Location Quotient of health sector MSA j at time t
E_{jt}= Employment in health sector i of MSA j at time t
E_{jtot}= total employment of MSAj at time t
E_{iust}=employment in health sector in US at time t
E_{ustot}=total employment of US in time t

The fourth indicator is local competition that is developed by Glaeser et al. (1992). This indicator is the ratio per employment establishment number of MSAj to ratio of national level. It is expected to have negative effect on agglomeration.

$$LC_{jt} = \frac{\frac{ETS_{jt}}{E_{jt}}}{\frac{ETS_{ust}}{E_{ust}}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

Where,
LC_{jt}= Local competition in health sector in MSA j at time t.
ETS_{jt}= Business establishment number of health sector in MSAj at time t
E_{jt}=Employment of health sector of MSA j at time t
ETS_{ust}= Business establishment number of health in US at time t
E_{ust}=Employment in health sector in US at time t

The fifth explanatory variable is proportion of small establishment number of MSAj to the total establishment number in the health sector. In this study, small industry is defined as industry with less than 100 employments. This is just an arbitrarily chosen. It is expected to have positive effect on agglomeration because of interconnectedness of the many small industries.

MSA population is the last variable that is considered for this model for MSAj at time t. It is expected to have positive effect on agglomeration. Population can be viewed as the labor pooling source as well as pool of consumers who consume the health sectors services.

Instead of looking at the individual intercepts of 352 MSAs, MSAs were clustered into four groups. In order to cluster them average cluster linkage method is used. Four categories are found to be appropriate to categorize all MSAs based on the agglomeration value. Cluster one has the lowest value of HA_{jt} (i.e. lowest agglomerated MSAs) whereas cluster 4 has the highest value of HA_{jt} (i.e. highest agglomerated MSAs). But, there are not very many MSAs in fourth cluster. After dividing them into four clusters least square dummy variable (LSDV) model is calculated in order to see the fixed effect model of panel data. After LSDV, random effect model is also calculated. Later Hausman's specification test is calculated in order to choose appropriate model between fixed-effect model or random effect model. Detail description of the fixed and random effect models are presented below.

a) Fixed effect model.

A fixed effect model assumes differences in intercepts across groups or time periods. Following model used to estimate the parameters.

$$y_{it} = (\alpha + u_i) + X'_{it}\beta + \varepsilon_{it}$$
$$\varepsilon_{it} \sim (0, \sigma_\varepsilon^2)$$

Where, α is usual intercept and u_t is intercept for the individual intercept for the MSA. X'_{it} is the vector of explanatory variables and β is usually parameter to be estimated. u_t is calculated by creating the dummies for each MSA. As earlier explained in this paper cluster of MSAs is used rather than dummy for each MSA. Before calculating model, descriptive statistics is calculated and presented below (table-4).

Table 4: Descriptive Statistics of Variables.

Variable	Abbreviation	N	Mean	Std Dev	Minimum	Maximum
agglomeration	FA	1760	1.096077	1.238713	0.021373	12.60626
Location Quotient	LQ	1760	1.196833	0.28179	0.489426	2.342737
Local competition	LC	1760	0.877256	0.218629	0.394344	1.728426
Population	pop	1760	691578.8	1570532	54724	18922571
Input availability	INP	1760	3.871999	0.627109	2.202	18.5673
Proportion small establishments	small	1760	0.103673	0.044513	0.06072	1.6791
State average health research expenditure	State_Res_exp	1760	4670.2	316.4083	4221	5155

Descriptive statistics values presented above do not have usual straight forward meaning because they are obtained after stacking over five-year period of each variable; therefore they are average over the five-year period of each variable.

Variables were also examined for multicollinearity using variance inflation faction (VIF). If there a multicollinearity, there might be chance of false conclusion of no linear relationship between an independent and a dependent variable (Green, 1993). Moreover, coefficients will have the wrong sign or implausible magnitude (Green, 1993).

Least squares dummy variable model (LSDV) is calculated with adding dummy variables for clusters of MSAs and time periods. City cluster is calculated by average linkage clustering method. Cluster 1 has lower value of agglomeration whereas cluster four has higher value of agglomeration. The result of LSDV model presented below (table-5). This model is overall significant and has r-square almost 90 percent. However, usually r-square is unreliable in panel data model.

Table 5: Estimates LSDV model with time and MSA cluster effect.

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Location Quotient	1	0.08307	0.05696	1.46	0.1449
Local Competition	1	-0.55066	0.07486	-7.36	<.0001
Population	1	1.77E-07	1.31E-08	13.59	<.0001
Input availability	1	0.07088	0.02272	3.12	0.0018
State average health research expenditure	1	0.000371	2.92E-05	12.71	<.0001
Proportion small establishments	1	0.00909	0.29002	0.03	0.975
d2 (cluster 2)	1	2.48651	0.08064	30.83	<.0001
d3 (cluster 3)	1	4.73686	0.09431	50.23	<.0001
d4 (cluster 4)	1	7.6136	0.33524	22.71	<.0001
y4 (year 2004)	1	-0.11821	0.04201	-2.81	0.005
y5 (year 2005)	1	-0.1722	0.04428	-3.89	0.0001
y6 (year 2006)	1	-0.23996	0.04613	-5.2	<.0001
y7(year 2007)	1	-0.39958	0.05118	-7.81	<.0001

It can be seen that all MSAs clustered in group 2, 3, and 4 are significantly different from group 1. Similarly, over the year agglomeration of health sector is significantly decreasing as compared with the year 2003. This may be the reason because of increasing trend of suburbanization of cities. It may be due to improvement on infrastructures in an around the cities. Moreover, local competition, population, input availability, and state average expenditure on health turned out to be significant. The expected sign of significant variable are seen as expected. In addition to estimation of this model joint test also calculated for the MSAs's coefficients. In this joint test, the null hypothesis is all coefficients of the MSAs are zero and alternative hypothesis is at least one different from zero. Null hypothesis is rejected and conclude that they are different from zero.

Fixed effect model cannot estimate effects of variables which vary across individuals but not over time. The use of fixed effects is inefficient if α_i is uncorrelated with x_{it} (i.e., if appropriate model is random effects). Further, the use of fixed effects can exacerbate biases from other types of specification problems, especially measurement error (Green, 1993). Therefore, I also estimate the random effect model.

b) Random effect model:

The random effects model examines how group and/or time affect error variances. Additionally, a random effect model is estimated by generalized least squares (GLS) when the variance structure is known and feasible generalized least squares (FGLS) when the variance is unknown (Green, 1993). Here, fixed effect and random effect models were judged in order to identify the better model for agglomeration of health sector. The general form of random effect model can be presented as below. In this model, individual specific constant term is randomly distributed across cross-sectional units. u_i is random disturbance i^{th} observation and constant over time.

$$y_{it} = \alpha + \beta' x_{it} + u_i + \varepsilon_{it}$$

Where,
y_{it}=dependent variable across i and time t
α = usual intercept
x_{it}= vector of independent variables across the MSA and time t
β= vector of parameters

$$u_i \sim iid(0, \sigma_u^2)$$

The assumption of this model is presented here,
$E[\varepsilon_{it}] = E[u_i] = 0$
$E(\varepsilon_{it}^2) = \sigma_\varepsilon^2$
$E(u_{it}^2) = \sigma_u^2$
$E[\varepsilon_{it} u_j] = 0 \; \forall \; i, t, and \; j$
$E[\varepsilon_{it}\varepsilon_{js}] = 0 \; if \; t \neq s \; or \; i \neq j$
$E[u_i u_j] = 0 \;\; if \; i \neq j$

Random effect model can be calculated either one-way random effect model or two-way random effect model depending upon the purpose of study. The model presented below is one-way random effect model. The result of the one-way random effect model is presented below (table-6). The result shows that location quotient, local competition, population, input availability, and state average research expenditure on health turn out to be significant. However, proportion of small firms is not found significant in one-way random effect model. Similarly, state average health research expenditure is found significant but the sign is contrary to the expectation.

Table 6: Estimates of one-way random effects model.

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1.353217	0.0793	17.06	<.0001
Location Quotient	1	0.125293	0.0293	4.28	<.0001
Local Competition	1	-0.729	0.0402	-18.15	<.0001
Population	1	4.98E-07	2.68E-08	18.57	<.0001
Input availability	1	0.007465	0.00352	2.12	0.0341
State average health research expenditure	1	-0.00004	5.84E-06	-6.44	<.0001
Proportion small establishments	1	0.033686	4.68E-02	0.72	0.4716

Since there is no data of average health research expenditure at the MSA level, here state level data is used. It is likely that average research expenditure is high in less health access area i.e. rural area than metro area. That may be reason to have negative sign of this variable.

In order to compare the fixed effect model and random effect model Hausman's specification test is also calculated. The Hausman's specification test examines that if the individual effects are uncorrelated with the other regressors in the model (Green, 1993). If correlated a fixed effect model is preferred. The essential result of the Hausman's specification test is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero (Green, 1993). Hausman's specification test process involves two steps. Firstly, obtaining the coefficient estimates of the fixed Effects model and subtracting the coefficient estimates of the random effects model to form a vector of the difference in the coefficient estimates of the two methods. Secondly, obtain the variance-covariance matrix from both fixed and random effect model substrate the variance-covariance matrix of random effect model from of variance-covariance matrix of fixed effect model. It is clearer by looking at the following Hausman's specification test formula.

$$\left[\hat{\beta}_{FE} - \hat{\beta}_{RE}\right]' \left[\mathrm{Var}(\hat{\beta}_{FE}) - \mathrm{Var}(\hat{\beta}_{RE})\right]^{-1} \left[\hat{\beta}_{FE} - \hat{\beta}_{RE}\right] \sim \chi^2_K$$

The result also shows that if it rejects the null hypothesis that means random effect model is not preferred over fixed effect model.

Based on above one-way random effect model, fixed effect model is preferred than random effect model. Similarly, two-way random effect model is also calculated here. There general form of equation can be presented below.

$$y_{it} = \alpha + \beta' x_{it} + u_i + \gamma_t + \varepsilon_{it}$$

Where, γ_t= random time factor

Other parameters are usual and as defined earlier. Two-way model includes both individual-specific and period-specific effect. Two-way model includes both individual-specific effects u_i and period-specific effects γ_t .The two way random effects model has the null hypothesis that variance components for groups and time are all zero. The result of the two-way random effect model is presented below (table-7)

Table 7: Results of two-way random effect model.

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1.322265	0.0946	13.98	<.0001
Location Quotient	1	0.13433	0.0294	4.57	<.0001
Local Competition	1	-0.69811	0.0413	-16.89	<.0001
Population	1	4.96E-07	2.68E-08	18.49	<.0001
Input availability	1	0.007264	0.00355	2.05	0.041
State average health research expenditure	1	-0.00004	1.20E-05	-3.15	0.0016
Proportion small establishments	1	0.027612	4.67E-02	0.59	0.5548

The result shows same results as in the case of one-way random effect model in term of significance of the variables. In this model also proportion of small firm is not significant. Hausaman's specification test showed that fixed effect model is preferred over random effect model

Conclusion

The phenomenon of agglomeration is getting attention for long period of time. Some industries try to co-locate with input markets, whereas others try to co-locate with output markets. Due to difference in the nature of industries factors affecting agglomerations are likely to be different for different industries. In analysis of health sector, location quotient is not found significant but population and input availability are significantly contributing to the agglomeration of health industries. This may be because of service oriented nature of the health sector. This study also concludes that Marshallian factors are important for the health sector as well. Besides, there is a significant different between the agglomeration index values between the time period as compared with the value of year 2003. Similarly, there is also significant different between the values of agglomeration index with the group of MSAs. Panel data has captured the dynamics of the agglomeration; therefore it can be beneficial to use to identify the factors affecting agglomeration. In continuation of that effort of finding appropriate model, this study found that the fixed-effect model can also be appropriate model to indentify the driver of agglomeration in health sector with many advantages over cross section model.

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Market Power of the Japanese Non-GM Soybean Import Market: The U.S. Exporters vs. Japanese Importers

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Abstract. Genetically modified (GM) soybean acreage has rapidly increased in the world in the past decade and globally the majority of countries now use GM soybeans to produce oil and meal for livestock and human consumption. Japan, however, uses only Non-GM soybeans for direct human consumption of which more than 80% are imported from the U.S., Canada, and China. This research used the inverse residual demand model to estimate a U.S.-Japan partial equilibrium trade model to test the existence of market power in the Japanese Non-GM soybean import market. The U.S.-Japan partial equilibrium trade model incorporated the U.S. residual Non-GM soybean supply for Japan, the Japanese residual demand for U.S. Non-GM soybeans, and the equilibrium condition, where the U.S. residual Non-GM soybean supply equals the Japanese residual Non-GM soybean demand. Monthly data from January 2003 to December 2007 were used for the analysis. Empirical results indicated that U.S. Non-GM soybean exporters have stronger market power than Japanese Non-GM soybean importers. The results also indicate that Japanese consumers are willing to pay higher prices for soybeans, tofu, natto, miso, and other all soy food products.

Keywords: Market power, Non-GMO, Industrial Organization, Soybeans

JEL Codes: F13 Q17

Introduction

In the past 100 years, Japan has changed from being a self-sufficient country to an industrially-advanced country that relies heavily on trade. As a result, Japanese citizens enjoy a high standard of living. But except for rice, Japan must import food commodities from all over the world. At present, the country's food self-sufficiency ratio is 39% (calorie base), which means that Japan depends on imports for 61% of its food supply. The self-sufficiency ratio in grains is 27% (MAFF 2003). For food grade soybeans, the self-sufficiency ratio, which has declined year by year, was only 15 percent in 2004. Some studies suggest that the decreasing Japanese self-sufficiency ratio may result in future problems (MAFF 2006a).

The United States is the leading soybean producer in the world. In the past decade, genetically modified (GM) soybean acreage has rapidly increased. Most of the major soybean importing countries, including China, Mexico, and South Korea, reading accept imports of GM soybeans for all uses. On the other hand, Japan, the world's third largest soybean importer, has insisted on importing only Non-GM soybeans for direct human consumption. Japan's major suppliers are the U.S., Canada, and China. Japan will likely continue to be the world's largest importer of Non-GM soybeans.

Figure 1 shows the U.S. Non-GM soybeans share of the total U.S. soybean acreage. In 1997, U.S. Non-GM soybeans were planted on over 95% of the total U.S. soybean acres. But GM soybean technology has been adopted rapidly by U.S. soybean farmers. As a result, Non-GM soybeans share decreased to less than 50% of the total soybean acreage by 1999. Non-GM soybean share has continued to fill in the new century to only 9% of total U.S. soybean acreage.

Japanese Soy-Foods

There are many food soybean products consumed around the world. For instance, tofu, soy milk, and soy sauce are popular in many countries. Consumption of other soybean foods, however, tend to be limited primarily to specific regions. For example, soy cheese, soy yogurt, and soy ice cream are popular products in the U.S., but only specialty soybean stores sell these soybean foods in Eastern Asia.

In the 1930's, Japan was self-sufficient in food-grade soybean production. Japan started to import soybeans, primarily for oil in the 1940's. By the 1950's, the amount of soybeans produced in Japan was approximately equal to soybean imports. During the 1960's, the amount of imported soybeans surpassed the amount of domestically produced soybeans. In 1972, the tariff on soybean imports was eliminated. In a short time, approximately eighty percent of all soybeans consumed in Japan were imported. United States produced soybeans made up 90% of soybeans imported into Japan. In the 1990's, consumption of GM soybeans became an increasingly important issue in Japan. Japanese consumers drove the debate by increasingly choosing to purchase Non-GMO products. In 2000, all soy products manufacturers fully shifted to Non-GM soybeans for tofu and natto production in Japan. Tofu has a long history in the Eastern Asian countries including in China, Japan, North and South Korea, and Taiwan. Tofu has been accepted as a health food in the U.S. and European Union (EU). Natto is an ethnic Japanese food of fermented whole soybeans. Natto soybeans are characterized by small seed size, which can be a maximum of only 5.5 mm diameter. Natto soybeans must also have a clear hilum, thin seedcoat, and high carbohydrate content. For centuries, natto has been popular in parts of Japan as a flavoring, especially as topping on rice for breakfast (Norris 2006). Natto is packaged in small white plastic packages with soy sauce and mustard. Miso is fermented and salted soybean paste. Although it is used primarily as a seasoning, miso soup is one of the most popular foods made from miso. It is usually served with rice at breakfast and supper meals in Japan.

Given the above facts, the Japanese Non-GM soybean import market can be characterized as a monopsony if all Japanese Non-GM soybean importers are viewed as one buyer. If all exporters in each country are aggregated, U.S., Canada, and China can be viewed as an oligopoly. The question then becomes who has more market power: the monopsony or the oligopoly? The party to a trade negotiation with the strongest market power can negotiate a more favorable price or other terms of trade than a trading partner with relatively weak market power. Estimating who has stronger market power should be of interest to both Non-GM soybean exporting countries and a Non-GM soybean importing country.

There are U.S., Canadian, and Chinese Non-GM soybean exporters in the Japanese Non-GM soybean market but U.S. Non-GM soybeans share over 70% in the Japanese Non-GM soybean market. Thus it is important to know the market power relationship of the United States compared to Japan: Japanese buyer vs. U.S. seller. U.S. policymakers would be in better position trade policies that could expand the U.S. market share in the Japanese Non-GM soybean import market. Japanese policy makers may be able to change trade policies to forestall future problems of relying on a powerful trade partner, such as the United States.

To determine relative Non-GM soybean market power relationships, this research will employ a two-country partial equilibrium trade model to test market power relationships for the Japanese Non-GM soybean import market between Japanese Non-GM soybean importers and U.S. Non-GM soybean exporters.

Literature Review and Overview of the Food Soybean Trade between the U.S. and Japan

The Lerner Index (LI, Lerner 1934) for measuring the market power of a single firm was created in 1934. Also, the Lerner Index can be used to measure the degree of market power of a firm in an imperfect market. The Lerner Index is defined as *LI= (P-MC)/P* where the variable *P* is the market price and *MC* is the marginal cost. However, measuring the degree of the market power is difficult using an empirical model because of the difficulty in obtaining marginal cost data by showing previous studies.

Carter et al. (1999) estimated the world wheat market by using the Residual Demand Elasticity (RDE) model. It was a new approach to measuring the market power of individual countries for wheat. Carter et al. assumed that each country was a firm, and those parameters could be interpreted as the share-weighted industry averages for all firms within one country. Using the double-log form, Carter et al. estimated the price flexibility for the U.S. wheat exports to Japan directly.

Song (2006) estimated the Chinese soybean market by using multiple- and two-country partial equilibrium trade model. This approach measures the market profits of both soybean importers and exporters in the Chinese soybean market. Song followed Carter et al. (1999) assumption that each country was a firm. Song first applied RDE model and The USDA-Economic Research Service (ERS)/Penn State Trade Model, then Song built up the multiple-country partial equilibrium trade model. Song used monthly data from January 1999 to February 2005 to estimate his model. These results indicated that the Chinese soybean importers have stronger market power than U.S. soybean exporters and this is consistent with actual observations.

The Non-GM Soybean Trade

Japanese trading companies import Non-GM soybeans into Japan. Japanese trading companies do not deal exclusively in one specific product or product group, but rather deal in many products. A typical leading trading company will buy or sell almost anything, including industrial goods, textile goods, raw materials including agricultural products and mineral resources among other products. There are eight Japanese trading companies in that import food soybeans. On the other side of the trades are U.S. grain exporters that sell the soybeans to Japanese trading companies.

There are two principle ways to ship U.S. soybeans to Japan. One is bulk shipment, and the other is container shipment. Bulk shipment is typically used for large-volume sales of commodity soybeans. The most common bulk shipment size is 40000 metric tons. Not all soybean trading companies can finance the large quantity required to fill a vessel of that size. Only the four largest Japanese trading companies have the capability to charter vessels (Fukunaga, 2003). There are many advantages of using containers, such as to reduce shipping risks, theft, handling damage, adverse temperatures, or risk of accidental mixing. Specialty soybeans may even be purchased directly from a farmer. U.S. soybeans shipped in containers usually maintain in high quality because there is less damage to the soybeans in transit and foreign material levels are lower. Also demurrage on containers is much lower than for vessels, thus there is less financial risk (USSEC).

Theoretical Model, Variable identification, and Empirical Estimation and Interpretation

As shown by most previous research in international agricultural trade, people believe that importers have more market power than exporters, both in competitive and non-perfect competitive markets. This research is focused on the food soybean market in Japan. As discussed in Chapter 2, Japan has a unique food soybean market. Japanese people consume only Non-GM soybeans, therefore Japan imports only Non-GM soybeans from the U.S., Canada, and China. In order to use the two-country partial equilibrium trade model, Japan is considered a monopsony by aggregating all Japanese Non-GM soybean importers. On the other side are the U.S., Canada, and China which makes up a three-country oligopoly of soybean sellers. If Japan as a country is a monopsonistic Non-GM soybean importer, it may have more market power than any one of the Non-GM soybean exporting countries. This research seeks to test who has the stronger market power in the Japanese Non-GM soybean import, buyer or seller.

To measure the market power of Japan as a Non-GM soybean buyer, the inverse residual Non-GM soybean demand and the inverse residual Non-GM soybean supply were estimated. In the two-country partial equilibrium Non-GM soybean trade model, the inverse residual Non-GM soybean demand and the inverse residual Non-GM supply were combined to estimate relative market power.

Models

This research focuses on the U.S.-Japan partial equilibrium Non-GM soybean trade model since over seventy percent of the Non-GM soybeans consumed in Japan come from the U.S. Other Non-GM soybean exporting countries, Canada and China, are treated as other Non-GM soybean exporters to Japan, IMP_{JPN}^{OTH} . Likewise, some European countries that import Non-GM soybeans from the U.S. are treated as other Non-GM soybean importers from the U.S., EXP_{US}^{OTH} .

Based on Song (2006) model, the U.S.-Japan partial equilibrium Non-GM soybean trade model is written as:

$$\begin{cases} LnP_{JPN}^{US,IMP} = \alpha_0 + \theta_{JPN}^{US} LnRD_{JPN}^{US} + \alpha_1 LnINC_{JPN} + \alpha_2 LnIMP_{JPN}^{OTH} + \alpha_3 FT + \varepsilon_{JPN} & (1) \\ LnP_{US}^{EXP} = \beta_0 + \theta_{US}^{JPN} RS_{US}^{JPN} + \beta_1 LnINC_{US} + \beta_2 LnEXP_{US}^{OTH} + \beta_3 LnSTK_{USi} + \varepsilon_{US} & (2) \\ LnRD_{JPN}^{US} = LnRS_{US}^{JPN} & (3) \\ LnP_{JPN}^{US,IMP} = \phi_0 + \phi_1 LnP_{US}^{EXP} & (4) \end{cases}$$

where, $P_{JPN}^{US,IMP}$ is Japanese Non-GM soybean import price from U.S. (￥/MT); RD_{JPN}^{US} is Japanese residual demand for U.S. Non-GM soybean (MT); INC_{JPN} is Japanese personal disposable income ($); IMP_{JPN}^{OTH} is Japanese Non-GM soybean imports from countries other than U.S. (MT); *FT* is the food time trend variable, measuring Americanization of Japanese dishes; ε_{JPN} is the error term, assumed identically and independently distributed. P_{US}^{EXP} is U.S. Non-GM soybean export price to Japan ($/MT); RS_{US}^{JPN} is U.S. residual Non-GM soybean supply for Japan (MT); INC_{US} is U.S. personal disposable income ($); EXP_{US}^{OTH} is Non-GM soybean exports from U.S. to countries other than Japan (MT); STK_{US} is the U.S. beginning Non-GM soybean stocks (MT); and ε_{US} is the error term.

Data Description

For estimating the U.S.-Japan partial equilibrium Non-GM soybean trade model, monthly data from January 2003 to December 2007, 60 observations in all, were used. See Table 3.1 for all variables used in this analysis and sources.

Data for the Japanese inverse residual Non-GM soybean demand, RD_{JPN}^{US} , and the U.S. inverse residual Non-GM soybean supply, RS_{US}^{JPN} , were obtained from the Ministry of Finance Japan (2008) and *Daily Soybean and Oil Seeds* published by Shokuhin Sangyou Shinbunsha Co., Ltd. (Food Industry Newsweek Co., Ltd.). The amount of monthly Non-GM soybean in Japan imported from the U.S. for each month, $SB_{JPN,M}^{US,NGM}$, is the amount of monthly soybean imported by Japan from the U.S., $SB_{JPN,M}^{US}$, divided by the amount of soybeans Japan imported yearly from the U.S., $SB_{JPN,Y}^{US}$, multiplied by the Non-GM soybeans imported by Japan yearly from the U.S., $SB_{JPN,Y}^{US,NGM}$. It can be written as:

$$SB_{JPN,M}^{US,NGM} = \frac{SB_{JPN,M}^{US}}{SB_{JPN,Y}^{US}} * SB_{JPN,Y}^{US,NGM} \qquad (5)$$

Japanese personal disposable income, INC_{JPN}, is from the U.S. Department of Agriculture, Economics Research Service (USDA-ERS) International Macroeconomic Data Set (USDA-ERS, 2008b). According to Song (2006), the U.S. personal disposable income and Japanese personal disposable income are annual data. In this research, however, monthly data is required. Personal disposable income for the U.S. and Japan were transformed into monthly format, as described below. First, the annual growth rate of Japanese personal disposable income was calculated. Second, the initial value was set as the January disposable income. Then, the calculated annual growth rate and the initial value were used to estimate disposable income for the remaining months of the year. The last step was to use the trial-and-error method to adjust the January income so that the sum of the estimated monthly disposable incomes equaled the actual annual disposable income. The estimated monthly income was used to approximate the actual monthly disposable income in the empirical estimation (Song 2006).

The variable, Japanese Non-GM soybean imports from other countries, IMP_{JPN}^{OTH} , was calculated from data obtained from the Ministry of Finance Japan (2008) and *Daily Soybean and Oil Seeds*, published by Shokuhin Sangyou Shinbunsha Co., Ltd. The variable IMP_{JPN}^{OTH} is the sum of the monthly Japanese soybean imports from Canada and China multiplied by the amount of yearly Japanese Non-GM soybean imports from Canada and China, $SB_{JPN,Y}^{OTH,NGM}$. The amount of monthly Japanese soybean imports from Canada where the sum of the amount of Japanese soybean imports from Canada and China equals 100, is the amount of monthly Japanese soybean imports from Canada, $SB_{JPN,M}^{CA}$; divided by the amount of yearly Japanese soybean imports from Canada, $SB_{JPN,Y}^{CA}$; multiplied by the yearly Canada to China soybean import to Japan ratio,

$$\left(\frac{SB_{JPN,Y}^{CA}}{SB_{JPN,Y}^{CA} + SB_{JPN,Y}^{CH}} * 100 \right)$$

The monthly Japanese soybean imports from Canada can be written as:

$$\frac{SB_{JPN,M}^{CA}}{SB_{JPN,Y}^{CA}} * \left(\frac{SB_{JPN,Y}^{CA}}{SB_{JPN,Y}^{CA} + SB_{JPN,Y}^{CH}} * 100 \right) \qquad (6)$$

Similarly, the amount of monthly Japanese soybean imports from China when the sum of the amount of Japanese soybean imports from Canada and China equals 100, is the amount of monthly Japanese soybean imports from China, $SB_{JPN,M}^{CH}$; divided by the amount of yearly Japanese soybean imports from China, $SB_{JPN,Y}^{CH}$; multiplied by the yearly Chinese soybean ratio in Japan, which is 100 minus the yearly Canada to China soybean import to Japan ratio. The monthly Japanese soybean imports from China can be written as:

$$\frac{SB_{JPN,M}^{CH}}{SB_{JPN,Y}^{CH}} * \left[100 - \left(\frac{SB_{JPN,Y}^{CA}}{SB_{JPN,Y}^{CA} + SB_{JPN,Y}^{CH}} * 100 \right) \right] \quad (7)$$

Thus, Japanese Non-GM soybean imports from Canada and China can be written as:

$$IMP_{JPN}^{OTH} = \left\{ \left[\frac{SB_{JPN,M}^{CA}}{SB_{JPN,Y}^{CA}} * \left(\frac{SB_{JPN,Y}^{CA}}{SB_{JPN,Y}^{CA} + SB_{JPN,Y}^{CH}} * 100 \right) \right] + \left[\frac{SB_{JPN,M}^{CH}}{SB_{JPN,Y}^{CH}} * \left(100 - \left(\frac{SB_{JPN,Y}^{CA}}{SB_{JPN,Y}^{CA} + SB_{JPN,Y}^{CH}} * 100 \right) \right) \right] \right\} * SB_{JPN,Y}^{OTH,NGM} \quad (8)$$

For the U.S. inverse residual Non-GM soybean supply to Japan model, the U.S. Non-GM soybean export price to Japan, P_{US}^{EXP}, is the FOB price reported by the U.S. Department of Agriculture, Foreign Agriculture Service (USDA-FAS, 2008). The U.S. personal disposable income, INC_{US}, is from USDA-ERS, International Macroeconomic Data Set (USDA-ERS, 2008c). Similar to the Japanese personal disposable income, the reported data for U.S. personal disposable income is annual data. Using the same method as used for the Japanese personal disposable income, U.S. monthly personal disposable income is estimated from the actual annual income. The variable U.S. Non-GM soybean beginning stocks, STK_{US}, was obtained from the USDA-ERS, Oil Crops Yearbook (USDA-ERS, 2008d). The variable U.S. Non-GM soybean exports to countries other than Japan, EXP_{US}^{OTH}, is calculated using data obtained from USDA-FAS. The variable EXP_{US}^{OTH}, is the amount of monthly U.S. Non-GM soybean exports, EXP_{US}^{NGM}; minus the amount of monthly U.S. Non-GM soybean exports to Japan, EXP_{US}^{JPN}. The amount of monthly U.S. Non-GM soybean exports, EXP_{US}^{NGM}; is the amount of monthly U.S. soybean exports, $EXP_{US,M}$; multiplied by the Non-GM soybean to GM soybean cropping ratio in the U.S. which is 1 minus the percentage of GM soybean cropping ratio in the U.S., $\left(1 - \%SB_{area}^{GM}\right)$; divided by twelve.

$$EXP_{US}^{OTH} = EXP_{US}^{NGM} - EXP_{US}^{JPN} \quad (9)$$

$$EXP_{US}^{NGM} = \frac{EXP_{US,M}}{12} * \left(1 - \%SB_{area}^{GM}\right) \quad (10)$$

Specification Test

Before estimating the U.S.-Japan two-country partial equilibrium Non-GM soybean trade model, a heteroscedasticity test and an autocorrelation test were conducted for both Japanese inverse residual demand function for the U.S. Non-GM soybeans and the U.S. inverse residual Non-GM soybean supply function for Japan. Test results indicate that the null hypothesis for equation (1) and (2) fail to reject for either model. These test results imply that neither the Japanese inverse residual demand function nor the U.S. inverse residual supply function have a heteroscedasticity problem and an autocorrelation problem.

Estimation and Interpretation

The U.S.-Japan two-country partial equilibrium Non-GM soybean trade model was simultaneously estimated by using the SAS Three-Stage Least Squares (3SLS) method. Estimated results, reported in Table 2, show that for the Japanese inverse residual demand function (1), Japanese residual Non-GM soybean demand, RD_{JPN}^{US} , is statistically significant at the 1% level.

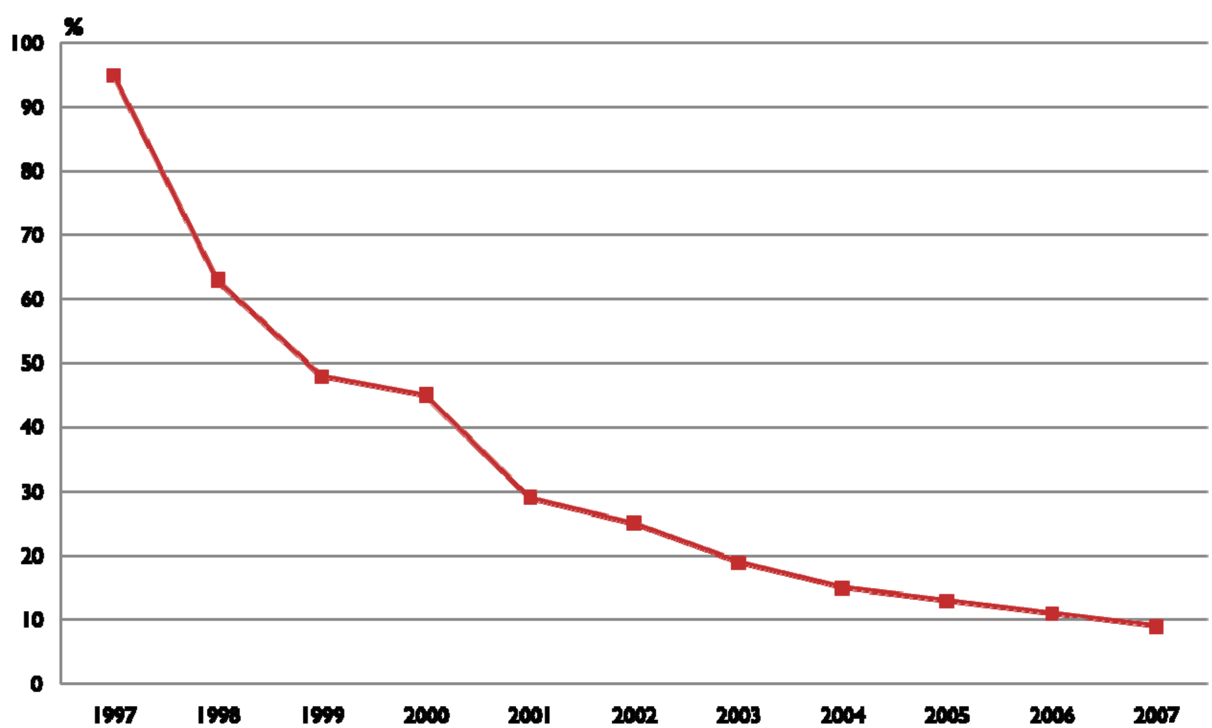
The sign of the estimated coefficient of the Japanese residual Non-GM soybean demand, RD_{JPN}^{US} , is negative as expected, indicating a downward sloping Japanese residual demand for U.S. Non-GM soybeans. By equation (1), the estimated coefficient is also the price flexibility of the Japanese residual demand function for U.S. Non-GM soybeans, equaling the Adjusted Lerner Index of the U.S., ALI_{US}, which can be used to measure the market power of the U.S. Non-GM soybean exporters as shown by Appendix equation (A3). From another perspective, the estimated coefficient also indicates the profit earned by U.S. Non-GM soybean exporters (the difference between the U.S. Non-GM soybean export price, the sum of the U.S. farm level soybean prices, and the U.S. Non-GM soybean exporters' transaction costs). The estimated price flexibility of the Japanese inverse residual demand for the U.S. Non-GM soybeans is -0.219 and the market profits of the U.S. Non-GM soybean exporters (the difference between the U.S. Non-GM soybean export price and the sum of the U.S. farm level Non-GM soybean prices and the transaction costs of the U.S. Non-GM soybean exporters) are about 22% of the export price as shown in Table 2.

For the U.S. inverse residual Non-GM soybean supply function (equation 2), the U.S. residual Non-GM soybean supply, RS_{US}^{JPN} , is statistically significant at the 1% level as shown in Table 2. The sign of the parameter for the U.S. residual Non-GM soybean supply for Japan, RS_{US}^{JPN} , is positive as expected, indicating an upward sloping U.S. residual Non-GM soybean supply curve. By equation (2), the estimated coefficient for the U.S. Non-GM soybean residual supply quantity, RS_{US}^{JPN} , is also the price flexibility of the U.S. inverse residual Non-GM soybean supply function for Japan, which is also the Adjusted Lerner Index for Japan, ALI_{JPN} as shown by Appendix equation (A4) which can be used to measure the market power of the Japanese Non-GM soybean importers. From another perspective, the estimated coefficient indicates the profits of Japanese Non-GM soybean importers (the difference between the Japanese domestic Non-GM soybean price, the Japanese Non-GM soybean import price from the U.S., and the Japanese Non-GM soybean importers' transaction costs). The estimated price flexibility of the U.S. inverse residual Non-GM soybean supply to Japan is 0.04 and the market profits of Japanese Non-GM soybean importers are about 4% of the Non-GM soybean import price as shown in Table 3. Comparing these two coefficients, it can be inferred that U.S. Non-GM soybean exporters have greater market power than Japanese Non-GM soybean importers.

Conclusions

People around the world have recently become more interested in food-related health issues. The Japanese people have long been concerned about healthy food. One of the most popular Japanese health foods is tofu produced from soybeans. However, Japan grows only about 10% of the soybeans consumed in the country each year. Japan imports about 70% of its food soybean needs from the U.S. In recent years, the U.S. soybean farmers have switched from producing all Non-GM soybeans to producing almost all GM soybeans. At present, only nine percent of the U.S. soybean crop remains Non-GM soybeans. Soybean producers in other countries are following the U.S. example and are switching to GM soybeans. GM soybeans have lowered production costs while raising yields for soybean producers. In the future, differential incentives for farmers to grow Non-GM soybeans will have to increase to offset lower yields, higher production costs, and the costs associated with segregating Non-GM soybeans from GM soybeans. By the late 1990's, Japanese people had developed widespread apprehension about the safety of consuming GM soybeans. Since then, they have insisted on eating only Non-GM soybeans. In response to consumer desires, Japanese soybean importers only import Non-GM soybeans for food soybeans in Japan. This makes the Japanese food soybean market unique in the world. Market power is defined in this paper to mean the ability of a seller to negotiate the market price of a product and other terms of trade in his favor. With the decline in Non-GM soybean production in the U.S. Canada, and China, it appears that market power in the Japanese food soybean market has shifted to the sellers of Non-GM soybeans. A two-country partial equilibrium trade model was constructed to test the hypothesis that market power has shifted to the sellers of Non-GM soybeans. The U.S.-Japan partial equilibrium trade model showed that U.S. Non-GM soybean exporters have relatively stronger market power than Japanese Non-GM soybean importers. The market margin for U.S. Non-GM soybean exporters was estimated at 22% of the export price. Conversely, the market margin for the Japanese Non-GM soybean importers was only about 4% of the Non-GM soybean import price. These results show that the Japanese importers may have to pay a higher price to purchase Non-GM soybeans in the future. It also indicates that Japanese consumers will have to pay higher prices for tofu, natto, miso, and other soy foods. The long term implication of the difference in market power is Japanese Non-GM soybean importers will purchase more Non-GM soybeans from Canada or China, or select inexpensive soybeans such as U.S. GM soybeans near future. Eventually, Japanese consumers will have to make a decision to keep paying a higher price for Non-GM soybeans or accept lower priced GM soybeans.

Figure 1. Non-GM Soybean Share in the Total Soybean Acreage of the U.S. (1997-2007)



Source: USDA-ERS, 2008a

Table 1. The U.S.-Japan Partial Equilibrium Non-GM Soybean Trade Model's Variables and Sources

Variable	Meaning	Source
$P_{JPN}^{US,IMP}$	Japanese Non-GM soybean import price from US (¥/MT)	USDA-FAS
RD_{JPN}^{US}	Japanese residual demand for U.S. Non-GM soybean (MT)	Ministry of Finance Japan Shokuhin Sangyou Shinbunsha Co., Ltd.
INC_{JPN}	Japanese personal disposable income ($)	USDA-ERS
IMP_{JPN}^{OTH}	Japanese Non-GM soybean imports from Canada and China (MT)	Ministry of Finance Japan Shokuhin Sangyou Shinbunsha Co., Ltd.
P_{US}^{EXP}	U.S. Non-GM soybean export price to Japan (S/MT)	USDA-FAS
RS_{US}^{JPN}	U.S. Non-GM soybean residual supply for Japan (MT)	Ministry of Finance Japan Shokuhin Sangyou Shinbunsha Co., Ltd.
INC_{US}	U.S. personal disposable income ($)	USDA-ERS
EXP_{US}^{OTH}	U.S. Non-GM soybean exports to other countries (MT)	USDA-FAS
STK_{US}	U.S. Non-GM soybean beginning stocks (MT)	USDA-ERS

Table 2. Estimated Results of the U.S.-Japan Partial Equilibrium Trade Model

	Variable	Coefficient	Standard Error	t Value	Pr > $\lvert t \rvert$
	Intercept	18.60854*	4.591843	4.05	0.0002
Japan Inverse	RD_{JPN}^{US}	-0.21955*	0.091787	-2.39	0.0102
Residual Non-GM	INC_{JPN}	-0.57598	0.405074	-1.42	0.1607
Soybean Demand:	IMP_{JPN}^{OTH}	0.008464	0.031475	0.27	0.7890
$P_{JPN}^{IMP} = P\left(RD_{JPN}^{US}, \ldots\right)$	FT	0.036404	0.039466	0.92	0.3603
	Intercept	3.148397*	3.516505	0.90	0.0045
U.S. Inverse	RS_{US}^{JPN}	0.040696*	0.21506	0.19	0.0068
Residual Non-GM	INC_{US}	0.662107	0.439792	1.51	0.1379
Soybean Supply:	EXP_{US}^{OTH}	-0.06222	0.051102	-1.22	0.2286
$P_{US}^{EXP} = P\left(RS_{US}^{JPN}, \ldots\right)$	STK_{US}	-0.03522**	0.018298	-1.92	0.0594
Price Relationship	*Intercept*	5.624331*	0.392903	14.31	<.0001
$P_{JPN}^{IMP} = P(P_{US}^{EXP})$	P_{US}^{EXP}	0.846458*	0.067456	12.55	<.0001

Note: * 1% significant level, ** 10% significant level.

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Appendix

Similar steps for achieving adjusted Lerner Index for Song (2006), U.S. Non-GM soybean exporters choose export quantity to Japan, Q_{US}^{EXP}, to maximize their profits, $\prod_{US}$.

$$\max_{Q_{US}^{EXP}} \prod_{US} = P_{US}^{EXP}(Q_{US}^{EXP}) * Q_{US}^{EXP} - (P_{US}^{Farm} + C_{US}) * Q_{US}^{EXP} \quad \text{(A1)}$$

where $\prod_{US}$ represents profits obtained by U.S. Non-GM soybean exporters. The variable P_{US}^{EXP} is U.S. Non-GM soybean export price, which is a function of the export quantity, Q_{US}^{EXP}. The variable P_{US}^{Farm} is U.S. Non-GM soybean farm level price that is equal to the exporter's purchase cost from U.S. Non-GM soybean farmers. The variable C_{US} is U.S. Non-GM soybean exporter's transaction costs.

The first order condition of equation (A1) and arrange it then,

$$\frac{P_{US}^{EXP} - \left(P_{US}^{Farm} + C_{US}\right)}{P_{US}^{EXP}} = -\frac{\partial P_{US}^{EXP}}{\partial Q_{US}^{EXP}} * \frac{Q_{US}^{EXP}}{P_{US}^{EXP}} \quad \text{(A2)}$$

The left side of equation (A2) represents the market power for U.S. Non-GM soybean exporters over the Japanese Non-GM soybean importers. The right side of equation (A2) is the price flexibility of the Japanese inverse residual Non-GM soybean demand from U.S. The market power for U.S. Non-GM soybean over the Japanese Non-GM soybean importers as the Adjusted Lerner Index for U.S., ALI_{US} . It can be written as:

$$\frac{P_{US}^{EXP} - \left(P_{US}^{Farm} + C_{US}\right)}{P_{US}^{EXP}} = ALI_{US} \quad \text{(A3)}$$

Therefore, the price flexibility of the Japanese inverse residual demand for Non-GM soybeans from U.S. can be used as an indirect measure to evaluate the market power of U.S. Non-GM soybean exporters. Similarly, the price flexibility of U.S. inverse residual Non-GM soybean supply for Japan can be used as an indirect measure to evaluate the market price of Non-GM soybean importers in Japan.

$$\frac{\left(P_{JPN}^{R} / E_{JPN}\right) - C_{JPN} - P_{JPN}^{US,IMP}}{P_{JPN}^{US,IMP}} = ALI_{JPN} \quad \text{(A4)}$$

Mid-Continent Regional Science Association

Working for California: The Impact of the California State University

Elizabeth Johnston
ICF International

Abstract. As the largest university in the world's leading knowledge economy, it is not surprising that the California State University's has a significant impact. Put succinctly, California reaps a five fold benefit from every dollar that state invests in the CSU. Furthermore, the system sustains over 150,000 jobs in California annually, and by providing education to those that would otherwise not have access, decreases statewide unemployment. Annually, the CSU generates nearly $1billion in state and local tax revenue, which particularly in this time of budget shortfalls is critical to the state's coffers. When the impact of the higher earnings of CSU graduates is considered, the impact rises to $70.4 billion annually, and supports more than 485,000 jobs. The tax impact of this combined spending impact is 1.7 times greater than the state's annual investment in the CSU.

While not directly quantifiable, the system is critical in filling the state's key, knowledge-based occupations with skilled and prepared workers. The system reaches out to and provides supports for the state's students who might otherwise not have had a change at higher education. While workforce development is the system's main goal, the CSU contributes to statewide applied research and innovation, particularly in the emerging field of sustainability. The system has made a commitment to on-campus and community-based sustainable practices and policies.

Keywords: California State University, institution of higher education, economic assessment, IMPLAN model

Introduction

A university education changes the trajectory of people's lives. It helps them fulfill their aspirations to become artists, engineers, teachers, health care professionals and more. University graduates are better prepared to succeed in, adapt to, and appreciate the rapidly changing world around them. In addition, a university education is widely recognized as an investment that pays a lifetime of dividends in the form of better jobs and higher incomes.

What is less well understood, however, is that the investment in higher education is also a strong investment for the state economy. When states invest in their public university systems, the state as a whole receives an economic boost. In this analysis, ICF International assessed the economic contribution of the California State University System, its 23 campuses and the Chancellor's office, to the State of California and eight separate regions. In addition to analyzing the effects associated with university and student (current and alumni) spending, this analysis evaluates the CSU's contribution to workforce development and applied research as well as the growing area of on-campus and region-wide sustainability.

The focus of this paper will be on the economic modeling methodology and results; however we will also present summary results for broader impacts on workforce, research and sustainability.

Project Context

Now is a particularly critical time for public universities to defend their budgets and show that they not only contribute to the long term job and GDP growth of the state by educating the innovators of tomorrow, but they also support immediate, local jobs through increased demand for goods and services purchased by the university, its faculty, and students. As the California State University prepares to celebrate its 50th anniversary, it is an important time to be reminded of the contribution that the CSU provides for the state of California and its economy. This analysis is an update to the CSU system-wide economic impact assessment conducted by ICF International in 2004.

Part I: Economic Modeling

Methodology

Direct spending and employment by the CSU system, its faculty and staff and students is the most obvious way in which the system contributes to the state's economy. Not only does each CSU campus and the Chancellor's Office purchase goods and services from the surrounding economy, they are also important regional employers. Furthermore, direct spending/employment represent only a portion of university-generated impact. The full economic benefit includes the impact associated CSU spending in other interdependent sectors. These indirect impacts can be assessed through regional economic impact analysis. Regional economic modeling is founded on the principle that industry sectors are mutually supporting: one industry purchases inputs from other industries and households (e.g., labor) and then sells outputs to other industries, households, and government. Economic activity in one sector causes an increased flow of money throughout the economy. Conventional economic impact assessments focus on estimating the direct and indirect expenditures of the organization being studied, in this case the CSU system, and the so-called "multiplier effect" triggered by initial organizational spending that creates 'ripples' of multiple rounds of spending throughout the economy. ICF used the modeling software IMPLAN[1] to conduct this analysis of the CSU's spending on the regional and state economy in California.

Expenditures alone, however, provide an incomplete picture of the impact of the university in terms of what *it actually does*—provide an affordable, accessible quality university education to nearly 2 million Californians who might not have otherwise attended university. No fiscal analysis can fully capture all of the impacts associated with the unique role that a higher education system has had on educating the state's workforce and enabling them to fulfill their career goals. However, one of the ways that the value of a CSU education can be estimated is by quantifying the higher earning power of university graduates. The U.S. Census Bureau has estimated that bachelor's degree holders earn, on average, nearly $1 million more than high school graduates[2] over the course of their working life. This means that a university education has a powerful economic impact for both individuals and the communities in which they spend. The increased earning power of university graduates therefore should be considered in a complete accounting of the CSU's impact on California.

ICF captured this long-term impact of the CSU by evaluating the life-long spending differential of CSU alumni. When alumni graduate with a more advanced degree, they are compensated with a higher income, which they in turn spend, generating additional jobs and industry activity. In 2008-09, the 1.96 million CSU bachelor's and master's degree alumni working in California earned an estimated $122 billion in income. While not all of this $122 billion is attributable to their university education, roughly $42.1 billion of it represents the enhanced earnings power that is

[1] IMPLAN, a proprietary model maintained by the Minnesota IMPLAN Group, is a widely accepted framework for analyzing the effects of an economic stimulus on a pre-specified economic region. Version 3.0 of the model was used for this analysis.

[2] Bachelor's degree holders that work full-time, year-round throughout their career can expect to earn an average of $2.1 million over their lifetime, compared to $1.2 million for workers with a high school diploma only. Source: U.S. Census, *The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earnings.*

attributable to their CSU degree. That $42.1 billion has indirect and induced effects on spending, jobs, and taxation, similar to all other types of spending, and ICF again used the IMPLAN to estimate these secondary effects.

The subsequent sub-sections of this report will discuss in-detail the methodology used for determining inputs, running the IMPLAN model and analyzing the results.

Inputs

ICF used financial information provided by the university system from academic year 2008-2009 to determine system-wide institutional spending on capital and operational expenses as well as auxiliary organizations. Campus auxiliary organizations, such as bookstores, campus restaurants, foundations, research institutes, and other entities captured the bulk of student expenditures for such things as books, housing and on-campus food purchases, etc. Off-campus student spending data was not included in campus financial records. To estimate total direct CSU student (on and off-campus) spending, ICF first determined the number of out-of-region students to capture only the spending of those students who would not have been spending locally if not for the CSU. (It was assumed that 'local' students would likely have been living locally and thus making similar expenditures whether or not they were attending the CSU). Only out-of-state students were included in the statewide analysis, and only students who came from outside of the region where they attended a CSU campus were included in the regional analysis. This represents a conservative approach (i.e., it might underestimate student spending impacts compared to many traditional impact calculations). ICF used the CSU Cost of Attendance 08-09 Report and Housing Occupancy database to estimate, by campus, how much a student typically spends, excluding items from on-campus and auxiliary organizations, such as food, housing (for students living on campus[3]), and books, which were already captures in the auxiliary expense reports.

Based on the data provided by the CSU and the assumptions described above, ICF estimated four main spending inputs, which totaled $7.96 billion in 2008-2009.

- $5.48 billion in university expenditures on wages and salaries, services, supplies, and related ongoing needs;
- $987 million in average annual university expenditures on construction and capital expense;
- $1.29 billion in expenditures by campus auxiliary organizations such as bookstores, campus restaurants, foundations, research institutes, and other entities;
- $203 million in additional off-campus spending by out-of-state students who are in California to attend the CSU. Expenditures on a statewide basis for housing and other living expenses by resident students were assumed to exist with or without the CSU and therefore were not considered an incremental benefit. On a regional basis, residential expenses were counted for out-of-area students as being an incremental benefit to that region.

As indicated, in addition to the impacts associated with current CSU-related spending (institutional and as well a student), the CSU system, in providing an education to nearly 2 million alumni, has supported generations of learners in achieving their career goals, earning a higher income and spending that income to generate additional jobs and industry activity. ICF estimated the direct impact associated with CSU alumni enhanced earnings power by determining the total

[3] It was assumed that for students living in on-campus housing, all food and housing expenditures would occur at auxiliaries.

number of alumni, by degree, by campus, dating back to 1970-1971[4] who are currently living in California. Average income was estimated and weighted based on age and degree earned. The amount of total earnings attributable to the CSU degree was calculated as the difference between the weighted average salary associated with their final educational level minus the weighted average salary associated with their previous educational level[5]. ICF estimated that CSU local alumni have an enhanced earnings power of approximately $42.1 billion that is attributable to their CSU degree.

Running the Model

ICF used the IMPLAN model to estimate the total economic contribution of the CSU system to the State of California and its regions based on the direct campus-level "spending' inputs, described above. For this analysis, ICF conducted the analysis at several modeling regions; statewide and each of the eight sub-regions; North Coast, Bay Area, Sacramento Valley, Central Coast, Inland Empire, San Joaquin Valley, Los Angeles region, and San Diego region. The current version of the IMPLAN model allows for the assessment of regional interaction, and therefore can account for impact that spending in one region has on surrounding regions. Within each defined study region, IMPLAN uses average expenditure data from the industries that originate the impact on supplier industries to trace and calculate the multiple rounds of secondary indirect and induced impacts that remain in the region (as opposed to "leaking out" to other areas). IMPLAN then uses this total impact on industry activity to calculate total job and tax impacts. Alumni impacts were modeled separately from the other spending impacts because they could only be calculated at the state-level.

Results

It was important to present the impact results in economic terms that would resonate with both University stakeholders and state-wide law makers and local residents. ICF used the following economic metrics:

- Economy-wide industry activity
- Jobs
- State and local tax revenue
- State-wide return on investment

Jobs and return on investment are particularly important indicators given the current political situation in California related to public university budget cuts.

The analysis presented results for three key geographic scales. Again, it was important that both state and local stakeholders be provided with data on the impacts as they relate to their constituency. ICF reported system-wide impacts on the entire state, as well as regional impacts, which constituted the aggregation of campus-specific impacts within a given region. ICF also provided campus-specific impacts for each of the 23 campuses and the Chancellor's office. The statewide return on investment is useful in discussions around public funding in Sacramento, while the regional campus-specific impacts are particularly valuable for the campuses as they articulate their benefit to the surrounding community.

Statewide Fiscal Impact

The full economic impact of the $7.96 billion in direct CSU-related expenditures (institutional and

[4] It was assumed that CSU graduates from that year and later years who were still residents of the state would still be in the labor force.

[5] Some students come to the CSU with a high school diploma only; others transfer after completing some college. The salary differences between bachelor's degree recipients and high school graduates were calculated as well as the salary difference between bachelor's degree recipients and transfer students with some college credits. These two differences were weighted based on historical data for the split between the two sources of students to the CSU (first-time freshmen with a high school diploma and transfer students).

student spending) is estimated at nearly $17 billion. CSU spending has a statewide multiplier effect of 2.13. In other words, every dollar of direct spending by the CSU "grows" to $2.13 when indirect and induced spending are considered. This level of spending activity supports almost 150,000 jobs statewide annually and generates over $995 million in annual taxes for state and local governments.

Furthermore, when alumni earnings are taken into account, the combined direct impact raises to roughly $50 billion, for a total statewide effect of $70.4 billion. This level of economic activity supports roughly 485,000 jobs annually in the state and generates $4.9 billion in annual tax revenue for state and local governments.

California's Return on Investment in the CSU.

The magnitude of the CSU's economic impact on California can be compared to the state's annual investment in the university system. In 2008-09, the state's investment in the CSU (operating and average capital appropriations) totaled $3.12 billion. For every dollar the state invests in the university system, the impact of CSU-related expenditures alone creates $5.43 in total industry activity. When the impact of the enhanced earnings of CSU graduates is included, the ratio rises to $23 in total industry activity impact for every dollar the state invests in the CSU.

Regional and Campus Results

Our analysis explored the impacts not only at the state-level but also in eight regions throughout the state (North Coast, Bay Area, Sacramento Valley, Central Coast, Inland Empire, San Joaquin Valley, Los Angeles region, and San Diego region). These regions are common jurisdiction breakdowns within the state, and thus are useful for policy and economic discussions. Each region consists of one to seven campuses (most have three to four). Results were presented for both the impact of the campuses on the region, as well as the region on the state, to show the relative impact across regions. It should be noted that the alumni impact could only be reported at the state-level due to the granularity of migration data. Trends across the regions were not surprising; non-metro regions, such as the North Coast, Central Coast, Inland Empire and San Joaquin Valley, experienced 'higher' leakages, as these communities were more likely to have to purchase their goods and services from larger metro areas. To illustrate, the regional purchase coefficient (RPC), the percentage of purchases that are felt locally, for the Inland Empire is roughly 40% compared to the RPC for the Bay Area which is roughly 80%. Bay Area economy is larger and more diverse and thus better able to satisfy the range of goods and service needs of local CSU campuses and their students.

In addition to conducting regional analysis, ICF also assessed the impact that individual campus had on the region and state. Each of the 23 campuses and the Chancellor's office was assessed separately. Not surprisingly, there was significant variance in impact across the campuses. The (direct) spending magnitude for larger campuses, with more students, was obviously higher. But even when size was taken into account, differences in how campuses "spent" their money, i.e. operational versus capital expenditures, greatly affected each campus' multiplier. Capital expenses, heavily concentrated in the construction industry, have more significant economy-wide impacts then spending in the service or higher education sector. Thus campuses that spent a significant portion of their investments on capital costs tended to have more significant economy-wide impacts.

Part II: Broader Benefits
Workforce Development

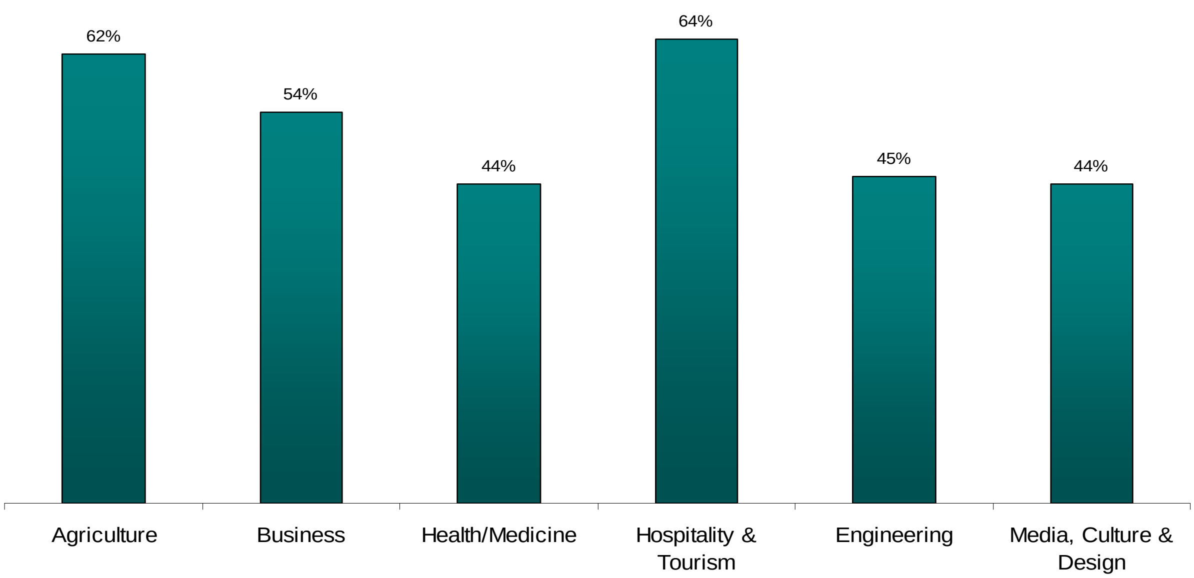
As the largest source of the state's skilled, diverse workforce, the California State University provides thousands of graduates in hundreds of fields each year. CSU graduates have the skills, expertise, and preparation to succeed and excel in emerging knowledge-based fields like life sciences, information technology, and the emerging "green" industries. The CSU is a key contributor to the state's public sector workforce, educating a substantial number of teachers, criminal justice employees, social workers, and policymakers. For all of these fields, the CSU strives to build a workforce based in a range of backgrounds and experiences, and to provide educational opportunities to students regardless of their financial means.

Our analysis focused on key knowledge-based and service industries that account for nearly five million jobs in California:

- Agriculture, Food and Beverages;
- Business and Professional Services;
- Life Sciences and Biomedicine;
- Engineering, Information Technology and Technical Disciplines;
- Media, Culture, and Design;
- Hospitality and Tourism;
- Education;
- Criminal Justice;
- Social Work;
- Public Administration.

The CSU's contribution to these industries is evident when analyzing the percentage of graduates in California who receive their degrees from the CSU. The graph below demonstrates the CSU's strong showing across California's key industries.

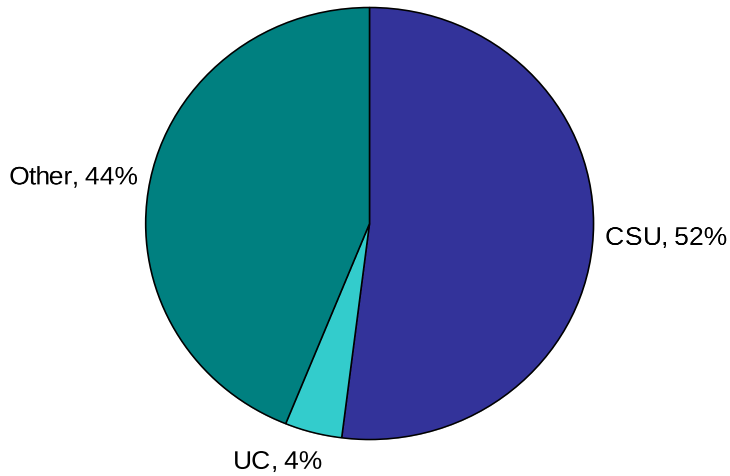
Percentage of California Bachelor's Degrees awarded by CSU, 2007



Source: California Postsecondary Education Commission

Of particular note is the CSU's significant contribution to graduates in the fields of Hospitality and Tourism, Business, and Agriculture. In each of these fields, the CSU produces well over 50 percent of the bachelor's degrees awarded in California. Additionally, the CSU continues to be California's largest source of educators. More than half the state's newly credentialed teachers in 2007-08—52 percent—were CSU graduates, expanding the state's ranks of teachers by more than 12,500 per year.

Newly Issued California Teaching Credentials (regular credentials and internships) by University, 2007-08



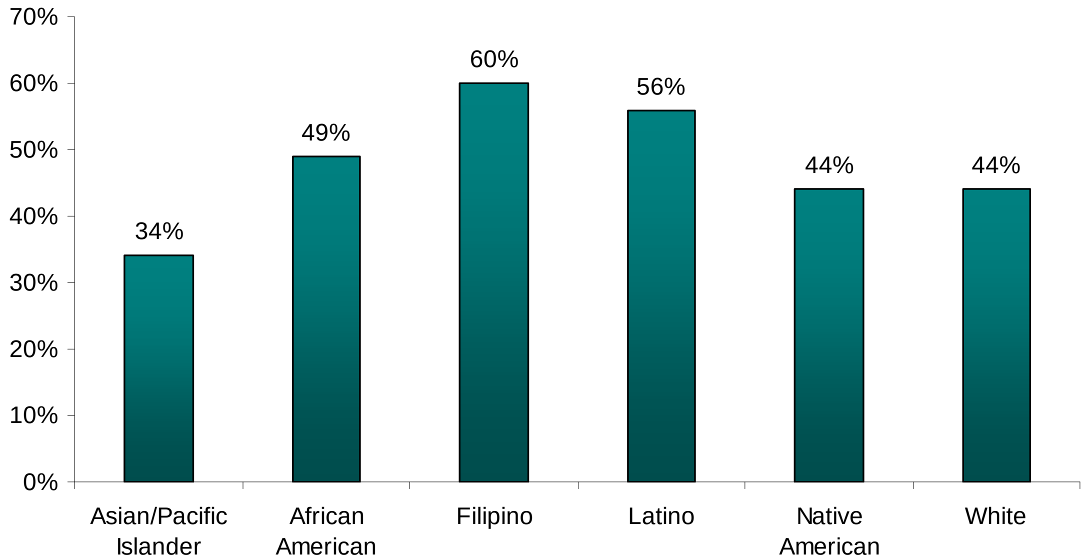
Source: California Commission on Teacher Credentialing

Making Higher Education Accessible

In every industry, California thrives on a workforce based in a range of backgrounds and perspectives. To that end, the CSU has a long tradition of providing access to higher education to Californians from different ethnic, socioeconomic, and educational backgrounds, making it the most diverse university system in the country. Over the last 10 years, the CSU has significantly enhanced its academic preparation and outreach efforts to underserved communities through a variety of programs and partnerships with the goal of increasing college readiness for K-12 students. Equally as important, the CSU is also focusing on helping students succeed and persist to a degree once they reach the university and has recently launched a Graduation Initiative aimed at increasing the graduation rate and halving the achievement gap of underrepresented students.

As of 2006-07, 56 percent of all bachelor's degrees granted to Latinos in California were CSU degrees. The numbers for other ethnic groups in the state were similar as shown in the following graph.

CSU Bachelor's Degrees Recipients as a Percentage of All California Public and Private University Bachelor's Recipients, 2006-07.



Source: California Postsecondary Education Commission

The CSU has also continued efforts to offer a university education to disabled students. More than 10,000 disabled students are currently enrolled at the CSU, and more than 95 percent graduate. This success rate is in part due to the wide range of services provided to assist disabled students. CSU campuses also provide comprehensive services that ensure the admission, retention, and graduation of foster youth. Foster youth are provided direct contact with staff members, ongoing academic monitoring and intervention, opportunities to build relationships in a community setting, and connections to campus clubs and organizations.

The CSU works to welcome students who enter college from community college or non-traditional avenues. In fall 2008, about 42 percent of students entering the CSU began their academic careers in community college. This is coupled with the CSU's programs that allow students to engage in learning later in life. Approximately 1 in 5 CSU students is older than 30, and one-quarter of students attend the CSU part-time. Programs and services like child care, veteran's offices, financial aid, and counseling and advising support help students successfully engage while in college.

Numerous online and distance learning programs also allow access to the CSU for students who otherwise may not have the opportunity to gain higher education. The CSU Extended Education units on every campus address the educational and training needs of California's workforce. Individuals can pursue degrees, take classes, complete credentials, earn certificates, and explore professional and career development opportunities. Extended Education partners with business and industry to design and deliver high-quality programs that enable people to excel in a competitive environment.

Beyond the wealth of programs designed to promote access to higher education, the CSU remains one of the most affordable public education systems in the nation. With federal and state aid, loans, and scholarships, students have many options to help them afford a college education. While state funding cuts have forced the CSU to find new ways to maintain quality, including raising fees, the CSU's in-state fees remain the second lowest among comparable institutions nationally. That said, about one-third of revenues from increased fees help bolster financial aid. In 2008, the CSU awarded more than $2 billion in financial aid, including loans, work study, and grants, helping to maintain its legacy as a uniquely affordable option for higher education. More than 250,000, or 54 percent, of CSU students received some form of aid in 2008.

Impact on Innovation and Entrepreneurship

Applied research and innovation is a productive and burgeoning economic engine for California. The CSU's research capabilities are an important asset to the state, with CSU research and project sponsored expenditures from federal, state, local, and private sources amounting to over half a billion dollars annually, and employing 6,000 students in fiscal year 2007-08. The CSU actively pursues research and sponsored program opportunities as evidenced by the 5,100 proposals it submitted to federal and state agencies and private foundations in 2007-08. That same year CSU campuses received grant or contract awards varying from approximately $2 million to $131 million from federal, state, foundation, and private sources. The CSU's applied research projects focus on multiple industries such as Energy and the Environment, Biotechnology and Health Care, Agriculture, Information Technology and Engineering, and Physical Sciences/Advanced Sciences.

Research partnerships and entrepreneurial initiatives are implemented not only through the CSU's centers and institutes but through faculty-led and student-supported programs and projects, and multi-campus consortiums. Examples of such projects include the California Seafloor Mapping project, the Biocompass project, and the California Vehicle Launch Education Initiative.

The CSU's expanding research agenda is complementing and stimulating its educational mission, while providing new solutions for and new forms of partnership with industry.

Sustainability: Environmental Consciousness and Energy

The CSU is dedicated to serving as a guardian of the state's natural resources—not only as a consumer of these resources but also as an institutional leader. The CSU campuses have committed to sustainability initiatives such as the Presidents' Climate Commitment, and the international higher education-sponsored Talloires Declaration, and have also joined associations and voluntary green programs. Sustainability and related fields of study are offered as undergraduate majors as well as graduate degree programs to prepare the next generation of environmental leaders. In addition, CSU campuses have adopted creative measures to incorporate sustainability in their everyday operations. The broad scope of green initiatives committed to by the CSU campuses are closely aligned with the statewide Integrated Energy Policy, which includes energy efficiency, water conservation, alternative transportation, local food options, recycling/waste reduction, green outreach/community action, green building/sustainable design, and renewable energy.

The CSU adopted renewable energy generation to help achieve energy independence for its campuses. The CSU Board of Trustees set a goal for the CSU to double its on-campus renewable generation by 2014, and the CSU is well on its way to exceed this target. Currently 23 percent of the CSU's electric power is from renewable sources. In 2005, the CSU partnered with the Department of General Services to lead a statewide effort to install solar-powered generation systems on university campuses and state facilities. This is expected to offset an amount of carbon dioxide that is equivalent to removing nearly 1,200 cars from the road annually or providing annual electricity for 800 homes.

Students too play a key role in the design and implementation of various innovative "green" initiatives that not only raise environmental awareness in the local community, but also ensure that graduates will join the community with a deeper understanding of sustainability and an increased environmental sensibility. Key examples of the latter are Chico's annual "This Way to Sustainability" conference, the nation's largest student-run conference focusing on sustainability, and Humboldt State University students' creation of a fee to fund student-led energy efficiency projects. Community education and action is a key component of the CSU's mission to raise environmental awareness on a local and regional level. The CSU offers specialized centers for community use such as Cal Poly Pomona's AGRIscapes, which integrates farming and urban landscaping practices that are sustainable, environmentally beneficial, economically viable, and technologically sound. San Francisco State University's Industrial Assessment Center provides small- and medium-sized manufacturers with free assessments of their plant's energy, waste and productivity efficiency, and offers recommendations for improvements.

Conclusion

As the largest university in the world's leading knowledge economy, it is not surprising that the California State University's has a significant impact. Put succinctly, California reaps a fivefold benefit from every dollar that state invests in the CSU. Furthermore, the system sustains over 150,000 jobs in California annually, and by providing education to those that would otherwise not have access, decreases statewide unemployment. Annually, the CSU generates nearly $1billion in state and local tax revenue, which particularly in this time of budget shortfalls is critical to the state's coffers. When the impact of the higher earnings of CSU graduates is considered, the impact rises to $70.4 billion annually, and supports more than 485,000 jobs. The tax impact of this combined spending impact is 1.7 times greater than the state's annual investment in the CSU.

While not directly quantifiable, the system is critical in filling the state's key, knowledge-based occupations with skilled and prepared workers. The system reaches out to and provides supports for the state's students who might otherwise not have had a change at higher education. While workforce development is the system's main goal, the CSU contributes to statewide applied research and innovation, particularly in the emerging field of sustainability. The system has made a commitment to on-campus and community-based sustainable practices and policies.