The Fiscal Impact of the Congress Avenue Bridge Bat Colony on the City of Austin

This is the executive summary of a fiscal impact study of the Congress Avenue Bridge bat colony conducted for the Bat Conservation International (BCI). The study had two purposes. The major purpose was to investigate the economic importance of the bat colony on the residents of the city of Austin. A secondary purpose of the study was to document the demographic characteristics of the visitors to the bat colony. The two principal investigators, Gail R. Ryser, Ph.D. and Roxana Popovici, worked in conjunction with BCI to complete this study.

Detailed results related to the two objectives are provided in the following sections of the report. This executive summary describes the methods and major results of the study.

Methods

We collected data for our study through a survey that was administered at the bat observation center using two procedures. Visitors were either interviewed one-on-one or asked to complete the survey independently and hand it in before leaving the center. We surveyed visitors on 17 randomly selected days between August 1, 1999 and October 31, 1999. In this way, we obtained responses from 879 individuals.

Data gathered through the survey included number of times respondents had visited bat colony, opinions concerning aspects of the visitors' center, party size, amount of influence the bat emergence had on the respondent visiting the downtown Austin area, overall expenditures, expenditures by category, and demographic information. In addition, BCI has collected data pertaining to the number of visitors by month and day of the week over a period of several years. We used this data and our visitor survey data to estimate the total number of visitors to the Congress Avenue Bridge bat colony and their economic impact on the local economy. The rest of this summary highlights the most important findings of this study.

Major Results

Visitor Demographics

• The average visitor to the Congress Avenue Bridge bat colony is younger than 45 years old, well off financially, and employed full time. About two-thirds of the visitors live outside of Austin and about 3 percent live outside the United States.

Visitor Opinions

• Most visitors have positive attitudes toward bats and enjoyed the experience of viewing the bat emergence, particularly the informal atmosphere and educational benefits.

• About one-half of the respondents wanted the bat visitation center improved. Most wanted some form of seating, red-filtered lighting, or increased educational information about the bats. In addition, several individuals indicated that the trees obscured the view and would like them trimmed.

Sample Expenditures

• Visitors to the bat colony spend money in various categories. The largest categories of expenditures were restaurants and lodging.

• Individuals in the sample estimated their expenditures to be $68,671.45. Weighting this amount by the amount of influence of viewing the bat emergence on a respondent visiting the downtown Austin area, the expenditures were estimated to be $52,917.86.

• The overall economic impact of the Congress Avenue Bridge bat colony for the sample ranged from $113,985.44 to $139,107.96.

• The overall employment effect for the sample ranged from 2.19 to 2.73.

Economic Impact

- The total direct effect is $3,182,256.00.
- The overall effect is $7,955,640.00.

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I. Introduction

The Congress Avenue Bridge is home to the largest urban bat colony in the United States.

Located in Austin, Texas, it supports approximately 1.5 million bats. The bats inhabit the underside of the bridge from March through November. Each summer evening, they consume approximately 30,000 pounds of insects including countless pests.

Due to the spectacular evening emergences, the colony has become a tourist attraction for the city of Austin. Hundreds of tourists and residents come to the bridge nightly to view the emergence, and Bat Conservation International (BCI), in cooperation with the *Austin American Statesman*, has established a viewing area at the bridge. This bat observation center is a grassy knoll of approximately one acre where visitors usually congregate 30 to 60 minutes before the bats emerge.

In order to understand the fiscal impact of the bat colony on the city of Austin, BCI contracted with Gail Ryser, Ph.D. and Roxana Popovici to conduct a study to examine and document the economic impact of visitors to the Congress Avenue Bridge Bat colony. A secondary purpose of the study was to document the demographic characteristics of visitors to the bat colony. The methods of the study and the results are discussed in the next two sections.

II. Survey Design and Implementation

The survey for the study is presented in Appendix A. We designed the survey to obtain as complete information as possible about the expenditures, demographic characteristics, and opinions of visitors to the bat colony. The survey first asked how many times a respondent had visited the bat colony and how the person found out about the colony. Next, the economic questions were asked followed by an opinion question about improvement of the site. Lastly, demographic information was obtained.

Visitor Contact Procedures

We chose to obtain information from visitors in two ways. First, we used person-to-person interviews. We also asked visitors to complete the survey and turn them in to an interviewer before leaving the viewing area. Person-to-person interviews are usually more accurate, but they take a longer time to administer, thus the second strategy was used to obtain a larger number of completed surveys.

Interviewers contacted visitors one hour prior to the bats emerging. The surveys were administered on 18 randomly selected days during the period of August 1 through October 31, 1999. Visitors were surveyed at the viewing area and interviewers were instructed to contact randomly as many visitors as possible. If visitors had not already completed a survey and were willing to participate, interviewers either asked them the survey questions or had them complete a survey and hand it in before leaving the area.

The days were chosen using the following procedures. BCI has estimated the number of visitors to the colony during each month and on different days of the week over the last several years. BCI divides the bat season into the following groups. July and August are the peak months, followed by June and September. March, April, and October are the slowest months for visitation. Weekend nights (Friday and Saturday) have the most visitors and are generally two to three times as busy as during the week. Therefore, we randomly chose 8 (44%) days in August, 6 (33%) days in September, and 4 (22%) days in October to survey visitors. In addition, we chose 10 (56%) days on the weekend to survey visitors. During one of the randomly chosen days in August, Austin experienced a thunderstorm and we were unable to collect data. Table 1 shows the number of respondents by date.

Table 1. Visitor Contacts at the Congress Avenue Bat Colony

Date	**Number**	**Percent**
August 6, 1999	28	3.2
August 7, 1999	34	3.9
August 8, 1999	38	4.3

August 12, 1999	39	4.4
August 19, 1999	44	5.0
August 21, 1999	60	6.8
August 22, 1999	no data	0
August 28, 1999	81	9.2
September 3, 1999	30	3.4
September 13, 1999	49	5.6
September 17, 1999	50	5.7
September 18, 1999	114	13.0
September 23, 1999	65	7.4
September 24, 1999	46	5.2
October 8, 1999	77	8.8
October 10, 1999	71	8.1
October 16, 1999	40	4.6
October 18, 1999	13	1.5
TOTAL	879	100

Sampling Procedures

When appropriate random sampling techniques are used, the sample is more representative of the parent population and the sample bias is minimized, or at least its magnitude may be quantified. One of the easiest forms of random sampling is **simple random sampling**, in which every observation has an equal chance of being included. In simple random sampling, observations have a known probability of being included. Random sampling does not imply haphazard sampling, but rather that each observation is assigned an equal probability of entering the sample. We used, therefore, the simple random sampling technique in administering our survey.

However, despite our approach, we could not overcome the self-selection bias. As it is almost always the case with survey data, our data suffers from selection bias. Selection bias refers to a situation in which inference is based only on the sample that receives the treatment rather than on the entire population. For example, if we want to study why wars occur but we only study wars, then we miss cases in which wars did not occur. In our study, we would have liked ideally to be able to observe both the spending patterns of people who had come downtown because of bats and those for whom bats had played no role in their decision to go downtown. In this ideal situation, we would have conducted our analysis by comparing the two groups and the results would have been point-estimates.

More importantly, we would like to be able to distinguish between those who choose to go downtown to participate in any forms of entertainment not related to the Congress Avenue Bridge Bat Colony and those who go downtown primarily with the intention to learn about and view the bats. To distinguish between these two groups, we asked respondents to rate the influence of the bat colony on their decision to visit downtown Austin. We used the response to this question (question 6) several ways and these will be discussed in the appropriate sections.

II. Results

The results are divided into five sections. We first discuss the visitor demographics. Next we present the responses to the opinion questions. We follow this with a discussion of the trip expenditures and estimates. Fourth we discuss the economic analysis and conclude this section with a comparison of this study with three other economic analysis studies.

Visitor Demographics

Visitor demographics include number, ages, gender, income level, employment status, and residence. Not all respondents were willing to answer all questions. In this case, we noted these as missing data. Of the 879 respondents, 54 did not give the number in their party. The other 825 did give the number in their party and in all there were 2,815 visitors. Table 2 shows the number and percent of visitors by date.

Table 2. Total Number in Respondents' Party

Date	Number	Percent
August 6, 1999	137	4.9
August 7, 1999	110	3.9
August 8, 1999	118	4.2
August 12, 1999	117	4.2
August 19, 1999	123	4.4
August 21, 1999	181	6.4
August 28, 1999	250	8.9
September 3, 1999	105	3.7
September 13, 1999	142	5.0
September 17, 1999	162	5.8
September 18, 1999	397	14.1
September 23, 1999	181	6.4
September 24, 1999	129	4.6
October 8, 1999	232	8.2
October 10, 1999	224	8.0
October 16, 1999	153	5.4
October 18, 1999	54	1.9
TOTAL		2,815 100.0

Respondents were asked to indicate the age and gender of all visitors in their party. Again, some respondents did not complete this section. Of the 2,815 visitors, data were available for 2,624. Of these, 1,254 (48%) were male and 1,370 (52%) were female. Figure 1 illustrates the age of the visitors. As this figure shows, the majority (36%) of visitors were between the ages of 30 through 45. The next two age groups who frequently visit were 19 through 29 year olds and 0 through 12 year olds. Many of the visitors between the ages of 19 and 29 were students from local universities. In addition, many of the visitors between the ages of 30 and 45 come with their families and have children between the ages of 0 through 12.

Figure 1. Age of Total Number of Visitors to Bat Colony

We also asked respondents about their employment status. As Figure 2 shows, the vast majority (71.2%) of the respondents were employed full time.

Figure 3. Employment Status of Respondents

Respondents were asked to indicate their income level. Table 3 illustrates these results. Most of the respondents had high incomes with the largest percent (11.7%) in the $100,000 to $149,999 range.

Table 3. Number and Percent of Respondents' Income

Income	Number	Percent
<$10,000	26	3.0
$10,000-$14,999	16	1.8
$15,000-$19,999	13	1.5
$20,000-$24,999	20	2.3
$25,000-$29,999	36	4.1
$30,000-$34,999	38	4.3
$35,000-$39,999	42	4.8
$40,000-$44,999	37	4.2
$45,000-$49,999	35	4.0
$50,000-$59,999	83	9.4
$60,000-$69,999	68	7.7
$70,000-$79,999	64	7.3
$80,000-$89,999	43	4.9
$90,000-$99,999	43	4.9
$100,000-$149,999	103	11.7
$150,000-$199,999	39	4.4

$200,000-$249,999	14	1.6	
=>$250,000	20	2.3	
Missing	139	15.8	
Total		879	100

Respondents were asked to name the city in which they lived. Only the respondent's residence was obtained; not all visitors in the party. Table 4 shows the number and percent of respondents' residence. While the majority of the visitors came from Texas (66.4%), many visitors came from other parts of the United States and there were a number of visitors from foreign countries.

Table 4. Number and Percent of Respondent's Residence

Residence Number	**Percent**	
Alabama	6	.7
Alaska	1	.1
Arizona	5	.6
Arkansas	3	.3
California	28	3.2
Colorado	6	.7
Connecticut	4	.5
Florida	14	1.6
Georgia	8	.9
Hawaii	1	.1
Illinois	20	2.3
Indiana	1	.1
Iowa		1 .1
Kansas	3	.3
Kentucky	3	.3
Louisiana	7	.8
Maine	5	.6
Maryland	3	.3
Michigan	6	.7
Minnesota	3	.3
Missouri	6	.7
Nebraska	1	.1
New Jersey	2	.2
New Mexico	6	.7
New York	16	1.8
North Carolina	1	.1
Ohio	7	.8
Oklahoma	9	1.0
Oregon	2	.2
Pennsylvania	8	.9
Rhode Island	1	.1
Tennessee	2	.2
Texas	584	66.4
Virginia	2	.2
Washington	7	.8
Washington DC	5	.6
West Virginia	1	.1
Wisconsin	7	.8
Wyoming	1	.1
Australia	1	.1
Canada	3	.3
England	5	.6
France	1	.1
Germany	5	.6
Holland	2	.2

Ireland	2	.2
Italy	1	.1
Mexico	1	.1
Netherlands	1	.1
New Zealand	1	.1
Poland	1	.1
Switzerland	2	.2
Missing	57	6.5
TOTAL	879	100

Of the 584 (66.4%) of the respondents from Texas, 292 (33.2%) lived in Austin. We asked residents of Austin to indicate their zip codes. We used this information to determine if resident visitors were from certain areas of Austin. Of the 292 individuals from Austin, 281 reported their zip codes. We divided the area of Austin into the following seven regions according to zip codes: North, South, East, West, North Central, South Central, and downtown. Table 5 illustrates the number and percent of the zip codes and the areas of Austin these zip codes represent.

Table 5. Number and Percent of Respondents' Zip Codes
(Ascending Order by Percent)

Area	**Number**	**Percent**
South Central	24	8
North Central	31	11
East	31	11
Downtown	31	11
South	47	16
West	54	18
North	63	22
Missing	11	4
TOTAL	292	100

Data on respondent demographics indicate that the typical visitor to the bat colony is younger than 45 years old, well off financially, and employed full time. About two-thirds of the visitors live outside of Austin and about 3% live outside the United States. These visitors bring economic gain for the city of Austin and its metropolitan area.

Responses to Opinion Questions

A number of the survey questions dealt with the number of times respondents had visited the bat colony and how visitors found out about the colony. Question one asked respondents if this was their first visit to the bat colony. The results of this question helped establish the proportion of first time visitors to repeat visitors. Of the respondents to the survey, 587 or 67% said this was their first visit and 292 or 33% said this was not their first visit. Respondents who stated that this was not their first visit were asked to estimate the number of times they had visited the colony. Table 3 shows the number of times respondents estimated visiting the bat colony.

Table 6. Number of Estimated Visits by Respondents
Who Had Previously Visited Bat Colony

Number of Prior Visits	**Frequency of Response**
1	14
2	99
3	67
4	32
5	26

6	19
7	8
8	4
10	7
12	3
15	3
20	1
24	1
30	1
40	1
50	3
60	1
100	1
500	1

We were also interested in finding out respondents' attitudes toward the bats. Only those respondents who had visited the bat colony prior to the survey were asked to respond to these questions. Of the 292 respondents who had visited the bat colony previously, 189 or 65% stated that visiting the bat colony improved their attitude toward bats, 93 or 32% stated that their attitude was the same, and 10 or 3% did not respond to the question. For those respondents who stated that their attitude was the same, we asked a follow up question designed to determine their attitudes toward the bat colony. Of the 92 respondents who answered, "the same", 63 or 68% stated that their attitudes toward the bats were positive, 24 or 26% stated that they were neutral, 2 or 2% stated that they were negative, and 4 or 4% did not respond. Overall the response to this question was very positive and most respondents' attitudes toward bats improved as a result of visiting the Congress Avenue Bridge bat colony.

We asked respondents if they thought the viewing area should be improved or kept the same. Currently, the viewing area consists of a grassy hill with a small circular concrete area containing five bat information panels. There are no lights or seats in the area. Of the respondents, 475 (54%) stated that they wanted the area to be kept the same, 353 (40%) stated that they would like the viewing area to be improved, and 51 (6%) did not respond. Several options for improvements were given to respondents. These included red-filtered lighting, which is non-intrusive to the bats to enhance the viewing area, seating, more educational material on bats, increased safety for the observers, and other. Respondents could choose as many of the options as were applicable. Figure 3 illustrates the percentage of the 353 respondents wanting the viewing area improved who chose each option. Respondents chose seating most often and increased safety least often.

Figure 3. Improvements to Viewing Area

We asked individuals who chose "other" as an option to this question to state the improvements they would recommend. Table 4 illustrates categories of "other" improvements made by three or more respondents. Many of the respondents gave more than one improvement and this is reflected in the total number. Several responses were made by only one respondent and we placed them in the "other" category.

Table 7. Other Comments Made by Respondents to Question 13:
Which of these improvements would you like? (N=105)

Category	**Number**	**Percent**
Trim or remove trees; better view	20	19
More seating; benches; covered seating; terracing; seating for elderly and disabled	14	13
Restrooms or port-a-potties	12	11

Signs that point to bat viewing area; better directions from Riverside to bat viewing; better signs and maps at airport; more lights	12	11
Water fountains; place to purchase drinks and/or food	11	10
More educational specialists; tours; bigger educational signs; educational signs at children's level; more on safety	8	8
Mow grass; groom	6	6
Don't water grass immediately before the bats emerge	5	5
Better parking; handicapped parking	3	3
Better bridge; bridge walkway for children	3	3
Other	11	10

As this table illustrates, 19 percent of respondents stated the "other" improvement needed was to trim the trees. When the bats emerge, the trees along the bank of the river often obscure their path. The second most common "other" improvement was benches. While seating was the choice most often chosen as an improvement, many respondents felt the need to reiterate this in the "other" category. Other responses include restroom facilities, better directional signs, and water fountains.

Our final question on the survey asked respondents if they had additional comments. Table 8 illustrates the categories of comments made by three or more respondents.

Table 8. Additional Comments Made by Respondents (N=55)

Category	**Number**	**Percent**
Great; cool; exciting; very nice; wonderful show	22	40
Like the informality of site; laid back atmosphere; small and intimate	7	13
Educational and informative	7	13
Love the bats	4	7
Thanks BCI; keep up the good work	4	7
Other	11	20

The majority of comments were positive. People who came to view the bats enjoyed the experience, particularly the informal atmosphere and educational benefits.

Trip Expenditures and Estimates

The information on trip expenditures was gathered from several questions on the survey. We asked respondents to estimate *only* the amount they had spent that evening in Austin. Watching the bats emerge is relatively quick, taking approximately 10 to 15 minutes (although most people arrive about 60 to 90 minutes prior to the bat emergence). Many bat watchers observe the emergence in conjunction with other activities, such as conferences or a

visit to another area of Austin. Therefore, it was important to determine the amount of influence the viewing of the bats had on individuals visiting Austin. Earlier we stated that question 6 on the survey asked respondents, using a 1 to 10 scale, to estimate the amount of influence the bats had on their decision to visit the downtown Austin area. A weight of 1 meant bat watching had minimal or no influence and a weight of 10 meant bat watching was the primary influence for the viewer visiting the downtown Austin area that evening. Question 8 on the survey asked visitors to estimate the amount they had or were planning to spend in Austin that night. The 1 to 10 scale was used to apply a weight to the amount respondents reported. For example, if a respondent stated that the amount of influence bat watching had on his or her decision to visit downtown Austin that evening was a 7, than a weight of 0.7 was applied to the amount the individual spent. Respondents were also asked to estimate the amount they had spent in the following categories: restaurants, lodging, entertainment, transportation, town lake boating, and other.

A few of the respondents did not provide an estimate of the amount they had spent that night. In addition, others did not provide a complete account of the amount they had spent in the various categories. Other data that were missing that were necessary for our calculation included income and the amount of influence the bats had on the respondents visiting the downtown Austin area. The lack of completed responses can be attributed to the desire for privacy or the complexity of the questions.

In order to handle the problem of missing data, we established criteria to estimate missing information so that these surveys could be included in the analyses. We used the following procedures to estimate missing data.

1. *Estimated Expenditures*
First, we correlated the median of each income range and the influence the bats had on visiting the downtown Austin area with estimated total expenditures. The correlation between median income and estimated total expenditures was statistically significant, while the correlation between influence and estimated total expenditures was not statistically significant. Therefore, we used median income to estimate the total expenditures.

Second, we broke the estimated expenditures into range categories. Seventy-five percent of the sample spent $100.00 or less. Another 15 percent spent between $100.00 and $200.00. Therefore, we divided total expenditures into the following seven range categories: $0-$25.00, $26.00-$50.00, $51.00-$75.00, $76.00-$100.00, $101.00-$150.00, $151.00-$200.00, >$200.00.

Finally, we calculated a frequency distribution of expenditure categories by median income. The expenditure category at the 50th percentile was used to fill in missing data for total estimated expenditures.

2. *Estimated Expenditures by Category*
We calculated the percentage spent in each category for surveys with complete data. We multiplied estimated expenditures by the percentage for each category. This amount was used to calculate missing data for estimated expenditures by category.

3. *Income*
We found the mean income range and used the median of this range to estimate missing income levels.

4. *Amount of Influence*
We calculated the mean amount of influence by date. The mean for each date was used to estimate missing amount of influence.

5. *Missing Values*
To estimate the missing values for the number of people in each party, we looked at two different pieces of data. First, we computed the average number of people in each party for the entire sample. Our estimate suggests that the average number of people per party is two. Second, we observed each individual's answer to the question that asked to explain whether

the amount spent was for herself or himself alone or for all members in the party. If the answer to this particular question indicated that the amount spent was for the entire group and if the respondent did not report the number of people in the party, we filled in the average value for our sample. Otherwise, we replaced the missing values with a one.

Total Expenditures and Expenditures by Category

We next calculated the total amount of expenditures. In all, respondents stated that they had spent $68,671.45. Weighting the responses by the amount of influence, the amount was $52,917.86. We also were interested in the percent of expenditures by category (see Figure 4).

Figure 4. Percent of Expenditures by Category

As this figure illustrates, the category, restaurants had the highest percent of expenditures, followed by lodging. Very few respondents reported spending money on transportation, or other.

Economic Analysis

This part of the report presents the results of the impact economic analysis. The analysis is meant to determine the impact of the Congress Bridge Bat Colony upon the local economy. The analysis is organized in three sections. First, we describe the methodology and the key concepts used in our analysis. Second, we estimate the direct economic impact including the total amount spent, per capita spending and type of purchase. The final section is a presentation of the overall economic impact estimated using local multipliers.

Methodology of Economic Analysis

Earlier we discussed the importance of distinguishing between respondents who choose to go to downtown Austin to participate in any form of entertainment not related to the Congress Avenue Bridge Bat Colony and those who visited downtown Austin primarily with the intention to learn about and view the bats. In order to conduct an unbiased inference, we divide our sample into two groups based on the answer to the question that asked each individual to quantify on a scale from 1 to 10 the influence of bats in his or her decision to go downtown. The first group includes those whose answer to this particular question was from 1 to 5. We will refer to this group as Category A. The second group encompasses those for whom bats played a role greater than 5 in the decision to go downtown. Let us refer to this group as Category B. Looking at the second group alone we essentially place a lower bound on our estimates; by studying the impact of the total number of people, we effectively obtain an upper bound of the estimates. We, therefore, will go beyond giving point estimates of our results to offering scientifically reliable interval estimates.

Figure 5. Illustration of Selection Bias

Visitors attracted by reasons other than the bat colony.
Visitors attracted by the bat colony.

As Figure 5 shows, the population of visitors includes both those who go downtown for reasons other than the bat colony and those who go downtown with the intention of viewing the bats. Conducting the economic analysis based on two categories, we treat our sample as if it possesses the characteristics of the population.

Direct Effect and Per Capita Spending by Category

In this section, we provide estimates of the direct effect that the bat colony has upon the local economy. Direct effects refer to the first round of purchases by visitors to the area. For instance, a person who spends $1 to buy a soft drink generates a direct effect of $1 in the local economy. Figure 2 shows that spending by individuals belonging to Category B

constituted 81% or $46,970 of total expenditure in downtown Austin between the months of August and October, 1999. This estimate constitutes a lower bound of the direct effect that the bat colony has upon the local businesses.

Figure 6 Percentage of Total Amount Spent in Downtown by Category
August-October 1999

In addition to computing the total direct effect of bats in the sample as a whole, we can also break down spending by month and see how our estimates vary on a monthly basis. Figure 7 shows that the magnitude of the direct effect of the bat colony is preserved throughout the entire August-October period despite minor oscillations. We detect fluctuations in the percentage amount spent as follows: 85%, 75% and 85% in August, September and October, respectively. However, spending by Category B still exceeds significantly the monthly spending patterns of category A. Again, we can conclude from these estimates that the lower bound of the monthly direct effect of the bat colony on the local economy is at least 75% of the monthly total expenditure of visitors to the area.

Figure 7. Total Spending by Category

Furthermore, when we analyze the effect of bats on spending by industry, we still find a direct effect of similar magnitude. In the restaurant industry, for instance, the overall and monthly direct effects of the bat colony on the spending patterns of visitors to the area are still around 80%. We conclude, thus, that at least 80% of total expenditure on restaurants is due to visitors whose decision to go downtown was highly influenced by the presence of the bat colony. This fact is illustrated in Figure 8. Moreover, although we observe fluctuations in the pattern of lodging expenditure over time, we can infer from the data that approximately 80% of lodging expenditure comes from people for whom bats played an important role in the decision to go downtown. The direct effect of the bat colony on lodging is, therefore, at least 76% or $16,057, as the dollar value indicates. Finally, Figure 10 lends support to our conclusion regarding the dominant effect of bats on expenditure in other industries such as, transportation and amusement.

Figure 8 Restaurant Expenditure by Category
Figure 9. Lodging Expenditure by Category
Figure 10. Total Expenditure in Other Industries By Category

To estimate per capita spending we computed the total amount spent by both categories as well as the number of members in each group as reported by the respondents. However, since we have no reason to believe that the per capita consumption patterns of the two groups differ, we expect to find similar results for both types of individuals. Since category-dependency in per capita spending patterns cannot be reasonably supported, we find it appropriate to report the overall per capita spending amount, $22.96[1].

Consequently, the data allows us to conclude that there exists a significant direct effect of the bat colony upon spending patterns. The increase in spending generated by visitors generates a chain of economic reactions and in the following section we will estimate the magnitude of the total impact and will indicate how this additional spending benefits the local economy.

Overall Economic Impact in the Sample

The overall economic effect of the Congress Bridge Bat colony on the local economy can be estimated in terms of direct, indirect and induced effects. Direct spending by tourists will ripple through the economy, providing indirect and induced benefits to the region. Tourists spend money on a multitude of items including restaurants, lodging and transportation. These first round of purchases represent the direct effect of the bat colony on businesses located in the area. The initial spending by tourists generates a chain reaction of additional purchases in the local economy. For instance, an increase in the demand for restaurant meals will induce the local restaurants to buy more inputs from suppliers who in turn will

increase their stocks as well to respond to the expansion in input demand. The economic activity stimulated by this chain reaction of purchases denotes the indirect effects of spending on the local economy.

Furthermore, the direct and indirect effects generate an increase in money velocity as well as in the production and distribution of goods and services. A more dynamic economy will generate more jobs and will increase household income. Given this additional income, consumption by locals will go up which in turn will result in a second round of increases in input demand by local businesses. The economic activity generated by the increase in the consumption patterns of the individuals involved in the local economy describes the induced effects.

To measure the overall economic impact of the Congress Bridge Bat Colony we use the following approach:

Overall Effect = Direct Effect + Indirect Effect + Induced Effect

To estimate the indirect and induced economic impact of the bat colony on local businesses, regional economic multipliers were used. Regional economic multipliers for the state of Texas are included in the US Department of Commerce's Regional Input-Output Modeling System (RIMS II) and in the Texas Input-Output Model prepared by the Economic Analysis Center of the Texas Comptroller of Public Accounts. There are essentially three matters that need to be addressed in order to determine which multipliers to use. First of all, we need to establish which industries are affected. Secondly, we need the computed values of the initial changes in output, earnings and employment. Finally, we must determine if the initial changes must be separated into production cost, transportation costs and trade margins.

For our purposes the industries directly affected are:
§ Eating and Drinking Places
§ Hotels and Lodging Places and Amusements
§ Transportation

However, if the initial changes are expressed as the final-demand changes – which are valued in final user's prices – then we could separate the changes into components for production costs, transportation costs and trade margins. For instance, if a consumer spends $100 on a restaurant meal, the price of his meal is the sum of (1) the producer's price that the manufacturer charges the wholesaler; (2) the wholesale margin; (3) the retail margin; and (4) the transportation costs. Accordingly, the final-demand changes associated with the purchase of the meal are the final-demand changes for manufacturing, wholesale trade, retail trade, and transportation industry.

Results of Overall Sample Estimation

We summarize our results in Table 1[2]. Two types of multipliers were used: an output multiplier and an employment multiplier. The output multiplier represents the total dollar change that occurs in each row industry for each additional dollar of output delivered to final demand. For instance, a multiplier of 2.5111 for the Eating and Drinking Industry implies that one dollar spent on food generates a chain of purchases of 2.5111 dollars. Similarly, the employment multiplier reflects the change in employment due to an increase in spending.

Table 9. Lower Bound Estimates for the Fifteen Days of the Survey of Three Industries Based on Output and Employment Multipliers

Lower Bound of Estimates

	Output	**Employment**
Eating and Drinking Places		

Multipliers	2.5111	50.6
Direct Effects	$25,759.43	
Overall Effect	$64,684.50	1.30

Hotels, Lodging Places and Amusements

Multiplier	2.3051	43.3
Direct Effects	$18,971.78	
Overall Effects	$ 43,731.85	0.82

Transportation

Multipliers	2.4871	30.9
Direct Effects	$2,239.19	
Overall Effects	$5,569.09	0.07

Total Effect	**$113,985.44**	**2.19**

According to our table, the lower bound of the overall economic impact in our sample is approximately $113,985 and the overall employment effect is 2.19 jobs. Not surprisingly, restaurants account for over half of the overall spending effect and the job creation process.

We proceed in a similar fashion to find the upper bound of our overall output effects and spending effects. As Table 10 shows the overall output effect is approximately $139,108 and the overall employment effect is 2.73.

Table 10. Upper Bound Estimates for the Fifteen Days of the Survey of Three Industries Based on Output and Employment Multipliers

Upper Bound of Estimates

	Output	**Employment**
Eating and Drinking Places		
Multipliers	2.5111	50.6
Direct Effects	$30,967.33	
Overall Effects	$77,762.06	1.57

Hotels, Lodging Places and Amusements

Multipliers	2.3051	43.3
Direct Effects	$24,197.13	
Overall Effects	$55,776.80	1.05

Transportation

Multipliers	2.4871	30.9
Direct Effects	$3,752.52	
Overall Effects	$5,569.09	0.12

Total Effect	**$139,107.96**	**2.73**

In conclusion, given our sample, we can infer that for the fifteen survey days, the overall economic impact was between $113,985 and $139,108. The employment effect for our sample predicts an increase of roughly 2 to 3 jobs in the local economy as a result of tourism generated by the Congress Avenue Bridge bat colony. What remains to be done is to extrapolate our results and obtain a rough estimate of the overall effect for the entire period that the bat colony spends in Austin. We anticipate that the final estimates will be of considerable magnitude given that our results so far only reflect observations taken on fifteen random days over a three-month period.

Extrapolation Technique and Results

Using the results provided by our sample and daily averages of the number of visitors over a period of several years, we estimate the yearly direct and indirect effects of the bat colony upon the local economy. Our extrapolation technique is based on the initial assumption that although there is high variability in the number of visitors depending upon the time of the year, the time of the week, and climatic factors, we expect little or no change in per capita spending. Employing our sample, we computed the average per capita spending to be $22.96. To complete our estimation, we need an estimate of the yearly number of visitors.

Data collected by Bat Conservation International over a period of several years reflects the following variations in the number of visitors (see Table 11).

Table 11: Monthly Number of Visitors

Month	**Weekdays**	**Weekends**	**Total**
March	275	450	9100
April	275	525	9700
May	325	800	12900
June	500	1000	18000
July	600	1200	21600
August	675	1450	25100
September	550	1100	19800
October	500	700	15600
November	200	350	6800
Total			**138600**

The total number of visitors was computed based on the assumption that there are four weeks in a month. Accordingly, there are twenty weekdays and eight weekends in a month. For instance, the total number of visitors in May was 12,900 or 325*20+800*8. The estimates provided by BCI are conservative and in concordance with data collected by the Austin Department of Tourism.

Armed with an estimate of per capita spending and of the average number of visitors throughout the entire year, we can calculate the direct and overall effect using the same techniques that we employed previously. Namely,

Direct Effect = (Per Capita Spending) * (Total # of Visitors) = $ 3,182,256.00

Overall Effect = (Direct Effect) * (Spending Multiplier) = $ 7,955,640.00

We can conclude, therefore, that the bat colony has an average yearly direct impact of approximately $3.2 million and an overall impact of circa $8 million. The estimates are conservative given the estimation technique employed and the assumptions made.

Conclusions and Comparison to Other Studies

In this section we compare our results with those of previous studies. The authors of the studies conducted statistical analyses to find in every case that the data lend support to the hypothesis that wildlife benefits the local economy. The first study presents the effect of recreational spending upon the rural economies of Georgia. The second study investigates the economic contributions of fishing, hunting and wildlife-viewing activities on National Forest lands. The last study concentrates on the importance of recreation as a science and offers statistical methods for quantifying its impact upon the local economy.

Bergstrom et. al. (1990) investigated the economic impact of recreational spending on selected local rural economies in Georgia. They used input-output analysis in their study and found a significant effect of recreational spending on gross output, income, employment and value added. They suggested, therefore, outdoor recreation as an alternative regional development policy.

Maharaj and Carpenter (1999) estimated the economic impact of fishing, hunting, and wildlife watching activities on a statewide and regional basis. In their study, they used

input-output analysis. They pointed out the large contribution of recreational activities on the economy in terms of employment, tax revenues, and wages. They emphasized the multiplier effects of wildlife throughout the region and the entire state. Their policy recommendation included the wise management of forest resources and increase awareness of local communities about the benefits of wildlife.

Clawson (1959) introduced recreation as a field of study of human activity. He also pointed out that the impact of recreation on the economy had been underestimated. Moreover, he discussed available data sources for researchers and indicated the limitations of these data sets. In contrast to the previous two researchers, he concentrated on statistical methodology and motivated the need to conduct statistical research in recreation economies.

In our study, we use statistical methods to derive reasonable and consistent conclusions employing the available data. Since people visit the selected areas as part of recreational activities, their spending pattern directly reflects the economic effect. However, in our case, we have to discriminate between the effect of downtown attractions and that of the bat colony, and conduct our analysis so that the overall effect includes only the impact of the bat colony alone. Thus, we construct two categories of visitors -- one group of people who visited the bridge due to the bat colony alone and a second group of people who visited the bridge due to other downtown attractions. Similar to the previous results, our results indicate that the overall wildlife benefits on the community are positive. Specifically, our study found that the economic benefits of the Congress Avenue Bridge bat colony upon the Austin economy are significant and of considerable magnitude.

[1] This amount was estimates using the imputed values for the total amount spent as well as the number of people in each group. Since we used a conservative imputation method, we believe that our estimates are likely. downward biased.
[2] It is important to notice that the estimates computed are only for the fifteen days when the survey was administered. Once we extrapolate, our estimates will be considerably larger.